IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

WIPQTUS INC., Plaintiff, v. SAMSUNG ELECTRONICS CO., LTD. and SAMSUNG ELECTRONICS AMERICA, INC., Defendants.	Civil Action No. 2:23-cv-00054-RWS-RSP **JURY TRIAL DEMANDED**

SAMSUNG'S INVALIDITY CONTENTIONS

I. INTRODUCTION

Pursuant to Rule 3-3 of the Local Patent Rules ("P. R.") of the Eastern District of Texas and the Standing Order Regarding Subject-Matter Eligibility Contentions, Defendants Samsung Electronics America, Inc. and Samsung Electronics Co., Ltd. (collectively, "Defendants" or "Samsung") hereby provide their Invalidity Contentions with respect to the claims identified by Plaintiff WIPQTUS INC. ("Plaintiff" or "WIPQTUS") in its Disclosure of Asserted Claims and Preliminary Infringement Contentions, served on August 9, 2023 ("Infringement Contentions"), in the above captioned case. Plaintiff asserts infringement of the following claims:

- Claims 1-2 of U.S. Patent No. 10,038,339 (the "'339 patent" or "Asserted Patent").

Pursuant to P. R. 3-3 and 3-4, Samsung hereby provides its invalidity disclosures and related documents pertaining only to the asserted claims as identified by Plaintiff in its Infringement Contentions. With respect to each asserted claim and based on its investigation to date, Samsung hereby: (a) identifies each currently known item of prior art that either anticipates

or renders obvious each asserted claim; (b) specifies whether such prior art anticipates each asserted claim or renders it obvious; (c) submits a chart identifying where each element in each asserted claim is disclosed, described, or taught in the prior art, including for each element that is governed by 35 U.S.C. § 112, ¶ 6, the identity of the structure(s), act(s), or material(s) in each item of prior art (if any) that performs the claimed function; and (d) identifies the grounds for invalidating asserted claims based on indefiniteness under 35 U.S.C. § 112, ¶ 2, or non-enablement or lack of written description under 35 U.S.C. § 112, ¶ 1. Samsung further relies on and incorporates all prior art references cited in and/or on the cover of the Asserted Patent and its prosecution history, including for supporting the obviousness of any asserted claim. Samsung hereby discloses and identifies as if originally set forth herein, all prior art references listed and/or asserted in the above as invalidating prior art against each of the asserted claims.

In addition, based on its investigation to date, Samsung has produced, and hereby produces the documents currently in its possession, custody, or control required to accompany these Invalidity Contentions pursuant to P. R. 3-4.

II. RESERVATIONS OF RIGHTS

Pursuant to P. R. 3-3 and 3-4, Samsung hereby provides disclosures and related documents pertaining only to the asserted claims identified by Plaintiff in its Infringement Contentions. Samsung reserves the right to modify, amend, or supplement these Invalidity Contentions to show the invalidity of any additional claims that the Court may allow Plaintiff to later assert. The Local Patent Rules and the Court's Docket Control Order contemplate that these Invalidity Contentions be prepared and served in response to Plaintiff's Infringement Contentions. However, Plaintiff's Infringement Contentions are insufficient in that they lack proper and complete disclosure as to how Samsung allegedly infringes the asserted claims. As such, Samsung reserves the right to

modify, amend, and/or supplement these Invalidity Contentions should the Court permit Plaintiff to correct, clarify, amend, and/or supplement its Infringement Contentions.

Samsung's Invalidity Contentions and selection of documents accompanying them are based on information currently available to Samsung and is subject to further revision. For example, Plaintiff (or its counsel) may be in possession of prior art that has not been disclosed to Samsung. As another example, because discovery has only recently begun, Samsung reserves the right to amend or supplement the information provided herein, including identifying and relying on additional references.

To the extent that these Invalidity Contentions reflect or otherwise embody particular constructions of terms or phrases in the asserted claims, Samsung is not proposing any such constructions as proper constructions of those terms or phrases. Various positions put forth in these Invalidity Contentions are submitted in view of on WiPQTUS's incorrect and/or overbroad interpretation of its claims as evidenced by its Infringement Contentions provided to Samsung. These Invalidity Contentions are not intended to, and do not necessarily, reflect Samsung's interpretation of the true and proper scope of the asserted claims. Samsung reserves the right to adopt claim construction positions that differ from positions put forth in this document. Also, Samsung objects to any attempt to infer any claim constructions from any identification of potential prior art. In those instances where Samsung asserts that the asserted claims are invalid under 35 U.S.C. § 112 (*e.g.*, no written description, not enabled, and/or indefinite), Samsung has applied the prior art in accordance with its assumption that WiPQTUS contends such asserted claims (1) are definite, (2) have written description support, and (3) are enabled, as evidenced by WiPQTUS's Infringement Contentions. As such, Samsung's Invalidity Contentions do not represent its agreement or view as to the meaning, definiteness, written description support for, or

enablement of any asserted claim. These Invalidity Contentions and accompanying documents are not intended to reflect Samsung's claim construction contentions, which will be disclosed in accordance with the Court's Docket Control Order.

Samsung's contentions may change depending on the Court's construction of the asserted claims, any findings as to the priority date of the asserted claims, and/or positions that Plaintiff or its experts may take concerning claim construction, infringement, and/or invalidity issues. Prior art not included in this disclosure, whether known or unknown to Samsung, may become relevant. In particular, Samsung is currently unaware of the extent, if any, to which Plaintiff will contend that limitations of the asserted claims are not disclosed in the prior art identified by Samsung, or will contend that any of the identified references do not qualify as prior art. To the extent that such an issue arises, Samsung reserves the right to identify other references that, *inter alia*, would have made the addition of the allegedly missing limitation to the disclosed technology obvious.

The identification of any patent or patent publication shall be deemed to include any counterpart patent or application filed, published, or issued anywhere in the world. The citation to any specifications published by standard-setting organizations shall be deemed to include any product that implements such specifications and that would qualify as prior art under 35 U.S.C. § 102, *e.g.*, under Sections 102(a), 102(b), or 102(g)(2).

Samsung's claim charts cite to particular teachings and disclosures of the prior art as applied to features of the asserted claims. Persons having ordinary skill in the art, however, may view an item of prior art in the context of other publications, literature, products, and understanding. As such, the cited portions are only exemplary, and Samsung reserves the right to rely on uncited portions of the prior art references and on other publications and expert testimony as aids in understanding and interpreting the cited portions, as providing context thereto, and as

additional evidence that the prior art discloses a claim limitation. Samsung further reserves the right to rely on uncited portions of the prior art references, other publications, and testimony to establish bases for combinations of certain cited references that render the asserted claims obvious. Further, for any combination, Samsung reserves the right to rely additionally on information generally known to those skilled in the art or common sense.

The references discussed in the claim charts may disclose the elements of the asserted claims explicitly or inherently, or they may be relied upon to show the state of the art in the relevant time frame. The suggested obviousness combinations are provided in the alternative to Samsung's anticipation contentions and are not to be construed to suggest that any reference included in the combinations is not by itself anticipatory.

Samsung reserves the right to challenge patentability of the asserted claims under 35 U.S.C. § 102(f) in the event Samsung obtains evidence that the named inventors of the Asserted Patent did not invent the subject matter claimed in the Asserted Patent. Should Samsung obtain such evidence, it will provide the name of the person(s) from whom and the circumstances under which the invention or any part of it was derived. Samsung further reserves the right to assert that the Asserted Patent are unenforceable due to inequitable conduct.

III. IDENTIFICATION OF PRIOR ART PURSUANT TO P. R. 3-3(a)

A. Priority Date of the Asserted Patent

The '339 patent issued from an application filed on April 10, 2016. In its Infringement Contentions, Plaintiff asserted a priority date for the '339 patent of August 13, 2012, or alternatively August 12, 2013. Without admitting the validity of either priority date, Samsung generally uses the asserted dates for the purposes of these Invalidity Contentions. However, to the extent that the Asserted Claims are not entitled to these priority dates, Samsung has identified

certain references in the tables below that would be prior art based on the actual filing date of the '339 patent.

B. Identification of Prior Art Patents and Patent Publications, Non-Patent Publications, and Systems

Pursuant to P. R. 3-3(a), and subject to Samsung's reservation of rights, Samsung identifies each item of prior art that at least evidences the obviousness of one or more of the asserted claims. Table 1 identifies each prior art patent by its number, country of origin, and date of issue. Table 2 identifies each non-patent prior art publication by, where possible, its title, date of publication, and author and/or publisher. Table 3 identifies each prior art system currently known to Samsung by, where possible, its name, date of use, offer for sale, or information becoming known, and the manner in which the reference was made public. Samsung reserves the right to identify additional non-patent and non-publication prior art systems that were sold, offered for sale, used, etc. prior to the priority date to the extent any such systems become known during discovery.

Table 1: Prior Art Patents and Applications

Patent	Inventors	Filing Date/Priority Date	Published/Issue Date	Short Name
US20110018356	Manjirnath Chatterjee	12/1/2009	1/27/2011	Chatterjee
US20130026981	Reinierus Hendricus Maria Van Der Lee	7/28/2011	1/31/2013	Van Der Lee
US8400801	Satoshi Shinoda	10/25/2011	3/19/2013	Shinoda
US20130257360	Manjit Singh	3/29/2012	10/3/2013	Singh-360
US20070103110	Kiran Sagoo	10/24/2006	5/10/2007	Sagoo
US8901875	James E. Schuessler	3/9/2011	12/2/2014	Schuessler
US20130162201	Ming-Hsiang Yeh	12/27/2011	6/27/2013	Yeh
CN101821919A	Pijnenburg Remco H W. Bruno Motte Scholtens Peter C S.	10/15/2007	9/1/2010	Pijnenburg.
EP2400629A2	Yossi Azancot	12/10/2008	12/28/2011	Azancot

Patent	Inventors	Filing Date/Priority Date	Published/Issue Date	Short Name
US20170012446A1	Kyungwoo Lim Kihyun Kim Seho Park Wooran Lee	7/6/2015	1/12/2017	Lim-446
KR20130032472A	Lim, Seung Ok; Won, Yun Jae; Moon, Yeon Kug; Kang, Shin Jae	9/23/2011	4/2/2013	Lim-472
US20010005126A1	Masaki Ichihara, Kozo Maemura	12/27/2000	6/28/2001	Ichihara
US20060184705A1	Yukio Nakajima	10/26/2005	8/17/2006	Nakajima
US20070021140A1	Marion A. Keyes IV Robert L. Yeager	7/22/2005	1/25/2007	Keyes
US20090039828A1	Daniel Benjamin Jakubowski	8/8/2007	2/12/2009	Jakubowski
US20090108679A1	Gunjan Porwal	10/30/2007	4/30/2009	Porwal
US20120146576A1	Afshin Partovi	6/10/2011	6/14/2012	Partovi
WO2012099965A2	Afshin Partovi	1/18/2012	7/26/2012	Partovi-965
US20100036773A1	James D. Bennett	9/30/2008	2/11/2010	Bennett
US20100248622A1	Miles Alexander Lyell Kirby. Anne Katrin Konertz Virginia Walker Keating Craig Lauer Michael John Mangan	10/2/2009	9/30/2012	Kirby
US20100270969A1	Kim-Yeung Sip	8/14/2009	10/28/2010	Sip
US20140097790A1	Ming-Hsiang Yeh	10/10/2012	4/10/2014	Yeh-790
US20160211694A1	Yuan-Hung Wang Che-Chang Chang Chieh-Wen Cheng Yung-Ning Yang	1/19/2015	7/21/2016	Wang
US7443057B2	Patrick Nunally	11/29/2004	10/28/2008	Nunally
US7791311B2	Kiran Pal Sagoo	10/24/2006	9/7/2012	Sagoo-311
US8169185B2	Afshin Partovi Michael Sears	5/7/2008	5/1/2012	Partovi
US8234189B2	Joshua B, Taylor David W. Bearman Scott A. Mollena	10/31/2012	7/31/2012	Taylor

Patent	Inventors	Filing Date/Priority Date	Published/Issue Date	Short Name
US8798537B2	Jaesung Lee Dohyeon Son Yongcheol Park Jeongkyo Seo Seonghun Lee	6/27/2012	8/5/2014	Lee-537
US9252846B2	Kevin Douglas Lee Zhen Ning Low	5/4/2012	2/2/2016	Lee-846
US9240824B2	John Hilland Miles A. Kirby Ernest T. Ozaki Stuart A. Hellsberg Michael J. Mangan Stephen Frankland	2/13/2009	1/19/2016	Hillan
US9419444B2	Eric Thomas Eaton	10/5/2011	8/16/2016	Eaton
US9425629B2	Jeon-Il Kim Sung-Bum Park Young-Min Lee Woo-Ram Lee	7/12/2012	8/23/2016	Kim-629
US20120161531A1	Sang Joon Kim	9/9/2011	6/28/2012	Kim-531
US20110127843A1	Jeyhan Karaoguz John Walley Ahmadreza (Reza) Rofougaran Nambirahjan Seshadri Reinier Van Der Lee	5/11/2010	6/2/2011	Karaoguz
US2014-0152251A1	Dong Zo Kim Sang Wook Kwon Ki Young Kim Nam Yun Kim Young Jin Moon Yun Kwon Park Keum Su Song Chi Hyung Ahn Young Ho Ryu Chang Sik Yoo Chang Wook Yoon Jin Sungt Choi	11/26/2012	6/5/2014	Kim251
US20110156640A1	Mehran Moshfeghi	12/27/2010	6/30/2011	Moshfeghi
US20120049646A1	Shigeki Teramoto Takanori Washiro	8/30/2010	3/1/2012	Teramoto

Patent	Inventors	Filing Date/Priority Date	Published/Issue Date	Short Name
US20150244341A1	David W. Ritter Jffrey J. Terlizzi Todd K. Moyer Jeffrey M. Alves Steven G. Herbst	2/23/2014	8/27/2015	Ritter
US20160126779A1	Soon-Sang Park	11/4/2014	5/5/2016	Park-779
WO2003105311A1	Lily Cheng Lai Ka James Westwood Hay Pilgrim Beart Gile William	6/6/2003	12/18/2003	Cheng
WO2010020895A2	Phillippe Maugars	7/30/2009	2/25/2010	Maugars
WO2010028092A1	Nigel P. Cook Lukas Sieber Hamspeter Widmer	9/2/2009	3/11/2010	Cook
WO2011112064A2	Hee-Won Jung Joon-Ho Park Eun-Tae Won Jun-Ho Koh	3/12/2010	9/15/2011	Jung
US9837203	Manjit Singh	3/29/2012	12/5/2017	Singh-203
US20130257167	Manjit Singh	3/29/202	10/3/2013	Singh-167
US20130260676	Manjit Singh	3/30/2012	10/3/2013	Singh-676
US8942624	Manjit Singh Siamak Bastami David Wilson	3/30/2012	1/27/2015	Singh-624
US9269333	Haifeng Yu	7/20/2011	5/23/2013	Yu-333
US20090261778	Yoon-Sang Kook	10/25/2006	9/7/2010	Kook
US20100148723	Nigel P. Cook Lukas Sieber Hanspeter Widmer	9/1/2009	6/17/2010	Cook
US20110127954	John Walley Jeyhan Karaoguz Ahmadreza (Reza) Rofougaran Nambirajan Seshadri Reinier Van Der Lee	6/3/2010	3/5/2013	Walley
US20110164471	David W. Baarman Sean T. Eurich William T. Stoner. Jr.	1/4/2011	7/7/2011	Baarman
US20110254377	Hanspeter Wildmer Nigel P. Cook Lukas Sieber	4/7/2011	2/7/2017	Wildmer

Patent	Inventors	Filing Date/Priority Date	Published/Issue Date	Short Name
US20120001593	Mario Di Guardo	6/30/2011	1/27/2015	Di Guardo
US20130049484	Eran Weissentern Arik Rofe Amir Ben-Shalom Guy Raveh Elieser Mach Oola Greenwald	10/30/2012	2/28/2013	Weissentern
WO2012013129	Haifeng Yu	7/20/2011	2/2/2012	Yu-129
EP2689538	Nam Yun Kim Sang Wook Kwon Yun Kwon Park	3/22/2012	1/19/2014	Kim-538
US8198858	Min-Suk Kim Won-Lee Park	12/12/2018	6/18/2008	Kim-858
US8432129	Chang Ki Lee Won Bae Jung	12/22/2009	6/24/2010	Lee-129
US8933583	Akiyoshi Uchida	9/13/2011	1/5/2012	Uchida
US9214818	Nam Yun Kim Sang Wook KWON Yun Kwon Park Eun Seok Park Young Tack Hong Young Ho Ryu Dong Zo Kim Jin Sung Choi	11/10/1022	5/10/2012	Kim-818
US20090039828	Daniel Benjamin Jakubowski	8/8/2007	6/5/2012	Jakubowski
US20110184888	Jeong Man LEE Seyoung MOON Jin Hwan SONG Hyung Jun YOON Kyu Sun Lee In Bum LEE Jae Hun Lee Zooyoung LEE Jin Suk LEE Hyoung Seok LEE Kyung Kook LIM Hyukjae Choi	8/26/2010	7/28/2011	Lee-888
US20120052923	Sekwon Park	12/6/2010	3/1/2012	Park-923
US8229356	Hirofumi Kawamura	12/11/2007	4/1/2010	Kawamura
US8183828	Akihiro Tanabe	3/6/2009	5/22/2012	Tanabe

Patent	Inventors	Filing Date/Priority Date	Published/Issue Date	Short Name
US8069100	Joshua B. Taylor David W. Baarman Scott A. Mollema	1/6/2009	11/29/2011	Taylor
US20110221389	Eun-Tae Won Seung-Hoon Park Joon-ho Park Jun-Ho Koh Hee-Won Jung Jae-Seung Son	3/14/2011	9/15/2011	Won

Table 2: Non-Patent Prior Art Publications

Author or Publisher	Reference Title	Publication / Use Date	Short Name
Wireless Power Consortium	System Description Wireless Power Transfer Volume I: Low Power Part 1: Interface Definition Version 1.0.3 September 2011	September 2011	WPT or WPT Standard

Table 3: Prior Art Items

Items Name	Use/Knowledge/Offer Date	Publisher	Short Name
Bi-directional wireless charging solution	Demonstrated on YouTube in April 2011; Demonstrated on YouTube in February 2012; Demonstrated at Computex Taipei 2012 in June 2012	Winstream Technology Co., Ltd.,	Winstream Solution
eCoupled two-way wireless charging solution	Demonstrated at CES 2013 in January 2013	Fulton Innovations	Fulton Solution

Samsung's investigation into the prior art is ongoing. It has issued discovery requests to third parties and is diligently pursing its investigation into the prior art. It will supplement its contentions as more information becomes available to it.

IV. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art ("POSA") as of the earliest claimed priority date for the '339 patent would have had a bachelor's degree in electrical engineering or a similar discipline, and two or more years of experience working with wireless charging systems. Additional education, such as a master's degree of electrical engineering could substitute for professional experience and significant work experience could substitute for formal education.

V. INVALIDITY DUE TO ANTICIPATION AND/OR OBVIOUSNESS PURSUANT TO P. R. 3-3(b) AND (c)

In accordance with P. R. 3-3(b) and (c), prior art references anticipating or rendering obvious some or all of the asserted claims are listed in the tables below.

A full citation to each reference is in the Tables above, along with the "Short Name" used to identify each reference throughout this disclosure. The following tables list (i) each anticipating prior art reference, (ii) the asserted claims anticipated by each anticipating reference, (iii) for each anticipating reference, the chart identifying where specifically in that reference each element of each asserted claim is found.

The art cited in the claim charts is illustrative and not exhaustive. Further, these claim charts provide illustrative citations to where each element may be found in the prior art references including with added emphasis. The cited references may contain other disclosures of each claim element as well, and Samsung reserves the right to argue any claim elements of the asserted claims are disclosed in non-cited and/or non-emphasized portions of these references. Similarly, where Samsung cites to a patent figure in the charts, it incorporates the accompanying specification text describing that figure and vice-a-versa.

Table 4: Prior Art Anticipating and/or Rendering Obvious the Asserted Claims

Exhibit	Prior Art Reference
1	Chatterjee
2	Van Der Lee
3	Shinoda
4	Singh-203
5	Sagoo
6	Schuessler
7	Yeh
8	Cook
9	Fulton Solution
10	Winstream Solution

To the extent that prior art identified by Samsung as anticipating is found not to anticipate, the prior art establishes that the claimed subject matter was obvious to a person of ordinary skill in the art at the time of the alleged invention. To the extent not anticipated, no asserted claim goes beyond combining known elements to achieve predictable results or does more than choose between clear alternatives known to those of skill in the art.

Even if a particular claim element is not expressly found in one of the charted references above, those charted references render the relevant asserted claims obvious without the need to combine with any other references, having in mind the information generally known to those skilled in the art, common sense, and/or routine innovation. Accordingly, Samsung discloses each of the references cited above in Section V as rendering obvious the asserted claims as shown in the charts referenced above.

In addition, the charted references in combination with one or more of the other charted references render obvious the asserted claims. As explained herein and/or in the accompanying charts, it would have been obvious to a person of skill in the art at the time of the alleged invention of the asserted claims to combine the various references cited herein so as to practice the asserted claims. In addition to the specific combinations of prior art and the specific combinations of groups of prior art disclosed, Samsung reserves the right to rely on any other combination of any prior art references disclosed herein. Samsung further reserves the right to rely upon combinations disclosed within the prosecution history of the references cited herein. These obviousness combinations reflect Samsung's present understanding of the potential scope of the claims that WIPQTUS appears to be advocating and should not be construed as Samsung's acquiescence to WIPQTUS' interpretation of the patent claims.

One or more combinations of the prior art references identified above pursuant to P. R. 3-3(a) would have been obvious because these references would have been combined using: known methods to yield predictable results; known techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining the prior art references identified above pursuant to P. R. 3-3(a) because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. In addition, the combination of the prior art references identified above pursuant to P. R. 3-3(a) would have been obvious because the combination represents the known potential options with a reasonable expectation of success.

Additional evidence that there would have been a motivation to combine the prior art references identified above pursuant to P. R. 3-3(a) includes the interrelated teachings of multiple prior art references; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the asserted claims; the existence of a known need or problem in the field of the endeavor at the time of the invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

Thus, the motivation to combine the teachings of the prior art references disclosed herein is found in the references themselves and: (1) the nature of the problem being solved, (2) the express, implied, and inherent teachings of the prior art, (3) the knowledge of persons of ordinary skill in the art, (4) the fact that the prior art is generally directed towards solving recognized problems with providing wireless power transfer with or without near-field data communication, and (5) the predictable results obtained in combining the different elements of the prior art. Additionally, one would be motivated to address at least the alleged problems or achieve the purported objectives identified in the description of the Asserted Patent.

Any reference or combination of references that anticipates or makes obvious an asserted independent claim also makes obvious any asserted claim dependent on that independent claim because every element of each dependent claim was known by a person of ordinary skill at the time of the alleged invention, and it would have been obvious to combine those known elements with the independent claims at least as a matter of common sense and routine innovation. Accordingly, Samsung contends that each asserted claim would have been obvious not only by the combinations explicitly defined in these contentions, but also by any combination of references that renders obvious an asserted claim.

Numerous prior art references, including those identified above pursuant to P. R. 3-3(a) and in the claim charts reflect common knowledge and the state of the prior art prior to the priority date of the Asserted Patent. As it would be unduly burdensome to create detailed claim charts for the thousands of invalidating combinations, Samsung has provided illustrative examples of such invalidating combinations below and in the charts attached hereto. For at least the reasons described above and below in the examples provided as well as in the attached claim charts, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those identified in the attached claim charts, to meet the limitations of the asserted claims. As such, Samsung's inclusion of exemplary combinations does not preclude Samsung from identifying other invalidating combinations as appropriate.

A. Identification of Combinations of Prior Art Rendering the Asserted Claims Obvious

The asserted claims are rendered obvious by single references when combined with the knowledge of a person of ordinary skill in the art, combinations of references, and combinations of references when combined with the knowledge of a person of ordinary skill in the art as explained herein and in the exhibits attached hereto.

Prior Art Combinations for the Asserted Claims of the '339 Patent

Prior Art Combinations
Chatterjee
Chatterjee + Corbridge
Chatterjee + Teramoto
Chatterjee + WPT Standard
Van Der Lee
Van Der Lee + Chatterjee
Van Der Lee + Shinoda
Van Der Lee + Singh-203
Van Der Lee + Yeh

Van Der Lee + Cook
Van Der Lee + Corbridge
Van Der Lee + Teramoto
Van Der Lee + WPT Standard
Van Der Lee + Chatterjee + Corbridge
Van Der Lee + Chatterjee + Teramoto
Van Der Lee + Chatterjee + WPT Standard
Van Der Lee + Shinoda + Chatterjee
Van Der Lee + Shinoda + Corbridge
Van Der Lee + Shinoda + Teramoto
Van Der Lee + Shinoda + WPT Standard
Van Der Lee + Singh-203 + Singh-624
Van Der Lee + Singh-203 + Chatterjee
Van Der Lee + Singh-203 + Corbridge
Van Der Lee + Singh-203 + Teramoto
Van Der Lee + Singh-203 + WPT Standard
Van Der Lee + Yeh + Chatterjee
Van Der Lee + Yeh + Chatterjee + Corbridge
Van Der Lee + Yeh + Chatterjee + Teramoto
Van Der Lee + Yeh + Chatterjee + WPT
Van Der Lee + Yeh + Shinoda + Chatterjee
Van Der Lee + Yeh + Shinoda + Corbridge
Van Der Lee + Yeh + Shinoda + Teramoto
Van Der Lee + Yeh + Shinoda+ WPT
Van Der Lee + Yeh + Singh-203 + Chatterjee
Van Der Lee + Yeh + Singh-203 + Corbridge
Van Der Lee + Yeh + Singh-203 + Teramoto
Van Der Lee + Yeh + Singh-203 + WPT
Van Der Lee + Yeh + Singh-624 + Chatterjee
Van Der Lee + Yeh + Singh-624 + Corbridge
Van Der Lee + Yeh + Singh-624 + Teramoto
Van Der Lee + Yeh + Singh-624 + WPT

Van Der Lee + Yeh + Schuessler + Chatterjee
Van Der Lee + Yeh + Schuessler + Corbridge
Van Der Lee + Yeh + Schuessler + Teramoto
Van Der Lee + Yeh + Schuessler + WPT
Van Der Lee + Yeh + Corbridge
Van Der Lee + Yeh + Teramoto
Van Der Lee + Yeh+ WPT
Van Der Lee + Cook + Chatterjee
Van Der Lee + Cook + Chatterjee + Corbridge
Van Der Lee + Cook + Chatterjee + Teramoto
Van Der Lee + Cook + Chatterjee + WPT
Van Der Lee + Cook + Shinoda + Chatterjee
Van Der Lee + Cook + Shinoda + Corbridge
Van Der Lee + Cook + Shinoda + Teramoto
Van Der Lee + Cook + Shinoda+ WPT
Van Der Lee + Cook + Singh-203 + Chatterjee
Van Der Lee + Cook + Singh-203 + Corbridge
Van Der Lee + Cook + Singh-203 + Teramoto
Van Der Lee + Cook + Singh-203 + WPT
Van Der Lee + Cook + Singh-624 + Chatterjee
Van Der Lee + Cook + Singh-624 + Corbridge
Van Der Lee + Cook + Singh-624 + Teramoto
Van Der Lee + Cook + Singh-624 + WPT
Van Der Lee + Cook + Schuessler + Chatterjee
Van Der Lee + Cook + Schuessler + Corbridge
Van Der Lee + Cook + Schuessler + Teramoto
Van Der Lee + Cook + Schuessler + WPT
Van Der Lee + Cook + Corbridge
Van Der Lee + Cook + Teramoto
Van Der Lee + Cook + WPT
Shinoda + Chatterjee
Shinoda + Van Der Lee

Shinoda + Singh-203

Shinoda + Yeh

Shinoda + Cook

Shinoda + Chatterjee + Corbridge

Shinoda + Chatterjee + Teramoto

Shinoda + Chatterjee + WPT Standard

Shinoda + Van Der Lee + Chatterjee

Shinoda + Van Der Lee + Corbridge

Shinoda + Van Der Lee + Teramoto

Shinoda + Van Der Lee + WPT Standard

Shinoda + Singh-203+ Chatterjee

Shinoda + Singh-203+ Corbridge

Shinoda + Singh-203+ Teramoto

Shinoda + Singh-203+ WPT Standard

Shinoda + Yeh + Chatterjee

Shinoda + Yeh + Corbridge

Shinoda + Yeh + Teramoto

Shinoda + Yeh + WPT Standard

Shinoda + Cook + Chatterjee

Shinoda + Cook + Corbridge

Shinoda + Cook + Teramoto

Shinoda + Cook + WPT Standard

Singh-203

Singh-203 + Singh-624

Singh-203 + Singh-167

Singh-203 + Singh-624 + Singh-167

Sagoo + Chatterjee

Sagoo + Chatterjee + Corbridge

Sagoo + Chatterjee + Teramoto

Sagoo + Chatterjee + WPT

Sagoo + Van Der Lee

Sagoo + Van Der Lee + Chatterjee

Sagoo + Van Der Lee + Shinoda

Sagoo + Van Der Lee + Shinoda + Corbridge

Sagoo + Van Der Lee + Shinoda + Teramoto

Sagoo + Van Der Lee + Shinoda + WPT
Sagoo + Van Der Lee + Singh-203
Sagoo + Van Der Lee + Singh-203 + Corbridge
Sagoo + Van Der Lee + Singh-203 + Teramoto
Sagoo + Van Der Lee + Singh-203 + WPT
Sagoo + Van Der Lee + Singh-203 + Chatterjee
Sagoo + Van Der Lee + Singh-624
Sagoo + Van Der Lee + Singh-624 + Chatterjee
Sagoo + Van Der Lee + Singh-624 + Corbridge
Sagoo + Van Der Lee + Singh-624 + Teramoto
Sagoo + Van Der Lee + Singh-624 + WPT
Sagoo + Van Der Lee + Schuessler
Sagoo + Van Der Lee + Schuessler + Chatterjee
Sagoo + Van Der Lee + Schuessler + Corbridge
Sagoo + Van Der Lee + Schuessler + Teramoto
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Sagoo + Van Der Lee + Corbridge
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Sagoo + Van Der Lee + WPT
Sagoo + Van Der Lee +Yeh
Sagoo + Van Der Lee +Yeh + Chatterjee
Sagoo + Van Der Lee +Yeh + Corbridge
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Sagoo + Van Der Lee +Yeh + Singh-624 + Corbridge
Sagoo + Van Der Lee +Yeh + Singh-624 + Teramoto
Sagoo + Van Der Lee +Yeh + Schuessler + WPT
Sagoo + Van Der Lee +Cook + Chatterjee

Sagoo + Van Der Lee +Cook + Corbridge
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Sagoo + Shinoda + Chatterjee
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Sagoo + Shinoda + Yeh + Chatterjee
Sagoo + Shinoda + Yeh + Corbridge

Sagoo + Shinoda + Yeh + Teramoto
Sagoo + Shinoda + Yeh + WPT
Sagoo + Shinoda + Cook
Sagoo + Shinoda + Cook + Chatterjee
Sagoo + Shinoda + Cook + Corbridge
Sagoo + Shinoda + Cook + Teramoto
Sagoo + Shinoda + Cook + WPT
Sagoo + Singh-167+ Chatterjee
Sagoo + Singh-167+ Chatterjee + Corbridge
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Sagoo + Singh-167+ Van Der Lee
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Sagoo + Cook + Yeh + Schuessler
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Sagoo + WPT + Van Der Lee
Sagoo + WPT + Van Der Lee + Chatterjee
Sagoo + WPT + Van Der Lee + Shinoda
Sagoo + WPT + Van Der Lee + Singh-203
Sagoo + WPT + Van Der Lee + Yeh
Sagoo + WPT + Van Der Lee + Cook
Sagoo + WPT + Singh-203
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Schuessler + Chatterjee
Schuessler + Chatterjee + Corbridge
Schuessler + Chatterjee + Teramoto
Schuessler + Chatterjee + WPT
Schuessler + Van Der Lee
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Schuessler + Singh-167 + Singh-203
Schuessler + Singh-167 + Singh-203 + Chatterjee
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Schuessler + Singh-167 + Singh-203 + Teramoto
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Schuessler + Singh-167 + Yeh + Chatterjee
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Schuessler + Singh-167 + Yeh + WPT
Schuessler + Cook

Schuessler + Cook + Chatterjee
Schuessler + Cook + Corbridge
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Schuessler + WPT + Singh-203
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Yeh + Van Der Lee + Schuessler + WPT
Yeh + Singh-167+ Chatterjee
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Yeh + Cook + Schuessler + WPT
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Cook + Corbridge + Singh-624 + Yeh
Cook + Corbridge + Schuessler + Van Der Lee
Cook + Corbridge + Schuessler + Singh-203
Cook + Corbridge + Schuessler + Yeh
Cook + Teramoto + Shinoda
Cook + Teramoto + Singh-203
Cook + Teramoto + Singh-624
Cook + Teramoto + Schuessler

Cook + Teramoto + Shinoda + Van Der Lee
Cook + Teramoto + Singh-624 + Van Der Lee
Cook + Teramoto + Schuessler + Van Der Lee
Cook + Teramoto + Shinoda + Singh-203
Cook + Teramoto + Singh-624 + Singh-203
Cook + Teramoto + Schuessler + Singh-203
Cook + Teramoto + Shinoda + Yeh
Cook + Teramoto + Singh-624 + Yeh
Cook + Teramoto + Schuessler + Yeh
Cook + WPT + Shinoda
Cook + WPT + Singh-203
Cook + WPT + Singh-624
Cook + WPT + Schuessler
Cook + WPT + Shinoda + Van Der Lee
Cook + WPT + Singh-203 + Van Der Lee
Cook + WPT + Singh-624 + Van Der Lee
Cook + WPT + Schuessler + Van Der Lee
Cook + WPT + Shinoda + Singh-203
Cook + WPT + Singh-624 + Singh-203
Cook + WPT + Schuessler + Singh-203
Cook + WPT + Shinoda + Yeh
Cook + WPT + Singh-203 + Yeh
Cook + WPT + Singh-624 + Yeh
Cook + WPT + Schuessler + Yeh
Fulton Solution in view of one or more of Chatterjee, Van Der Lee, Shinoda, Singh-203, Singh-624, Singh-167, Sagoo, Schuessler, Yeh, Cook, Corbridge, Teramoto, and WPT
Winstream Solution in view of one or more of Chatterjee, Van Der Lee, Shinoda, Singh-203, Singh-624, Singh-167, Sagoo, Schuessler, Yeh, Cook, Corbridge, Teramoto, and WPT

B. Motivations to Combine Prior Art Cited in Claim Chart Exhibits

In *KSR*, the Supreme Court emphasized that an idea that is the result of ordinary innovation, ordinary skill, or common sense should not be patentable. *See KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398 (2007). The Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420-21.

Although a patent challenger is not required to show that one of ordinary skill in the art would have had a specific motivation to combine prior art references, such a showing may be helpful to the obviousness analysis. *Id.* at 418; *see also id.* at 402.

One of skill in the art would have been motivated to combine the references identified herein because, for example, the identified combinations fall into one or more of the following categories:

- A combination of elements known in the prior art according to known methods to yield a predictable result;
- A combination that is a simple substitution of one or more known elements for another to obtain a predictable result;
- A combination that involves using a known technique to improve a similar device or method in the same way;
- A combination that involves applying a known technique to a known device or method ready for improvement to yield a predictable result;
- A combination that results from a finite number of identified, predictable solutions with a reasonable expectation of success, such that the solution was one which was "obvious to try";
- A combination that results from known work in one field of endeavor prompting variations of it for use either in the same field or a different field based on design incentives or other market forces in which the variations were predictable to one of ordinary skill in the art; and
- A teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine the teachings of various prior art references to arrive at the claimed invention.

Further, the Federal Circuit has held that a motivation to combine references may be implicit for patents claiming an "improvement":

> [A]n implicit motivation to combine exists not only when a suggestion may be gleaned from the prior art as a whole, but when the "improvement" is technology-independent and the combination of references results in a product or process that is more desirable, for example because it is stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient. Because the desire to enhance commercial opportunities by improving a product or process is universal—and

> even commonsensical—we have held that there exists in these situations a motivation to combine prior art references even absent any hint of suggestion in the references themselves. In such situations, the proper question is whether the ordinary artisan possesses knowledge and skills rendering him capable of combining the prior art references.

DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co., 464 F.3d 1356, 1368 (Fed. Cir. 2006). The prior art references identified herein explicitly or implicitly refer to other prior art references, share common authors or inventors, were published in the same journals, presented at the same conferences, were presented as proposals to standards working groups, and/or were developed at common companies, schools, or organizations, all of which would motivate one of skill in the art to combine them. These references are also within the field of the Asserted Patent and are directed to similar subject matter within that field. Additionally, any products, devices, or processes described in the references existed and/or were invented before or during the period in which the claimed inventions were developed, providing further motivation to combine them.

To the extent Plaintiff challenges a combination of prior art with respect to a particular element, Samsung reserves all rights to supplement these contentions to further specify the motivation to combine the prior art. Samsung may rely on cited or uncited portions of the prior art, other documents, and/or expert testimony to establish that a person of ordinary skill in the art would have been motivated to modify or combine the prior art so as to render the claims invalid as obvious.

1. Motivation to Combine: ’339 patent

A POSA would have been motivated to combine the references identified in Exhibits 1-10 herein because the identified combinations involve analogous references that are each directed to wireless power charging. Further, a POSA would have been motivated to combine these references and would have had a reasonable expectation of success in combining the references because the claim limitations in the asserted claims of the ’339 patent recite no more than well-known,

conventional components and configurations that had been implemented for wireless power charging devices with or without near-field data communication capabilities. Indeed, the references identified in Exhibits 1-10 demonstrate that each limitation recited in the asserted claims was known in the art. To the extent a particular reference does not expressly disclose one of these or the other conventional limitations recited in the asserted claims, it would have been obvious to a POSA to implement such features for the reasons set forth in Exhibits 1-10 as well as general considerations including (1) well-known prior art wireless power charging devices and methods, including industry standards, (2) well-known principles of electrical engineering and circuitry design, and (3) market demands, such as improved functionality, reduced cost, and reduced size for a wireless power charging device. Additional rationales and motivations are provided in the claim chart Exhibits.

C. There is No Evidence of Any Indicia of Non-Obviousness

There is no evidence of any indicia of non-obviousness, including any long-felt but unsolved need; copying; failure of others; commercial success due to the patented invention; no industry praise; no unexpected results; no industry skepticism and no licensing. Each is address in turn below:

No long felt but unsolved need. There was no long-felt but unsolved need that the Asserted Claims solve. The concepts described in the Asserted Patent were all well known before the alleged invention dates of the Asserted Patent as evidenced by the patents themselves, their file histories and references cited therein, and the prior art identified herein, including those identified in the above-referenced Exhibits. In addition, there was no long felt but unsolved need because there is nothing particularly compelling about the claimed methods, systems, and apparatus.

No copying. Plaintiff has provided no credible evidence that the alleged inventions of the Asserted Patent were copied, or more specifically, that any functionality that practices the Asserted Patent was copied. Copying "requires evidence of efforts to replicate a specific product." *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010). Here, Plaintiff has not, and cannot, show that Samsung copied any product that embodies the Asserted Patent. Further, evidence of copying is "not sufficient to demonstrate non-obviousness of the claimed invention" where, as here, there is a "substantial question of validity raised by the prior art references" cited by Samsung. *Amazon.com, Inc. v. Barnesandnoble.com, Inc.*, 239 F.3d 1343, 1366 (Fed. Cir. 2001). As explained in detail in these contentions, the Asserted Patent is rendered obvious by the prior art. Thus, Plaintiff cannot show any nexus between any alleged copying and the merits of the claimed inventions of the Asserted Patent.

No failure of others. Although "[n]onobviousness is suggested by the failure of others to find a solution to the problem which the patents in question purport to solve," *Symbol Techs., Inc. v. Opticon, Inc.*, 935 F.2d 1569, 1578 (Fed. Cir. 1991), this is not such a case. As explained in detail in these contentions, wireless power charging circuitry, techniques, and communication protocols were well known in the art. A person of ordinary skill would have been motivated to apply the teachings of prior art references to provide improved functionality, reduced cost, and reduced size for a wireless power charging device. Furthermore, a person of ordinary skill in the art would have found combining such teachings to be straightforward, predictable, and a matter of routine optimization.

No commercial success. Plaintiff has not provided any evidence that any alleged success of its products or any other products is due to the alleged inventions claimed in the Asserted Patent. A patentee bears the burden of demonstrating that the relevant commercial success is attributable

to the claimed invention "as opposed to other economic and commercial factors unrelated to the technical quality of the patented subject matter." *Cable Elec. Prods, Inc. v. Genmark, Inc.*, 770 F. 2d 1015, 1027 (Fed. Cir. 1985). Here, Plaintiff has not shown and cannot show that Samsung's success is due to the alleged invention of the Asserted Patent. The commercial success of the accused products is unrelated to the purported inventions of the Asserted Patent. Furthermore, if any commercial success is due to any of the concepts disclosed in the Asserted Patent, those concepts are also present in the prior art and thus are irrelevant to the question of obviousness. *See Tokai Corp. v. Easton Enterprises, Inc.*, 632 F.3d 1358, 1369-70 (Fed. Cir. 2011) ("If commercial success is due to an element in the prior art, no nexus exists."); *In re Huai-Hung Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) ("Where the offered secondary consideration actually results from something other than what is both claimed and novel in the claim, there is no nexus to the merits of the claimed invention."); *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006) ("[I]f the feature that creates the commercial success was known in the prior art, the success is not pertinent.").

No industry praise. Plaintiff has presented no evidence of industry praise for the alleged inventions of the Asserted Patent or any functionality that allegedly practices the Asserted Patent. To the extent any praise is related to any functionality that allegedly practices the Asserted Patent, that praise is not due to the allegedly novel features of the Asserted Patent, but instead only to features present in the prior art, which is not a sufficient nexus to be relevant to the question of industry praise for purposes of obviousness. *See Muniauction, Inc. v. Thomson Corp.*, 532 F.3d 1318, 1328 (Fed. Cir. 2008).

No unexpected results. There is no evidence of any unexpected results when the elements of the Asserted Claims were combined. Instead, as discussed above, the concepts claimed in the

Asserted Patent were already combined or would have been obvious to combine in the same manner as the Asserted Claims. These prior art systems and products, as described in in these contentions, disclosed the same combinations of elements, and the same results of such combinations, that are recited in the Asserted Claims of the Asserted Patent. Thus, there were no unexpected results that arose from combining the well-known elements in the Asserted Claims of the Asserted Patent.

No industry skepticism. Plaintiff has presented no evidence that others were skeptical before the alleged invention date of the Asserted Patent, nor can it. In fact, there was no industry skepticism concerning the claimed concepts that predates the Asserted Patent. Instead, many companies and individuals were already using the concepts claimed in the Asserted Patent as demonstrated by the attached Exhibits. Thus, there was no industry skepticism that using or combining these well-known prior art concepts would be viable; others in the field were already combining them in the same manner as arranged in the Asserted Claims.

Simultaneous Invention. Individuals working independently of the Asserted Patent's named inventors simultaneously or near-simultaneously invented the alleged invention of the Asserted Claims of the Asserted Patent. Such evidence supports a finding that the Asserted Claims would have been obvious to a person of ordinary skill in the art at the time of the invention. *See Geo. M. Martin Co. v. Alliance Mach. Sys.*, 618 F.3d 1294, 1305 (Fed. Cir. 2010) ("Independently made, simultaneous invention, made within a comparatively short space of time, are persuasive evidence that the claimed apparatus was the product only of ordinary mechanical or engineering skill.") (citing *Concrete Appliances Co. v. Gomery*, 269 U.S. 177, 184 (1925)) (internal quotations omitted); *see also Ecolochem, Inc. v. So. Cal. Edison Co.*, 227 F.3d 1361, 1379 (Fed. Cir. 2000).

VI. INVALIDITY UNDER 35 U.S.C. § 112 PURSUANT TO P. R. 3-3(d)

The following Invalidity Contentions set forth below, pursuant to P. R. 3-3(d), are subject to revision and amendment pursuant to Federal Rule of Civil Procedure 26(e) and the Orders of record in this matter to the extent appropriate in light of further investigation and discovery regarding the defenses below, the Court's construction of the claims at issue, and/or the review and analysis of expert witnesses.

A. Indefiniteness Under 35 U.S.C. § 112, ¶ 2

Claims are indefinite under 35 U.S.C. § 112, ¶ 2 when they "fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014). To the extent an asserted apparatus claim includes both apparatus and method limitations, that claim is invalid for indefiniteness under § 112, ¶ 2 because it fails to identify or notify the public of what constitutes direct infringement. *See IPXL Holdings, L.L.C. v. Amazon.com, Inc.*, 430 F.3d 1377 (Fed. Cir. 2005).

Paragraph 2 of 35 U.S.C. § 112 also requires that the claimed subject matter be what "the inventor or a joint inventor regards as the invention." "Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention, we must hold that claim invalid under § 112, paragraph 2." *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1349 (Fed. Cir. 2002).

Samsung specifically reserves the right to present any (or none) of the indefiniteness arguments outlined below and will present its detailed arguments as to any indefiniteness at that time, through the *Markman* meet and confer and briefing processes.

Furthermore, Samsung reserves the right to argue that the limitation(s) of the '339 patent listed below, when read in light of the specification and prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention, either because the

specification does not use phrases that appear in these limitation(s) and/or fails to delineate the scope of each limitation, including with relation to other limitation(s), and therefore, one of ordinary skill would not understand the metes and bounds of the claims in which these limitation(s) appear, as required by 35 U.S.C. § 112, ¶ 2.

- "the stored power" (claim 1);
- "one of coil and capacitor electrodes" (claim 1);
- "impedance network" (claim 1);
- "switch network" (claim 1);
- "said power" (claim 1);
- "change … topology of said switch network" / 'change said topology of said switch network" (claim 1);
- "power-up" (claim 1)
- "perform a function associated with said transmitted power in conjunction with said first circuitry" (claim 1)
- "identify a type of said secondary wireless power receiver" (claim 1)
- "identify a wireless power protocol of said secondary wireless power receiver" (claim 1)
- "one of an inverter and a rectifier" (claim 2)

Therefore, all of the Asserted Claims (claims 1-2 of the '339 patent) are invalid for indefiniteness.

B. <u>Lack of Enablement/Written Description Under 35 U.S.C. § 112, ¶ 1</u>

35 U.S.C. § 112, ¶ 1 requires that the specification contain a written description of the invention. "[T]he hallmark of written description is disclosure." *Boston Scientific Corp. v.*

Johnson & Johnson, 647 F.3d 1353, 1361-62 (Fed. Cir. 2011) (citation omitted). The test for whether a specification adequately describes an invention is "whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date. . . . [T]he test requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. . . . [It] is a question of fact." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*); *Boston Scientific*, 647 F.3d at 1362.

The enablement requirement of § 112 demands that the patent specification enable "those skilled in the art to make and use the full scope of the claimed invention without 'undue experimentation.'" *Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1365 (Fed. Cir. 1997) (quoting *In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993)). "[T]he scope of the claims must be less than or equal to the scope of the enablement." *Nat'l Recovery Tech., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999).

Based on the claim scope adopted by Plaintiff in its Infringement Contentions, Claims 1-2 of the '339 patent are invalid for lack of written description and/or enablement with respect to the following limitations:

- "impedance network" (claim 1) lacks written description support and enablement at least with respect to the Plaintiff's contention that the scope of this limitation encompasses, for example, capacitors and/or switches connected to CMA, CMB, COM1, COM2, GND, BST1, and BST2 (*see, e.g.*, Infringement Contentions, Ex. 2 at 14-18);
- "change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power" (claim 1) lacks written description support and enablement at least with respect Plaintiff's contention that the

scope of this limitation encompasses, for example, activating capacitors connected to CMA, CMB, COM1, COM2 to pull voltage to zero (*see, e.g.*, Infringement Contentions, Ex. 2 at 29-33). This limitation also lacks written description for the additional reason that the specification does not provide sufficient description of a "change . . . of . . .topology";

- "change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver " (claim 1) lacks written description support and enablement at least with respect Plaintiff's contention that the scope of this limitation encompasses, for example, disconnecting capacitors connected to CMA, CMB, COM1, COM2 to the ground, or adjusting signal frequency (*see, e.g.*, Infringement Contentions, Ex. 2 at 38-46). This limitation also lacks written description and enablement for the additional reason that the specification does not provide sufficient description of "change said topology";
- "identify a type of said secondary wireless power receiver" (claim 1) lacks written description and enablement at least with respect Plaintiff's contention that the scope of this limitation encompasses, for example, identifying various types of data in the Qi WPC specification identification packet (*see, e.g.*, Infringement Contentions, Ex. 2 at 48-53).
- "identify a wireless power protocol of said secondary wireless power receiver" (claim 1) lacks written description and enablement at least with respect Plaintiff's contention that the scope of this limitation encompasses, for example, identifying various types of data in the Qi WPC specification identification packet (*see, e.g.*, Infringement Contentions, Ex. 2 at 53-55). This limitation also lacks written description and enablement for the additional reason that the specification does not provide sufficient description of "identifying a wireless power protocol".

VII. P. R. 3-4 DOCUMENT PRODUCTION

A. Documents Related to Accused Instrumentalities Under P. R. 3-4(a)

Pursuant to P. R. 3-4(a), and based on Samsung's currently available understanding of Plaintiff's Infringement Contentions (and despite the deficiencies found in the Infringement Contentions), Samsung is producing in good faith herewith documents bates labeled SAM-WIPQTUS-000012665 - SAM-WIPQTUS-000015397 and SAM-WIPQTUS-000015407 - SAM-WIPQTUS-000015430, and will continue to produce, documentation sufficient to show the operation of the Accused Products that Samsung understands are accused of infringement. Source code is made available at Greenberg Traurig's New York office for inspection pursuant to the Protective Order.

B. Documents Related to Prior Art Under P. R. 3-4(b)

Pursuant to P. R. 3-4(b), Samsung is producing concurrently with these Contentions documents bates labeled SAM-WIPQTUS-000010275 - SAM-WIPQTUS-000012664 and SAM-WIPQTUS-000015398 - SAM-WIPQTUS-000015406 reflecting the prior art references identified above and/or in the attached charts in connection with Samsung's P. R. 3-3(a) disclosures.

Dated: October 11, 2023

Respectfully Submitted

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CERTIFICATE OF SERVICE

I certify that, on October 11, 2023, I caused a true and correct copy of Samsung's Invalidity Contentions including the above pleading and the associated claim charts, to be served upon all counsel of record via electronic mail.

/s/ Andrew Sommer

U.S. Pat. Pub. No. 2011/0018356 (“Chatterjee”)

The asserted claims of U.S. No. 10,038,339 (the “’339 patent”) are anticipated and/or rendered obvious by U.S. Patent Application Publication No. 2011/0018356 (“Chatterjee”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. 2010/0083012 (“Corbridge”), U.S. 2012/0049646 (“Teramoto”), and/or WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 (“WPT Standard” or “WPT”).

Chatterjee was filed on December 1, 2009 and published on January 27, 2011. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Corbridge was filed on June 4, 2009 and published on April 1, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Teramoto was filed on August 23, 2011 and published on March 1, 2012. It qualifies as prior art under either pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

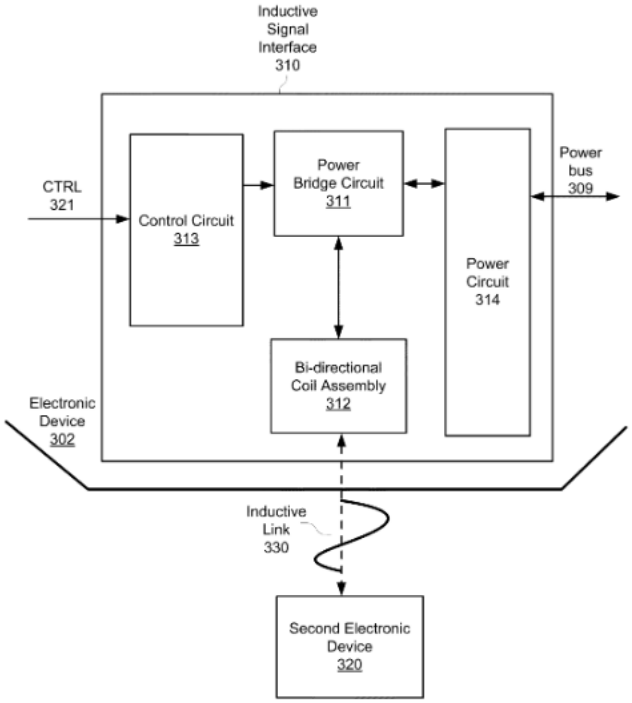
WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1).

Claim Limitation	**Exemplary Prior Art Disclosures**
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or	To the extent the preamble is limiting, Chatterjee teaches and renders obvious a “dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver.” Chatterjee discloses an electronic device that can be used to create an inductive link with a second electronic device for transmitting or receiving power. For example: The disclosed embodiments relate generally to the field of inductive signal interfaces. In particular, the disclosed embodiments relate to ***an inductive signal interface capable of bi-directional inductive signaling***. Chatterjee, ¶ 2. Embodiments described herein include ***an inductive signal interface that uses shared circuit elements to be operable as either a power transmitter or a power receiver***. More specifically, an inductive signal interface includes a three-legged (or three-branched) structure that uses separate

Claim Limitation	Exemplary Prior Art Disclosures
transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	pairs of legs or branches to operate as an inductive power transmitter or an inductive power receiver. An inductive signal interface includes a coil assembly which has one or more inductive coils. The inductive signal interface also has a bridge circuit that couples to the coil assembly to a power input/output (I/O). ***The bridge circuit has components that operate to enable the inductive signal interface to selectively operate in either a power transmit mode or a power receive mode.*** Chatterjee, ¶¶ 29-30. Still further, another embodiment provides a computing system that includes a first and a second computing devices, each computing device including a similarly structured inductive signal interface. The inductive signal interface of each computing device includes a coil assembly which has one or more inductive coils and a bridge circuit that couples to the coil assembly to a power input/output (I/O). ***Each bridge circuit has components that operate to enable the respective inductive signal interface to selectively operate in either a power transmit mode or a power receive mode***. Chatterjee, ¶ 33. A device having inductive signal interface **310**, may be referenced as an 'electronic device', and correspond to, for example, a mobile computing device or docking station. ***The inductive signal interface 310 is shown in FIG. 1 to be provided on a first electronic device 302, and used to create an inductive link 330 with a second electronic device 320. The second electronic device 320 may be any device capable of inductively receiving or transmitting signals.*** For example, in one implementation, the first electronic device corresponds to a docking station, and the second electronic device corresponds to a mobile computing device. In another implementation, both the first and second computing device may correspond to mobile computing devices. Other variations are similarly possible. On the first electronic device **302**, the combination of the bi-directional coil assembly **312** and the power bridge circuit **311** establish the inductive link **330** with the second electronic device **320**. ***In one implementation, the first device 302 operates to transmit power to the second electronic device 320, in which case inductive signal interface 310 uses a power bus 309 and power circuits 314 to inductively transmit power to the second device 320***. As mentioned below, the power bridge circuit **311** may be structured to handle a DC current that originates from a power

Claim Limitation	Exemplary Prior Art Disclosures
	source, such as a wall outlet (in which case rectifiers may be used to convert the AC signal to DC) or battery unit. ***In another implementation, the first device 302 operates to receive power over the inductive link 330. The same power bridge circuit 311 may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes***, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶¶ 34, 35. ***In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302***, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. Chatterjee, ¶ 37. In usages ***when inductive signal interface 310 is in a power receive mode, the power signal is received from the second electronic device 320 over the inductive link 330***. The inductive signal interface 310 may be coupled to a power storage element, such as a rechargeable battery. The inductive signal interface 310 may be configured to charge the power storage element or to provide power to other circuitry within the first electronic device through the voltage supply line. The power circuit 314 receives current transmitted from the power bridge circuit 311 and is configurable to perform voltage and current regulation in order to charge the power storage element or provide power to other circuitry. The bi-directional coil assembly 312 receives power inductively from the second electronic device 320, the power bridge circuit 311 converts AC current received inductively at the bi-directional coil assembly 312 to DC current to be transferred to the power circuit via the power bus.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 4 illustrates an embodiment of the ***inductive signal interface capable of performing data transfer through an inductive link***. According to an embodiment, the inductive signal interface 410 resides on an electronic device 402 (e.g. mobile computing device or dock) and includes a power bridge circuit 411, a bi-directional coil assembly 412, a processor 413, a power circuit 414, and a communication circuit 415. Similar to the inductive signal interface 310 of FIG. 3, the inductive signal interface 410 may reside on any device that is capable of inductively receiving or transmitting power with another suitably configured device. As with an embodiment of FIG. 3, a first computing device uses the inductive signal interface 410 to form an inductive link 430 with a second electronic device 420. The second electronic device may also include an embodiment of inductive signal interface 410. Chatterjee, ¶¶ 40-41. Similar to the inductive signal interface 310 of FIG. 3, ***certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes***. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. Chatterjee, 42. ***During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420***. The power signal is transmitted in modulated form over the power bridge circuit 411, which performs rectification to output a DC current to the power circuit 414. The power circuit 414 is configured to clamp current levels, regulate voltage levels, and perform other functions to transmit an outgoing power signal in the power receive mode. According to embodiments, the resulting power signal is a DC signal and is routed to: (i) charge a rechargeable battery within the electronic device 402, and/or (ii) provide power to circuit elements within the electronic device. Chatterjee, ¶ 46.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3

Claim Limitation	Exemplary Prior Art Disclosures

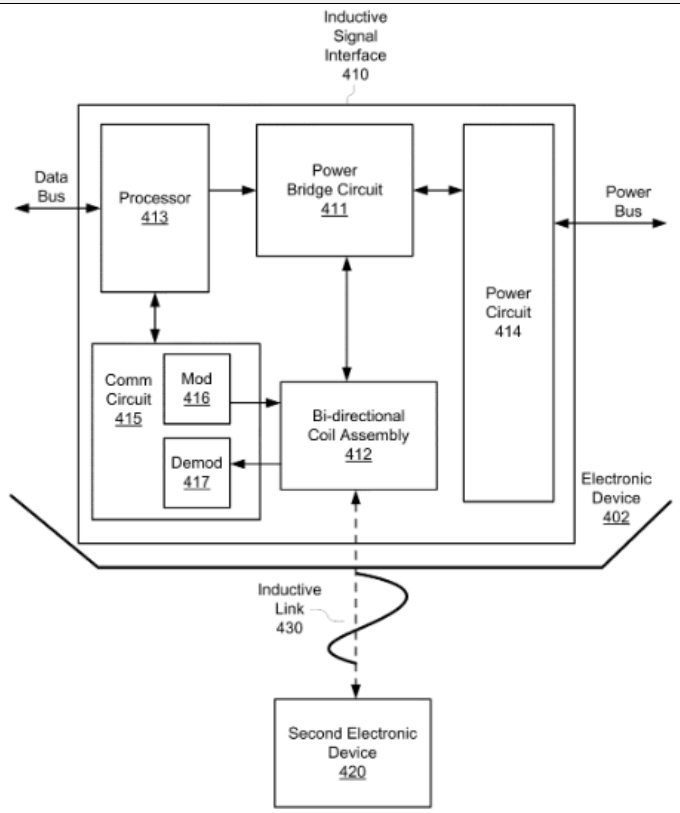


FIG. 4

Chatterjee, Figs. 3, 4, 5.

> In usages when inductive signal interface 310 is in a power receive mode, the power signal is received from the second electronic device 320 over the inductive link 330. The inductive signal interface 310 may be coupled to a power storage element, such as a rechargeable battery.

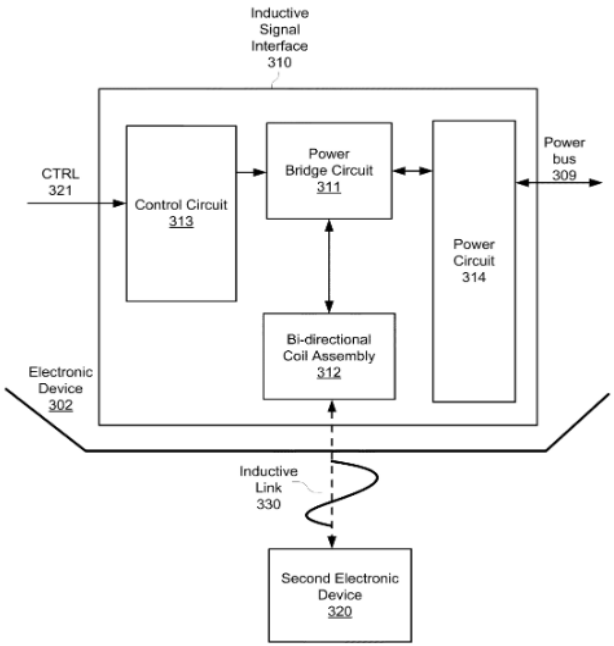
Chatterjee, ¶ 40.

> ***FIG. 4 illustrates an embodiment of the inductive signal interface capable of performing data transfer through an inductive link***. According to an embodiment, the inductive signal interface

Claim Limitation	Exemplary Prior Art Disclosures
	410 resides on an electronic device 402 (e.g. mobile computing device or dock) and includes a power bridge circuit 411, a bi-directional coil assembly 412, a processor 413, a power circuit 414, and a communication circuit 415. Similar to the inductive signal interface 310 of FIG. 3, the inductive signal interface 410 may reside on any device that is capable of inductively receiving or transmitting power with another suitably configured device. ***As with an embodiment of FIG. 3, a first computing device uses the inductive signal interface 410 to form an inductive link 430 with a second electronic device 42***0. The second electronic device may also include an embodiment of inductive signal interface 410. Chatterjee, ¶ 41. The bi-directional coil assembly 412 is configurable to form the inductive link 430 with the second electronic device 420. The bi-directional coil assembly 412 is coupled to the power bridge circuit 411 to transmit and/or receive a power signal. The bi-directional coil assembly 412 operates in a similar fashion as the bi-directional coil assembly 312 of FIG. 3 to transmit and receive the power signal. ***The bi-directional coil assembly 412 is also coupled to the communication circuit 415 to receive and transmit modulated data signals***. Chatterjee, ¶ 45. The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The ***communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. Chatterjee, ¶ 51. ***The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal***. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 53. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. *See generally* Chatterjee, Figs. 3-10. Chatterjee discloses or renders obvious the "dual mode wireless power receiver configured to . . . communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device." Chatterjee discloses communication between the two electronic devices that results in charging of the second electronic device. For example: In some embodiments, ***the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from*** (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) ***by identification of the second electronic device 320*** in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal***

Claim Limitation	Exemplary Prior Art Disclosures
	interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit **411** to control the operation of the power bridge circuit **411** based on the determined mode of operation. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. *See generally* Figs. 3-5.
[1a] one of coil and capacitor electrodes;	Chatterjee discloses or renders obvious this limitation. Chatterjee discloses coils or inductors in a bi-directional coil assembly. For example: **The bi-directional coil assembly 312 receives power *inductively from the second electronic device 320***, the power bridge circuit **311** converts AC current received inductively at the bi-directional coil assembly **312** to DC current to be transferred to the power circuit via the power bus. The bi-directional coil assembly 412 is configurable to form the inductive link 430 with the second electronic device 420. ***The bi-directional coil assembly 412 is coupled to the power bridge circuit 411 to transmit and/or receive a power signal***. The bi-directional coil assembly 412 operates in a similar fashion as the bi-directional coil assembly 312 of FIG. 3 to transmit and receive the power signal. The bi-directional coil assembly 412 is also coupled to the communication circuit 415 to receive and transmit modulated data signals. Chatterjee, ¶¶ 40, 45. During the power transmit mode of the inductive signal interface 410, the ***bi-directional coil assembly 412 is used to carry the modulated power signal to the second electronic device 420***. The power may originate from another component on the electronic device 402, such as a battery (not shown) or from other power sources, such as a wall adapter (not shown). The power circuit 414 is configured to treat the incoming power signal (as described above) to transmit a treated outgoing power signal to the power bridge circuit 411. According to some embodiments, the output power signal of the power circuit 414 to the power bridge circuit 411 in the power transmit

Claim Limitation	Exemplary Prior Art Disclosures
	mode is substantially a DC signal, and the power bridge circuit 411 performs DC to high-frequency conversion to output a high-frequency power signal to the bi-directional coil assembly 412. The bi-directional coil assembly 412 transmits power via the inductive link 430 to the second electronic device 420. Chatterjee, 47.  **FIG. 3** Chatterjee, Fig. 3; *see also id.* Figs. 4, 5. ***FIG. 6A illustrates a circuit level embodiment of the power bridge circuit 311, 411, 511 and the bi-directional coil assembly 312, 412, 512 of FIGS. 3, 4, and 5, respectively***. An embodiment depicted shows the power bridge circuit 610 as being "3-legged", meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for

Claim Limitation	Exemplary Prior Art Disclosures
	use with either the H-bridge or the synchronous bridge rectifier branch. In more detail, power bridge circuit 610 includes an H-bridge branch 611, a shared branch 612, and a sync bridge branch 613. The power bridge circuit 610 has a power input/output (I/O) to receive or transmit a DC current. Each of the three branches is coupled to the power I/O and includes two serially-connected switches. On each of the three branches, one of the serially-connected switches is coupled to the power I/O and the other of the serially-connected switches is coupled to a ground voltage level or a negative supply voltage. On each of the three branches, the node between the two serially-connected switches is coupled to the bi-directional coil assembly 631. The H-bridge branch 611 includes switches 621 and 622 which are connected at a node 601 and are controlled by signals G1 and G2 respectively. The shared branch 612 includes switches 623 and 624 which are connected at a node 602 and are controlled by signals G3 and G4 respectively. The sync bridge branch 613 includes switches 625 and 626 which are connected at a node 603 and are controlled by signals G5 and G6 respectively. The bi-directional coil assembly 631 is coupled to all three branches of the power bridge circuit and includes a capacitor C1 and ***two inductive coils L1 and L2***. The capacitor C1, inductive coils L1 and L2 are coupled to a node 604. C1 is also coupled to the H-bridge branch 611 at the node 601. Inductive coil L1 is also coupled to the shared branch 612 at node 602. Inductive coil L2 is also coupled to the sync bridge branch 613 at the node 603. The inductive coils L1 and L2 can form an inductive link with an second electronic device to transfer power and/or data. Chatterjee, ¶¶ 61–62; *see also id.* Figs. 6-10.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	Chatterjee discloses and/or renders obvious this limitation. First, Chatterjee discloses and/or renders obvious "a first circuitry comprising: an impedance network." Chatterjee discloses a bi-directional coil assembly whose impedance is changeable. For example:

Claim Limitation	Exemplary Prior Art Disclosures

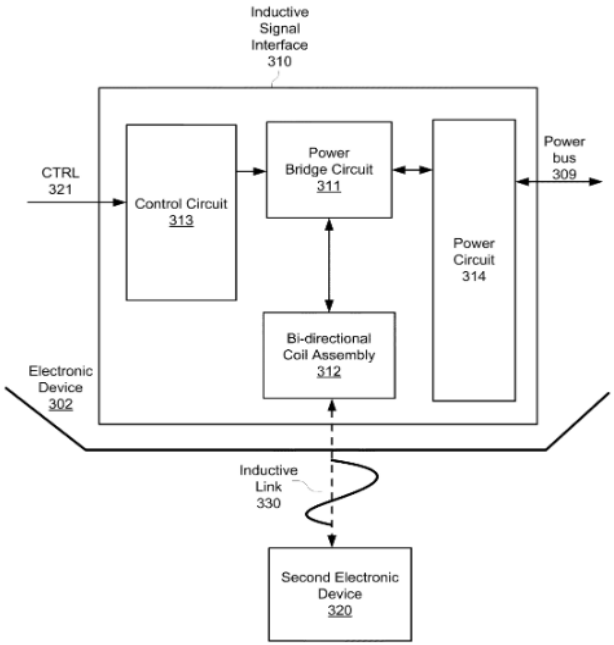


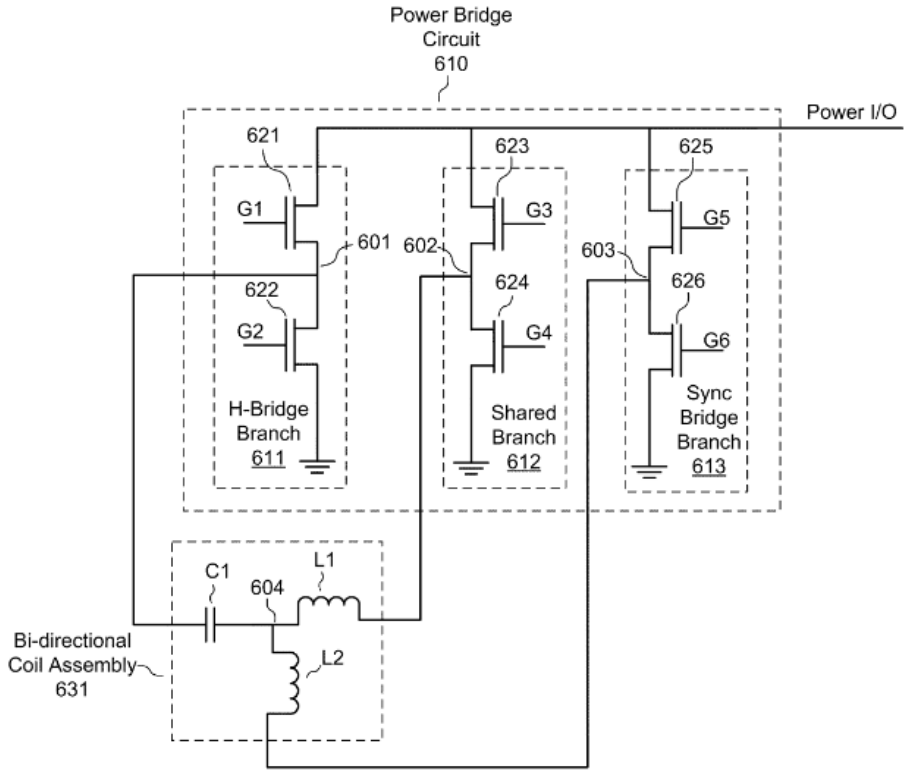
FIG. 3

Chatterjee, Fig. 3; *see also id.* Fig. 4.

> By selectively turning off the H-bridge branch 611 or the sync bridge branch 613, the power bridge circuit 610 is configurable to ***selectively turn off current paths in the bi-directional coil assembly 631 to change the impedance of the bi-directional coil assembly 631 based on the mode of operation of the inductive signal interface***. For example, in the power receive mode of the inductive signal interface, the current paths through the bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the capacitor C1 and the inductive coil L1. In the power transmit mode, the current path through bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the inductive coils L1 and L2.

Chatterjee, ¶ 66.

Claim Limitation	Exemplary Prior Art Disclosures



Chatterjee, Figs. 6A; *see also id*. Figs. 6B-6D, ¶¶ 61-73.

See generally Chatterjee, Figs. 7, 9, 10.

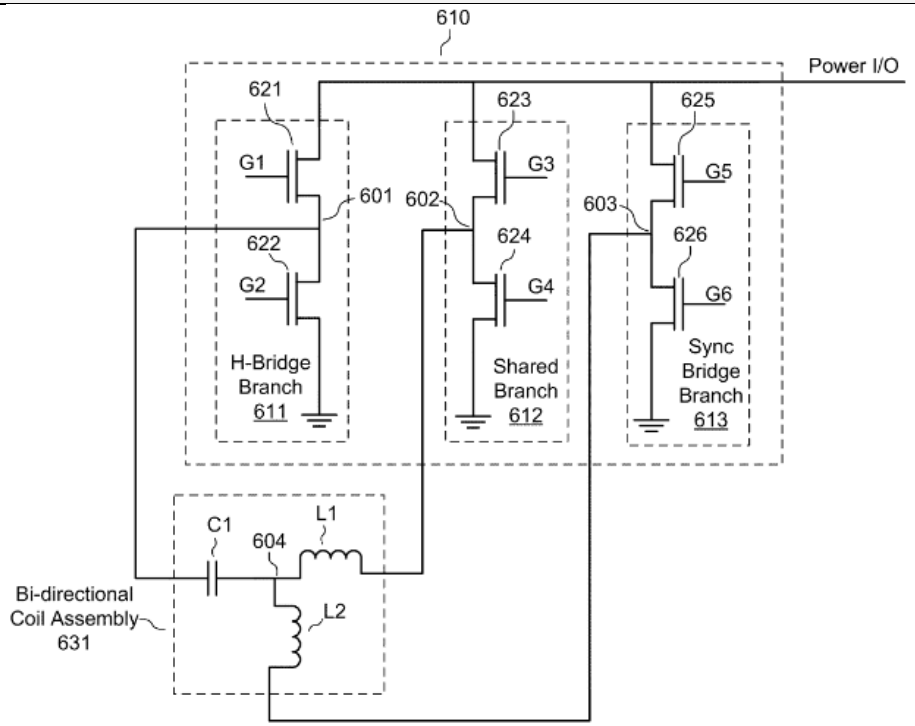
Second, Chatterjee discloses and/or renders obvious "a first circuitry comprising: . . . a switch network." Chatterjee discloses a power bridge circuit that form different circuits depending on the mode of operation.

For example:

> According to embodiments described herein, the power bridge circuit **311** corresponds to a circuit element that is used by the inductive signal interface **310** when in both power transmit and power

Claim Limitation	Exemplary Prior Art Disclosures
	receive modes. ***More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode***. FIG. 6A illustrates a circuit level embodiment of the power bridge circuit **311**, **411**, **511** and the bi-directional coil assembly **312**, **412**, **512** of FIGS. 3, **4**, and **5**, respectively. An embodiment depicted shows the ***power bridge circuit 610 as being "3-legged", meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for use with either the H-bridge or the synchronous bridge rectifier branch***. Chatterjee, ¶¶ 38, 61. In the power transmit mode of the inductive signal interface, the power I/O transmits an input DC current to the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the input DC current can be a regulated current transmitted by the power circuit **314** or **414**. ***In the power transmit mode, G5 and G6 are de-asserted by the control logic so that the switches 625 and 626 in the sync bridge branch 613 are in an off (i.e. open) state. Thus, the sync bridge branch 613 is off while the H-bridge branch 611 and the shared branch 612 are active***. Accordingly, current flow through the inductor L**2** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of capacitor C**1** and inductive coil L**1**. In the power receive mode of the inductive signal interface, the power I/O transmits an output DC current from the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the output DC current may be transmitted via the power bus to the power circuit **314** or **414** which performs voltage and current regulation on the output DC current in order to output a regulated current. ***In this mode of operation of the inductive signal interface, the signals G1 and G2 de-asserted such that the switches 621 and 622 of the H-bridge branch 611 are in the off state. Thus, the H-bridge branch 611 is off while the sync bridge branch 613 and the shared branch 612 are active***. By turning off the H-bridge branch **611**, current flow through capacitor C**1** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of inductive coils L**1** and L**2**. Chatterjee, ¶¶ 64–65.

Claim Limitation	Exemplary Prior Art Disclosures

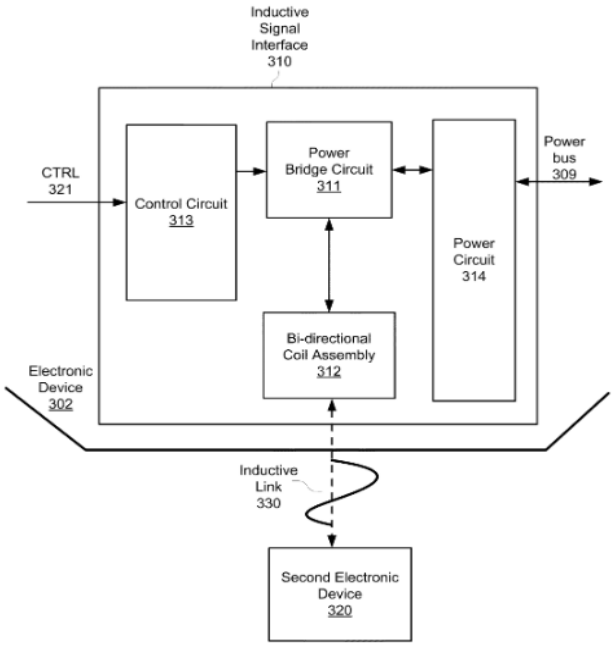


Chatterjee, Fig. 6A; *see also id.* Fig. 6B–6D, ¶¶ 61-73.

> ***FIG. 1 illustrates an H-bridge inverter circuit 110 for transferring power from a DC supply 120 to an AC load 115***. The H-bridge inverter circuit **110** includes four switches **111**-**114** each controlled by a respective one of control signals H**1**-H**4**. During the operation of the H-bridge inverter **110**, the switches **111**-**114** turn on and off in pairs to deliver an AC current to the AC load **115**. For example, at one instance, the signals H**1** and H**4** are asserted to turn on switches **111** and **114**, while the signals H**2** and H**3** are de-asserted to turn off the switches **112** and **113**. Current flows from DC power supply **120** through switch **111**, to the AC load **115**, through the switch **114**, and to a ground voltage or a negative supply voltage. At another instance, the signals H**1** and H**4** are de-asserted to turn off switches **111** and **114**, while the signals H**2** and H**3** are asserted to turn on the switches **112** and **113**. During this instance, the current flows

Claim Limitation	Exemplary Prior Art Disclosures
	from the DC supply **120** through the switch **113**, to the AC load **115**, through the switch **112**, and to the ground voltage or the negative supply voltage. By altering the direction of the current flow, the H-bridge inverter is configured to deliver an AC current from the DC supply **120** to the AC load **115**. ***FIG. 2 illustrates a sync bridge circuit 210 for transferring power from an AC supply 215 to a DC load 220***. The sync bridge circuit **210** includes four switches **211**-**214** each controlled by a respective one of control signals S**1**-S**4**. The sync bridge circuit **210** receives an AC current from the AC supply **215**, and the switches **211**-**214** of the sync bridge circuit **210** turn on and off in pairs to deliver a DC current to the DC load. Chatterjee, ¶¶ 3–4; *see also id.* Figs. 1–2. 3. The inductive signal interface of claim 2, wherein two of the three branches operate to form an H-bridge circuit while the inductive signal interface operates in the power transmit mode. 4. The inductive signal interface of claim 2, wherein two of the three branches operate to form a synchronous bridge rectifier circuit while the inductive signal interface operates in the power receive mode. Chatterjee, cls. 3, 4. *See generally* Chatterjee, Figs. 7-11. Third, Chatterjee discloses and/or renders obvious a "a first circuitry comprising: . . . a filter capacitor." For example: The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. ***The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode)***. The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 37. The power circuit 414 operates in a similar fashion as the power circuit 314 of FIG. 3 to handle current received in either the power transfer mode or the power receive mode. The power bridge circuit 411 operates in a similar fashion as the power bridge circuit 311 of FIG. 3. Chatterjee, ¶ 44. FIG. 10 illustrates a power bridge circuit and a bi-directional coil assembly, together **1010**, coupled to current conditioning circuitry, under an embodiment. The power bridge circuit and bi-directional coil assembly combination **1010**, which may be any of the above described embodiments, is coupled via a signal line Power I/O to a decoupling circuit 1020. ***The decoupling circuit 1020 operates to act as a filter for certain signal frequencies and prevents those signals from passing through.*** Chatterjee, ¶¶ 89; *see also id.* Fig. 10.
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	Chatterjee discloses or renders obvious this limitation. Chatterjee discloses a control circuit including e.g. a processor and a communication circuit. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3

Claim Limitation	Exemplary Prior Art Disclosures

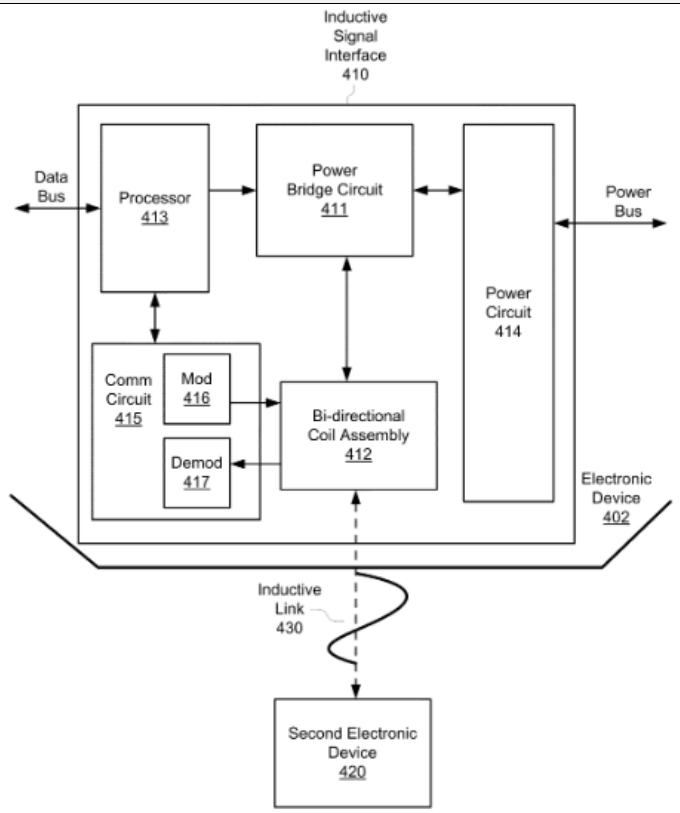


FIG. 4

Chatterjee, Figs. 3, 4, 5.

First, Chatterjee discloses or renders obvious "a second circuitry comprising: a control logic circuit." Chatterjee discloses a processor that controls the operation of the circuitry the inductive signal interface.

For example:

> The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal***

Claim Limitation	Exemplary Prior Art Disclosures
	interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 51. The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. The power bridge circuit 610 is operable in both the power receive and transmit modes of an inductive signal interface, such as the inductive signal interface 410 of FIG. 4. ***The operation of the power bridge circuit 610 is controlled by the signals G1-G6, which are transmitted by control logic coupled the switches 621-626***. Referring back to FIGS. 3 and 4, for example, ***the control logic may be the control element 313 or processor 413***. Chatterjee, ¶ 63. In the power transmit mode, the sync bridge branch 613 is turned off and the current path through the bi-directional coil assembly 632 is the series combination of the capacitor C2 and the inductive coil L3. In the power receive mode, the H-bridge branch 611 is turned off and the current path through the bi-directional coil assembly 632 is the inductive coil L3. Chatterjee, ¶ 69. As shown by an embodiment of FIG. 11, the MCD 1110 has a housing shell 1112 having a thickness (t). The housing shell 1112 may be used to retain internal components of the MCD 1110,

Claim Limitation	Exemplary Prior Art Disclosures
	such as ***a circuit board, processor***, memory, or components of a display assembly. The MCD 1110 may be structured so that a primary facade 1115 (e.g. the back panel) of the housing shell 1112 rests on a receiving surface 1125 of the dock 1120. Chatterjee, ¶ 94. Second, Chatterjee discloses and/or renders obvious a "a second circuitry comprising: . . . modulator/demodulator circuit." For example: The communication circuit **415** is coupled to the bi-directional coil assembly **412** in order to transmit and receive data over the inductive link **430**. ***The communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. Chatterjee, ¶¶ 51-54.

Claim Limitation	Exemplary Prior Art Disclosures
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Chatterjee discloses and/or renders obvious this limitation. Chatterjee discloses a power receive mode. For example: ***During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420. The power signal is transmitted in modulated form over the power bridge circuit 411, which performs rectification to output a DC current to the power circuit 414***. The power circuit 414 is configured to clamp current levels, regulate voltage levels, and perform other functions to transmit an outgoing power signal in the power receive mode. According to embodiments, ***the resulting power signal is a DC signal and is routed to: (i) charge a rechargeable battery within the electronic device 402, and/or (ii) provide power to circuit elements within the electronic device***. Chatterjee, ¶ 46. *See generally* Limitation [1p].
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device;	Chatterjee discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network." Chatterjee discloses a bi-directional coil assembly whose impedance is changeable and a power bridge circuit that form different circuits depending on the mode of operation, as explained above in claim limitation [1b]. Chatterjee discloses and/or renders obvious that changing "impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device" is "based on an input from said control logic circuit." Chatterjee discloses a processor that controls the electronic device to operate in a power receive mode. For example: The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. The processor **413** may be configured to process identification and status information transmitted over the inductive signal interface **430** to determine a mode of operation of the inductive signal interface **410**. ***The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor **413** may also be

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Claim Limitation	Exemplary Prior Art Disclosures
	configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH) Chatterjee, ¶ 55. The same power bridge circuit **311** may be used for implementations in which first device **302** can only receive power over the inductive link **330**. ***The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in*** both power receive and ***power transmit modes***, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may (i) ***link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode***; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In usages when inductive signal interface **310** is in a power receive mode, the power signal is received from the second electronic device **320** over the inductive link **330**. The inductive signal interface **310** may be coupled to a power storage element, such as a rechargeable battery. The inductive signal interface **310** may be configured to charge the power storage element or to provide power to other circuitry within the first electronic device through the voltage supply line. The power circuit **314** receives current transmitted from the power bridge circuit **311** and is configurable to perform voltage and current regulation in order to charge the power storage element or provide power to other circuitry. The bi-directional coil assembly **312** receives power inductively from the second electronic device **320**, ***the power bridge circuit 311 converts AC current received inductively at the bi-directional coil assembly 312 to DC current*** to be transferred to the power circuit via the power bus. Chatterjee, ¶ 40. During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420. Chatterjee, ¶ 46; *see also id.* Figs. 3-10; *see generally* Limitations [1b] and [1c].

Claim Limitation	Exemplary Prior Art Disclosures
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	Chatterjee discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network." Chatterjee discloses a bi-directional coil assembly whose impedance is changeable and a power bridge circuit that form different circuits depending on the mode of operation, as explained above in claim limitation [1b]. Chatterjee also discloses and/or renders obvious that changing "said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver" is "based on an input from said control logic circuit." Chatterjee discloses a processor that controls the electronic device to operate in a power transmit mode. For example: > The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. The processor **413** may be configured to process identification and status information transmitted over the inductive signal interface **430** to determine a mode of operation of the inductive signal interface **410**. ***The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH) Chatterjee, ¶ 55. > The same power bridge circuit **311** may be used for implementations in which first device **302** can only receive power over the inductive link **330**. ***The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive*** and power transmit modes, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may ***(i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode***; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35.

Claim Limitation	Exemplary Prior Art Disclosures
	The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. ***The power bridge circuit 311 is coupled to the power circuit 314 to (i) convert signals from DC to high-frequency form over inductive link 330 when the inductive signal interface 310 is in the power transmit mode***, or (ii) from high-frequency form to DC when the inductive signal interface 310 is in the power receive mode. According to embodiments described herein, the power bridge circuit 311 corresponds to a circuit element that is used by the inductive signal interface 310 when in both power transmit and power receive modes. More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode. In particular, the circuit elements include some circuit elements that are shared and used in both modes, and other circuit elements that are dedicated for a particular one of the two modes. In some embodiments, the circuit elements are provided as branches, where two branches combine to route incoming and outgoing current over the inductive link 330. In one embodiment, the power bridge circuit 311 has a three-legged formation, which

Claim Limitation	Exemplary Prior Art Disclosures
	provides a shared branch that combines with (i) a second branch in order to transmit power over the inductive link 330, and (ii) a third branch in order to receive power over the inductive link 330. As described below, the three branches combine to effectively form an H-bridge and synchronous bridge rectifier combination for use with the inductive link 330. Chatterjee, ¶ 37; *see also id.* Figs. 3-10; *see generally* Limitations [1b] and [1c].
[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	Chatterjee discloses and/or renders obvious this limitation. Chatterjee discloses that the processor receives and process data from the second electronic device, including a type identification and communication protocol of the second electronic device. For example: The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control

Claim Limitation	Exemplary Prior Art Disclosures
	signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive

Claim Limitation	Exemplary Prior Art Disclosures
	mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer

Claim Limitation	Exemplary Prior Art Disclosures
	System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430***. The communication circuit includes a modulator **416** and a demodulator **417**. The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. Chatterjee, ¶ 51.

Claim Limitation	Exemplary Prior Art Disclosures
	The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Chatterjee, ¶ 53. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. Chatterjee discloses and/or renders obvious that identifying "a type of said secondary wireless power receiver" and "wireless protocol of said secondary wireless power receiver" happens "on power-up of said secondary wireless power receiver" because a POSA would have understood or found it obvious that data is communicated over the power link by modulating the wirelessly transmitted power (*see e.g.* claim limitation [1c]), and thus can only happen when the power link exists. To the extent it is argued that Chatterjee does not teach this limitation, this limitation would have been obvious in view of the teachings of one or more of the following references. It would have been obvious to apply the teachings of the following references in implementing Chatterjee's inductive signal interface because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Corbridge**

Claim Limitation	Exemplary Prior Art Disclosures
	For example, Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path). Corbridge, ¶54-55.

Claim Limitation	Exemplary Prior Art Disclosures
	On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of

Claim Limitation	Exemplary Prior Art Disclosures
	protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0" values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the

Claim Limitation	Exemplary Prior Art Disclosures
	two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step 1120)***. Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment.

Claim Limitation	Exemplary Prior Art Disclosures
	In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

Claim Limitation	Exemplary Prior Art Disclosures

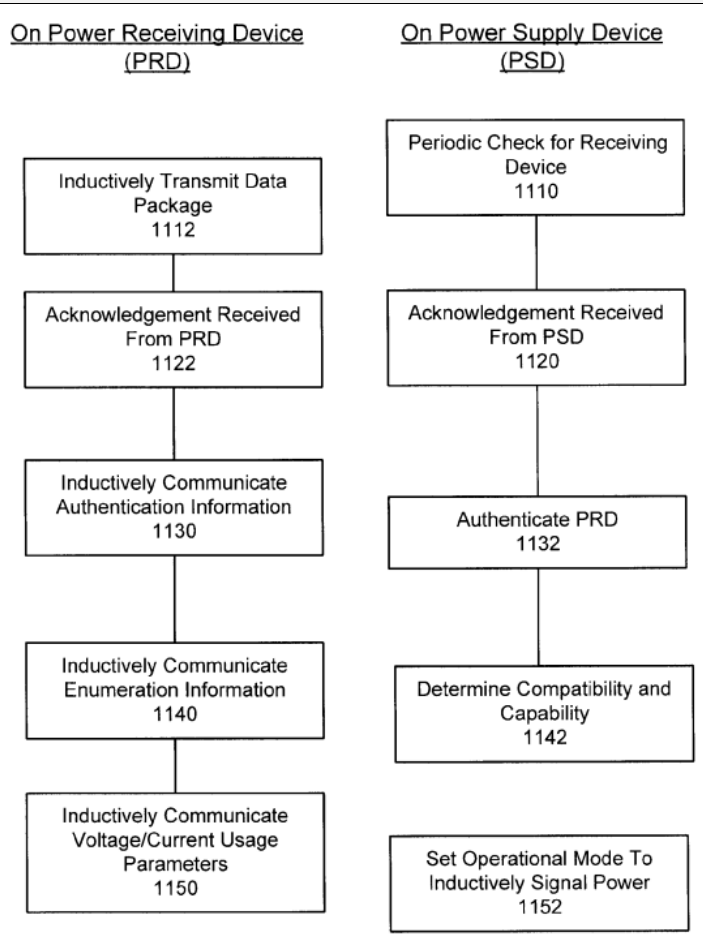


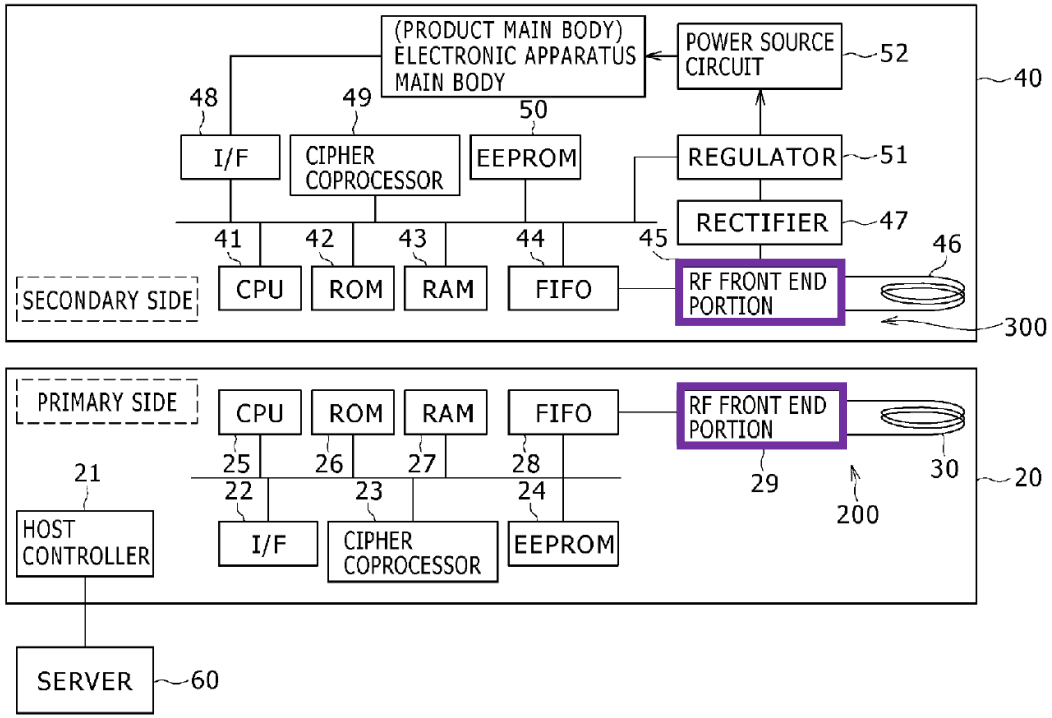
FIG. 11

Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

Teramoto

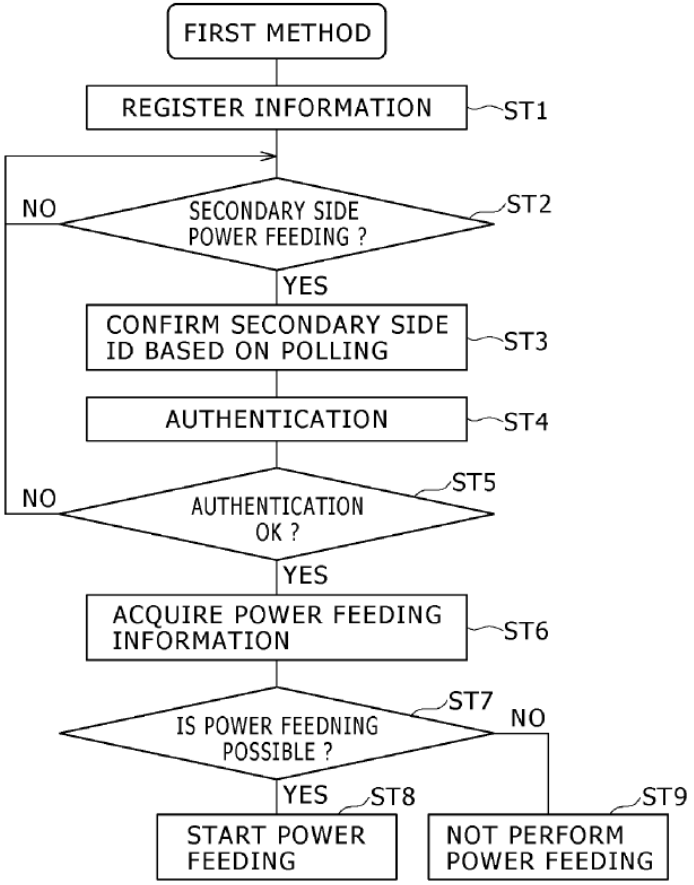
Claim Limitation	Exemplary Prior Art Disclosures
	For example, Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** For example, the WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of

Claim Limitation	Exemplary Prior Art Disclosures
	data defined in the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator

Claim Limitation	Exemplary Prior Art Disclosures
	The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme") From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** | | b_7 | b_6 | b_5 | b_4 | b_3 | b_2 | b_1 | b_0 | | B_0 | Signal Strength Value | **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** | | b_7 | b_6 | b_5 | b_4 | b_3 | b_2 | b_1 | b_0 | | B_0 | End Power Transfer Code |

Claim Limitation	Exemplary Prior Art Disclosures

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two's complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

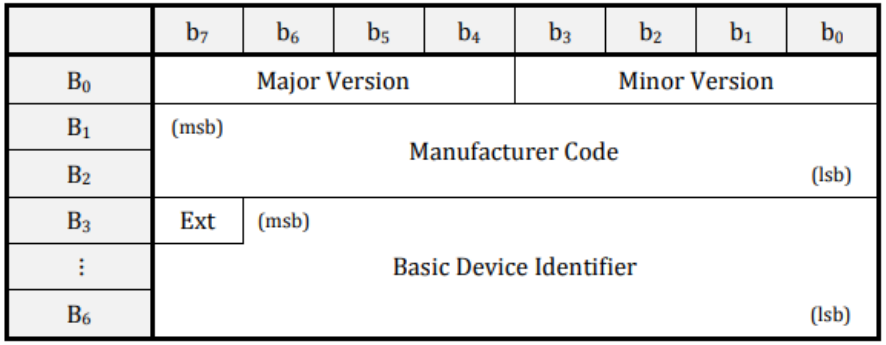
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Chatterjee, alone or in combination with any of the references discussed above in limitation [1g], discloses and/or renders obvious this limitation by disclosing that the processor receives and processes data from the second electronic device in the identified wireless power protocol. For example, Chatterjee discloses: > ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430***. The communication circuit includes a modulator **416** and a demodulator **417**. The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. Chatterjee, ¶ 51. > The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The***

Claim Limitation	Exemplary Prior Art Disclosures
	communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. Chatterjee, ¶ 53. The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit **411** to control the operation of the power bridge circuit **411** based on the determined mode of operation. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode,***

Claim Limitation	Exemplary Prior Art Disclosures
	the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48; *see also supra* Limitation [1g].
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Chatterjee, alone or in combination with any of the references discussed above in limitation [1g], discloses and/or renders obvious this limitation. Chatterjee discloses that the processor sets the mode of operation, such as a power transmit mode, and controls the power transfer, based on interpretation of data from the second electronic device. For example, Chatterjee discloses: In some embodiments, inductive signal interface 410 is configurable to transfer data as well as power via the inductive link 430. In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface 410. Data transmitted over the inductive link 430 may also include commands from the electronic device 402 to the second electronic device 420, or vice-versa. As an example, the electronic device 402, which is a mobile computing device, includes an embodiment of the inductive signal interface 410, and the second electronic device 420 is a dock. The inductive signal interface 410 is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link 430. Upon processing the data, the mobile computing device transmits commands over the inductive link 430 to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes

Claim Limitation	Exemplary Prior Art Disclosures
	commands to cause the inductive signal interface 410 to enter the power receive mode of operation. In some embodiments, the inductive signal interface 410 is used to transmit or receive power signal requirements. In power receive mode, the electronic device 402 may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link 430 may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor 413. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation*** of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. Chatterjee, ¶ 55; *see also supra* Limitation [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured	Chatterjee discloses and/or renders obvious this limitation. For example: **3**. The inductive signal interface of claim 2, wherein ***two of the three branches operate to form an H-bridge circuit while the inductive signal interface operates in the power transmit mode***.

Claim Limitation	Exemplary Prior Art Disclosures
as one of an inverter and a rectifier.	**4**. The inductive signal interface of claim 2, wherein ***two of the three branches operate to form a synchronous bridge rectifier circuit while the inductive signal interface operates in the power receive mode***. ***FIG. 1 illustrates an H-bridge inverter circuit 110 for transferring power from a DC supply 120 to an AC load 115***. The H-bridge inverter circuit 110 includes four switches 111-114 each controlled by a respective one of control signals H1-H4. During the operation of ***the H-bridge inverter 110***, the switches 111-114 turn on and off in pairs to deliver an AC current to the AC load 115. For example, at one instance, the signals H1 and H4 are asserted to turn on switches 111 and 114, while the signals H2 and H3 are de-asserted to turn off the switches 112 and 113. Current flows from DC power supply 120 through switch 111, to the AC load 115, through the switch 114, and to a ground voltage or a negative supply voltage. At another instance, the signals H1 and H4 are de-asserted to turn off switches 111 and 114, while the signals H2 and H3 are asserted to turn on the switches 112 and 113. During this instance, the current flows from the DC supply 120 through the switch 113, to the AC load 115, through the switch 112, and to the ground voltage or the negative supply voltage. By altering the direction of the current flow, the H-bridge inverter is configured to deliver an AC current from the DC supply 120 to the AC load 115. ***FIG. 2 illustrates a sync bridge circuit 210 for transferring power from an AC supply 215 to a DC load 220***. The sync bridge circuit 210 includes four switches 211-214 each controlled by a respective one of control signals S1-S4. The sync bridge circuit 210 receives an AC current from the AC supply 215, and the switches 211-214 of the sync bridge circuit 210 turn on and off in pairs to deliver a DC current to the DC load. Chatterjee, ¶¶ 3, 4, cls. 3, 4; *see also supra* claim Limitation [1b].

U.S. 2013/0026981 (“Van Der Lee”)

The asserted claims of U.S. No. 10,038,339 (“’339 patent”) are anticipated and/or rendered obvious by U.S. Patent Application Publication No. 2013/0026981 (“Van Der Lee”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. 2011/0018356 (“Chatterjee”), U.S. 8,400,801 (“Shinoda”), U.S. Pat. No. 9,837,203 (“Singh-203”), U.S. Patent No. 8,942,624 (“Singh-624”), U.S. Pat. No. 8,901,875 (“Schuessler”), U.S. Pat. No. 8,698,450 (“Yeh”), U.S. Patent Application Publication No. 2010/0148723 (“Cook”), U.S. 2010/0083012 (“Corbridge”), U.S. 2012/0049646 (“Teramoto”), and/or WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 (“WPT Standard” or “WPT”).

Van Der Lee was filed on July 28, 2011 and published on January 31, 2013. It qualifies as prior art under either pre-AIA 102(e), or post-AIA 102(a)(2).

Chatterjee was filed on December 1, 2009 and published on January 27, 2011. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Shinoda was filed on October 25, 2011, published on February 16, 2012, and issued on March 19, 2013. It qualifies as prior art under pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Singh-203 was filed on March 29, 2012, published on October 3, 2013, and issued on December 5, 2017. It qualifies as prior art under pre-AIA 102(e), or post AIA 102(a)(2).

Singh-624 was filed on March 30, 2012, published on October 3, 2012, and issued on January 27, 2015. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Schuessler was filed on March 3, 2011 and published on September 13, 2012. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Yeh was filed on December 27, 2011 and published on June 27, 2013. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(2).

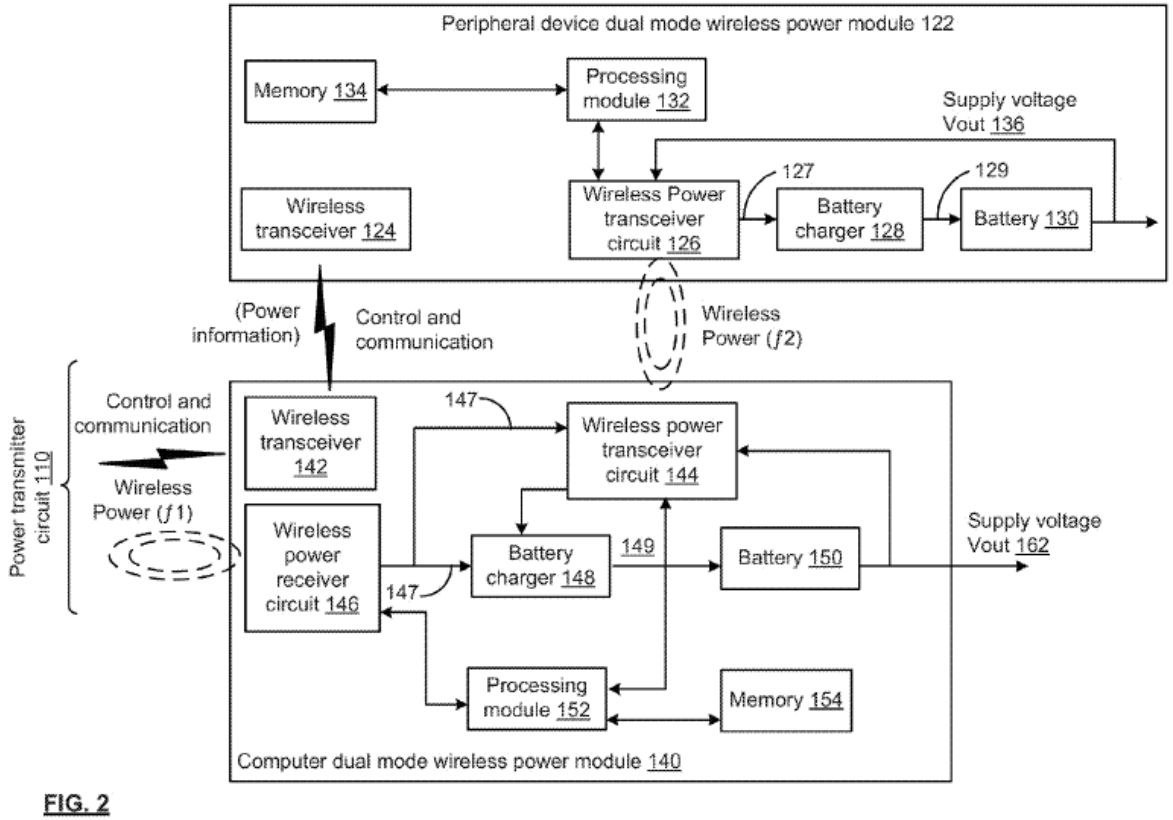
Cook was filed on September 1, 2009 and published on June 17, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Corbridge was filed on June 4, 2009 and published on April 1, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

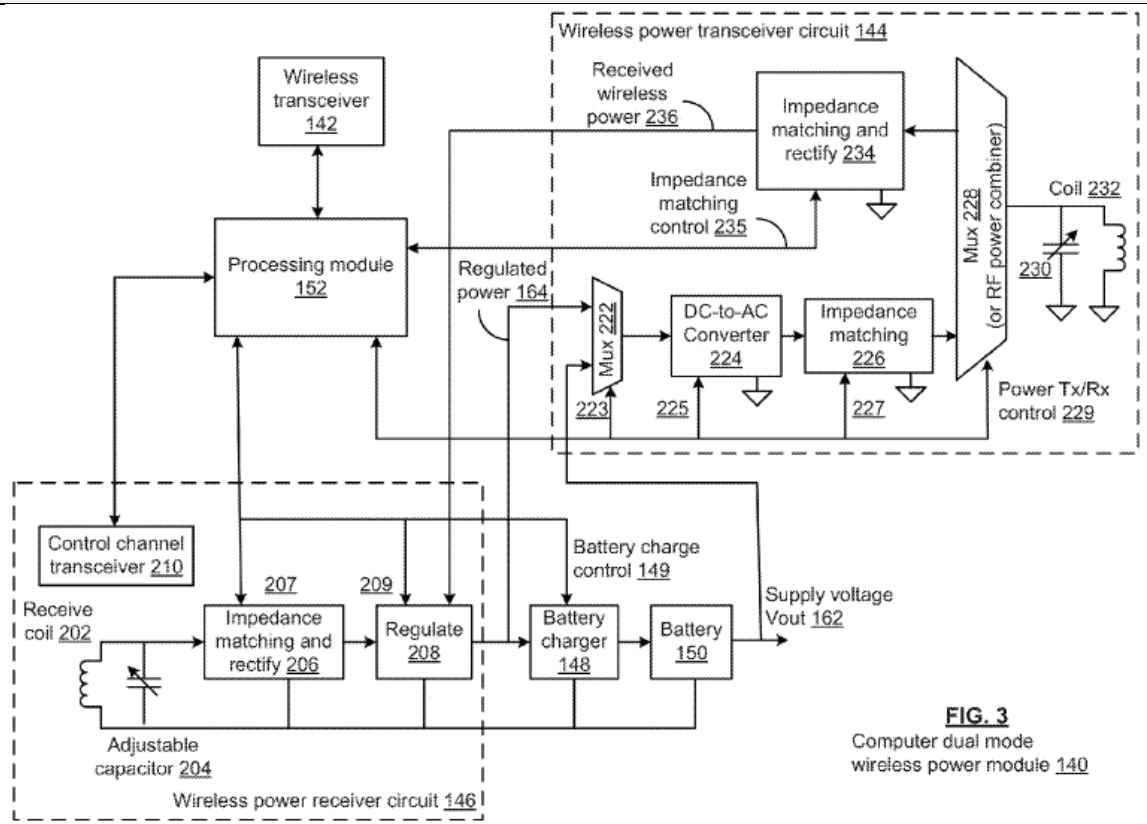
Teramoto was filed on August 23, 2011 and published on March 1, 2012. It qualifies as prior art under either pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1).

Claim Limitation	**Exemplary Prior Art Disclosures**
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	To the extent the preamble is limiting, Van Der Lee discloses and/or renders obvious the preamble. First, Van Der Lee discloses and/or renders obvious a “dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver.” Van Der Lee discloses a “dual mode wireless power module for a device that includes a wireless power transceiver circuit” that can transmit or receive power. (Van Der Lee, Abstract). For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 2 Van Der Lee, Fig. 2.

Claim Limitation	Exemplary Prior Art Disclosures

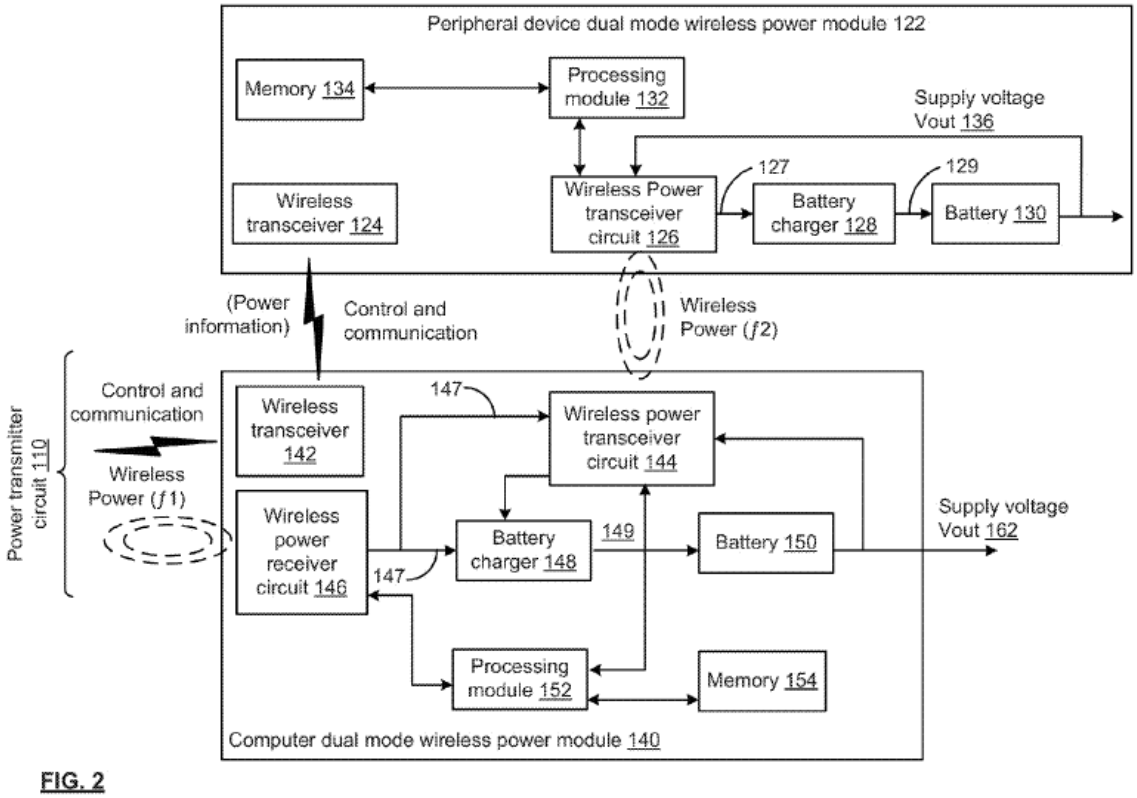


Van Der Lee, Fig. 3.

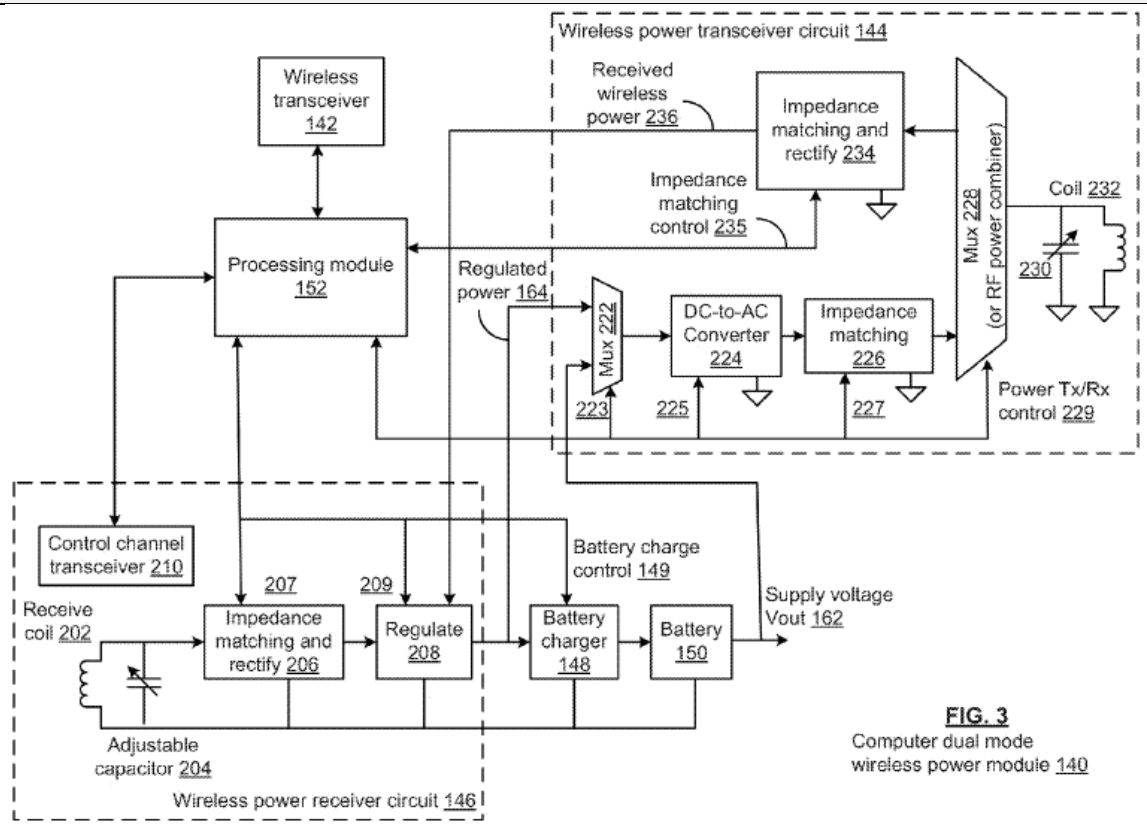
When in ***a wireless power transmit mode, the wireless power transceiver circuit 144 generates an electromagnetic field that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122***. The wireless power transceiver circuit 144 may be sourced by the DC rail voltage 147 when the computer dual mode wireless power module 140 is sufficiently proximal to the power transmitter circuit 110, or

Claim Limitation	Exemplary Prior Art Disclosures
	sourced by the supply voltage Vout 162 from the battery 150 when the computer dual mode wireless power module 140 is not sufficiently proximal to the power transmitter circuit 110. When ***in a wireless power receive mode, the wireless power transceiver circuit 144 receives an electromagnetic field that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122***. The wireless power transceiver circuit 144 converts the wireless power link into a voltage delivered to the battery charger 148, which in turn charges the battery 150. Van Der Lee, ¶¶ 46-47. ***When in a wireless power transmit mode,*** as dictated by the power Tx/Rx control 229 from the processing module 152, ***the wireless power transceiver circuit 144 is powered by*** two possible sources, the first being the regulated power 164 (that is, a regulated rail voltage) when receiving wireless power from wireless power receiver circuit 146, and the second being ***the battery 150 via the supply voltage Vout 162*** when the computer is in a battery operated mode (further presuming the battery 150 has sufficient energy to charge other devices, as is discussed later in further detail with respect to FIGS. 5 and 6). ***In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228***. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232 to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. ***The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module***. When ***in a wireless power receive mode***, such as when the computer dual mode wireless power module 140 does not receive wireless power via the wireless power receiver circuit 146, as indicated through the power Tx/Rx control 229 from the processing module 152, ***the coil 232 of the wireless power transceiver circuit 144 receives a wireless power signal*** transmitted by the coil

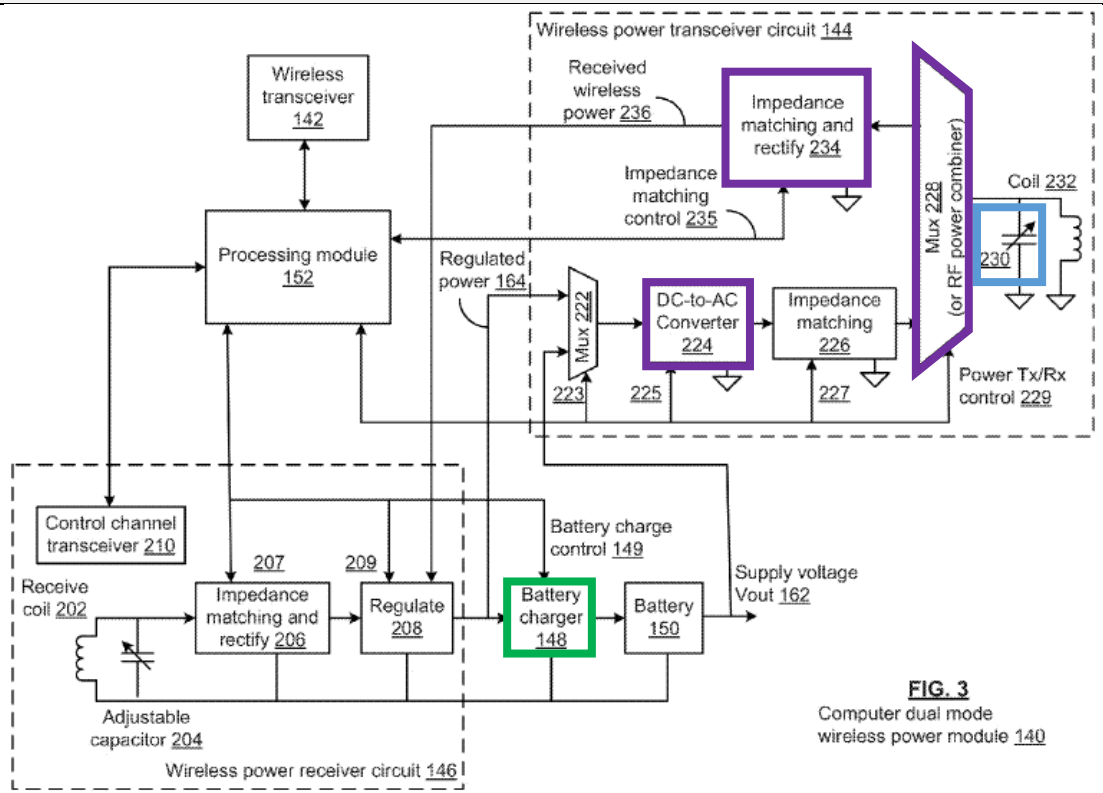
Claim Limitation	Exemplary Prior Art Disclosures
	another device having a peripheral device dual mode wireless power module. In this mode, ***the impedance matching and rectify circuit 234 converts the AC voltage into a received wireless power 236, which is rectified to a DC voltage. The DC voltage is regulated via the regulate circuit 208 for the battery charger 148, which in turn charges the battery 150***. Van Der Lee, ¶¶ 53–55. For clarity, in discussion of the Figures, the computer 100 may be referred to as a primary device, and the other devices as peripheral devices. The understanding being that these labels for the purpose of convenience and clarity, and with the further understanding that some or all of the devices may include a dual mode wireless power module as discussed herein. Van Der Lee, ¶ 23. Second, Van De Lee discloses or renders obvious the "dual mode wireless power receiver configured to . . . communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device." Van Der Lee discloses a wireless power module that receives power information from another wireless power module to places itself in, for example, a power transmit mode. For example: ***The computer dual mode wireless power module 140 communicates with the peripheral device dual mode wireless power module 122 with power information*** via the wireless transceivers 142 and 124, respectively, using a control and communication link (for example, Radio Frequency (RF), Bluetooth, Millimeter Wave (MMW), Near Field Communications (NFC), et cetera) regarding wireless power matters (such as, frequency selection, operating frequency, impedance matching settings, power levels, et cetera). Van Der Lee, ¶ 48. ***From the frame-of-reference of the device receiving the power information, a determination is made whether to place that the dual mode wireless power device in either of a receive wireless power mode when the power status of the other device is favorable, or of a transmit wireless power mode when the power status of the other device is unfavorable***. Van Der Lee, ¶ 77.

Claim Limitation	Exemplary Prior Art Disclosures
	In the other context ***when the power status of the other device is unfavorable***, indicating that the other, or peripheral, device seeks to charge or replenish the peripheral device's battery, and the primary, or computer, device has the voltage capacity and ***the wireless power transceiver of the computer dual mode wireless power module is placed in a power transmit mode*** at step 408. Van Der Lee, ¶ 79.  FIG. 2 Van Der Lee, Fig. 2; *see also id.* ¶¶ 75-79, Fig. 5.
[1a] one of coil and capacitor electrodes;	Van Der Lee discloses and/or renders obvious this limitation. Van Der Lee discloses inductive coupling using coils and capacitive energy transfer using capacitor electrodes.

Claim Limitation	Exemplary Prior Art Disclosures
	For example: Commercial wireless power products generally include either of a transmit unit or a receive unit, and a bidirectional control channel. In these products, the primary method of energy transfer is ***inductive coupling***, but some lower power applications may include solar energy transfer, thermo-electronic energy transfer, and/or ***capacitive energy transfer***. Van Der Lee, ¶ 5. FIG. 3 is a schematic block diagram of an embodiment of a computer dual mode wireless power module 140 that includes the wireless power receiver circuit 146, the battery charger 148, the battery 150, the wireless power transceiver circuit 144, the wireless transceiver 142, and the processing module 152. The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, a DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, an adjustable capacitor 230, and a ***coil 232***. Van Der Lee, ¶¶ 50-51.

Claim Limitation	Exemplary Prior Art Disclosures
	 **FIG. 3** Computer dual mode wireless power module 140 Van Der Lee, Fig. 3.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	Van Der Lee discloses and/or renders obvious this limitation. First, Van Der Lee discloses and/or renders obvious “a first circuitry comprising: an impedance network.” Van Der Lee discloses and/or renders obvious a capacitor and/or a coil whose impedance is adjustable. For example:

Claim Limitation	Exemplary Prior Art Disclosures

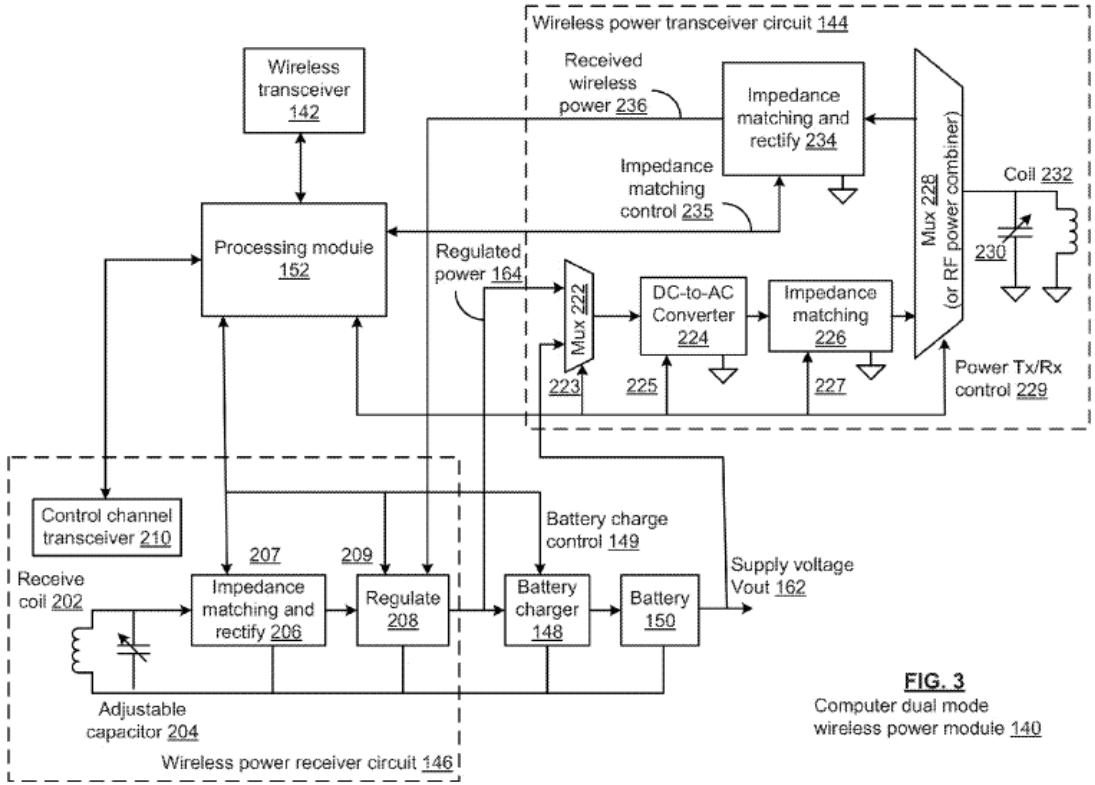


Van Der Lee, Fig. 3.

> The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, a DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, ***an adjustable capacitor 230***, and a coil 232.

Van Der Lee, ¶ 51.

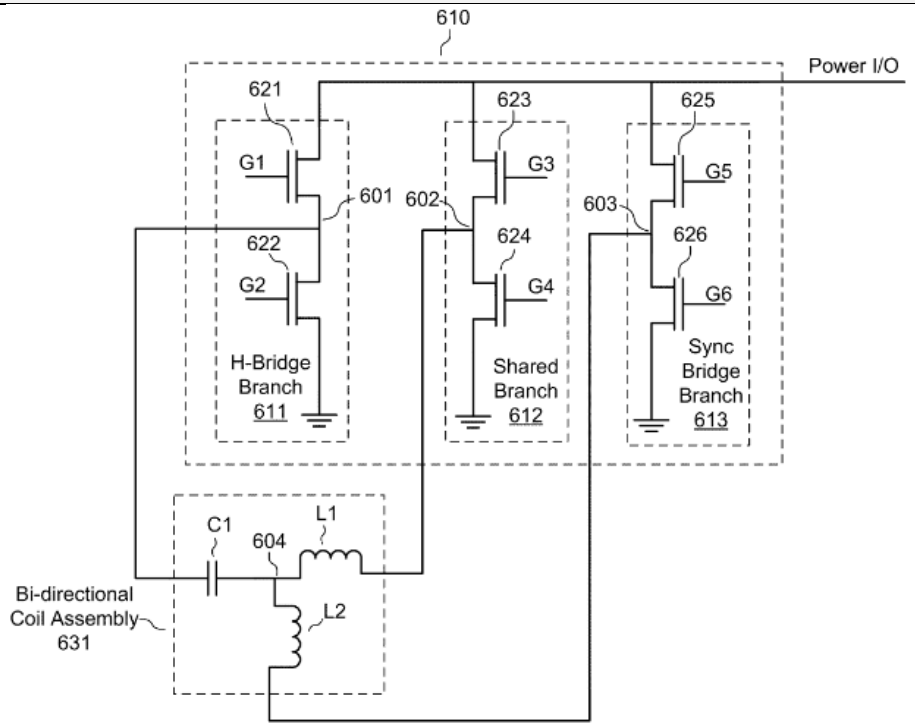
Claim Limitation	Exemplary Prior Art Disclosures
	In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. ***As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit***. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54, Fig. 3; *see also id.* ¶¶ 62, 73, Fig. 4. Van Der Lee discloses and/or renders obvious “a first circuitry comprising: . . . switch network”. Van Der Lee discloses a rectifier, an inverter, and/ a multiplexer that chooses between the two modes of operation. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 Van Der Lee, Fig. 3. The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, ***a DC-to-AC converter 224***, an impedance matching circuit 226, an impedance matching and ***rectify circuit 234***, an adjustable capacitor 230, and a coil 232. Van Der Lee, ¶ 51.

Claim Limitation	Exemplary Prior Art Disclosures
	Note that the processing module 152 may be fabricated on a single integrated circuit or on a multiple integrated circuit with one or more of the components of the regulator 208, ***the rectifier portion of the impedance matching and rectify circuit 206 and 234***, battery charger 148, and/or a battery current sense. Van Der Lee, ¶ 59. In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. ***The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232***. ***The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224*** at a desired frequency. In an alternate embodiment, ***the DC-to-AC converter 224 may include a half bridge inverter topology***. The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232 to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54. ***The processing module 142 provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit or a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 56; *see also id.* ¶¶ 62, 72-73, Fig. 4. ***The terms "circuit" and "circuitry" as used herein may refer to an independent circuit or to a portion of a multifunctional circuit that performs multiple underlying functions.*** For example, depending on the embodiment, processing circuitry may be implemented as a single chip processor or as a plurality of processing chips. Likewise, ***a first circuit and a second circuit may be combined in one embodiment into a single circuit*** or, in another embodiment, operate independently perhaps in separate chips. The term "chip," as used herein, refers to an integrated

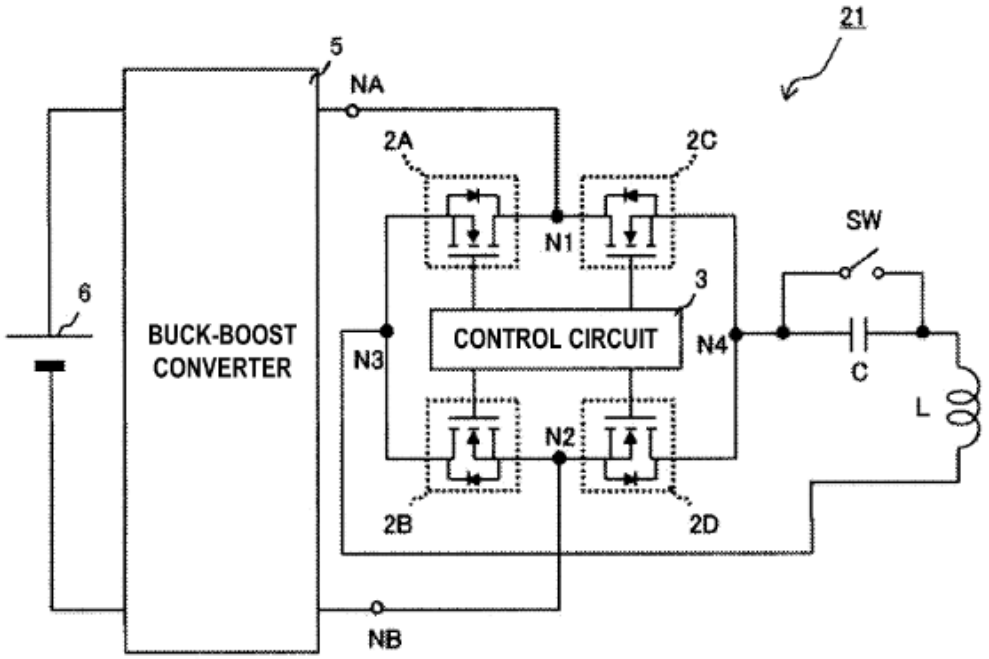
Claim Limitation	Exemplary Prior Art Disclosures
	circuit. Circuits and circuitry may comprise general or specific purpose hardware, or may comprise such hardware and associated software such as firmware or object code. Van Der Lee, ¶ 88. Third, Van Der Lee discloses "a first circuitry comprising: . . . filter capacitor." The primary device and/or the peripheral device may include an integrated circuit (IC) to support the above-described functions. For example, an IC may include at least a portion of the wireless power transceiver circuit (for example, one or more of the coil, capacitor, and diodes of the rectifying circuit may be off-chip), ***at least a portion of the battery charger (for example***, one or more of the switching transistors, ***the output filter capacitor***, the inductor may be off-chip), the transceiver, and the processing module. Van Der Lee, ¶ 36. To the extent it is argued that Van Der Lee does not teach "a first circuitry comprising: . . . a switch network," Van Der Lee in view of the any of the following references would have rendered this limitation obvious. It would have been obvious to apply the circuitry designs disclosed in the following references to provide a switch network with changeable topology in implementing Van Der Lee's dual mode wireless power module because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have found it obvious to choose the circuitry design disclosed in the following references from a finite number of predictable solutions to implement Van Der Lee's dual mode wireless power module and would have had a reasonable expectation of success because the disclosed circuitry is well known in the art and operates in well-known and predictable ways. **Chatterjee** For example, Chatterjee discloses a power bridge circuit that form different circuits depending on the mode of operation: According to embodiments described herein, the power bridge circuit **311** corresponds to a circuit element that is used by the inductive signal interface **310** when in both power transmit and power receive modes. ***More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode***.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 6A illustrates a circuit level embodiment of the power bridge circuit **311**, **411**, **511** and the bi-directional coil assembly **312**, **412**, **512** of FIGS. 3, **4**, and **5**, respectively. An embodiment depicted shows the ***power bridge circuit 610 as being "3-legged", meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for use with either the H-bridge or the synchronous bridge rectifier branch***. Chatterjee, ¶¶ 38, 61. In the power transmit mode of the inductive signal interface, the power I/O transmits an input DC current to the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the input DC current can be a regulated current transmitted by the power circuit **314** or **414**. ***In the power transmit mode, G5 and G6 are de-asserted by the control logic so that the switches 625 and 626 in the sync bridge branch 613 are in an off (i.e. open) state. Thus, the sync bridge branch 613 is off while the H-bridge branch 611 and the shared branch 612 are active***. Accordingly, current flow through the inductor L**2** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of capacitor C**1** and inductive coil L**1**. In the power receive mode of the inductive signal interface, the power I/O transmits an output DC current from the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the output DC current may be transmitted via the power bus to the power circuit **314** or **414** which performs voltage and current regulation on the output DC current in order to output a regulated current. ***In this mode of operation of the inductive signal interface, the signals G1 and G2 de-asserted such that the switches 621 and 622 of the H-bridge branch 611 are in the off state. Thus, the H-bridge branch 611 is off while the sync bridge branch 613 and the shared branch 612 are active***. By turning off the H-bridge branch **611**, current flow through capacitor C**1** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of inductive coils L**1** and L**2**. Chatterjee, ¶¶ 64–65.

Claim Limitation	Exemplary Prior Art Disclosures
	 Chatterjee, Fig. 6A; *see also id.* Fig. 6B–6D, ¶¶ 61-73. ***FIG. 1 illustrates an H-bridge inverter circuit 110 for transferring power from a DC supply 120 to an AC load 115***. The H-bridge inverter circuit **110** includes four switches **111**-**114** each controlled by a respective one of control signals H**1**-H**4**. During the operation of the H-bridge inverter **110**, the switches **111**-**114** turn on and off in pairs to deliver an AC current to the AC load **115**. For example, at one instance, the signals H**1** and H**4** are asserted to turn on switches **111** and **114**, while the signals H**2** and H**3** are de-asserted to turn off the switches **112** and **113**. Current flows from DC power supply **120** through switch **111**, to the AC load **115**, through the switch **114**, and to a ground voltage or a negative supply voltage. At another instance, the signals H**1** and H**4** are de-asserted to turn off switches **111** and **114**, while the signals H**2** and H**3** are asserted to turn on the switches **112** and **113**. During this instance, the current flows

Claim Limitation	Exemplary Prior Art Disclosures
	from the DC supply **120** through the switch **113**, to the AC load **115**, through the switch **112**, and to the ground voltage or the negative supply voltage. By altering the direction of the current flow, the H-bridge inverter is configured to deliver an AC current from the DC supply **120** to the AC load **115**. ***FIG. 2 illustrates a sync bridge circuit 210 for transferring power from an AC supply 215 to a DC load 220***. The sync bridge circuit **210** includes four switches **211**-**214** each controlled by a respective one of control signals S**1**-S**4**. The sync bridge circuit **210** receives an AC current from the AC supply **215**, and the switches **211**-**214** of the sync bridge circuit **210** turn on and off in pairs to deliver a DC current to the DC load. Chatterjee, ¶¶ 3–4; *see also id.* Figs. 1–2. 3. The inductive signal interface of claim 2, wherein two of the three branches operate to form an H-bridge circuit while the inductive signal interface operates in the power transmit mode. 4. The inductive signal interface of claim 2, wherein two of the three branches operate to form a synchronous bridge rectifier circuit while the inductive signal interface operates in the power receive mode. Chatterjee, cls. 3, 4. *See generally* Chatterjee, Figs. 7-11. **Shinoda** For example, Shinoda discloses switching elements (FETs 2A to 2D) that operate as different circuits depending on the mode of operation: FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via ***a respective power transmission circuit 103 and a power reception circuit 104***. ***The power transmission circuit 103 includes an inverter*** for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field

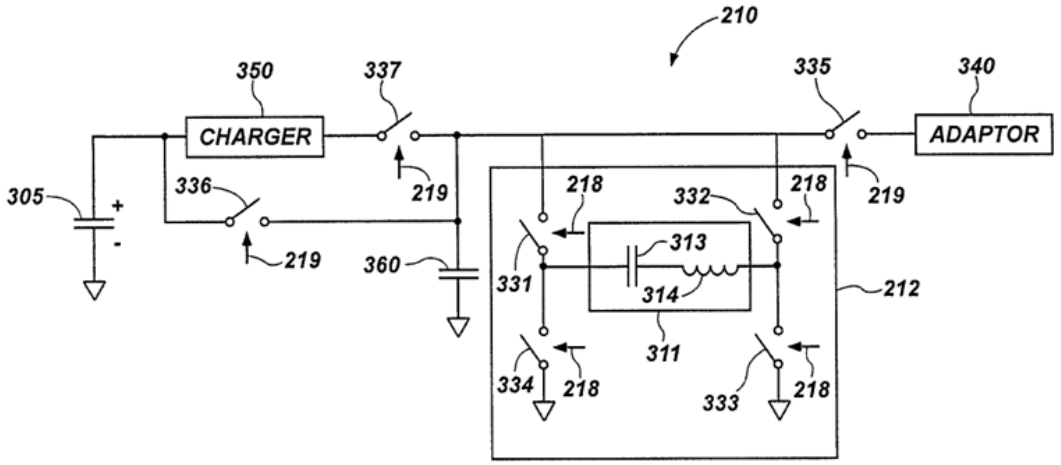
Claim Limitation	Exemplary Prior Art Disclosures
	output from the partner device. ***The power reception circuit 104 includes a rectifier circuit*** for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 1:31-46. ***For a power transmission mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the ***FETs 2A to 2D function as a full-bridge inverter circuit***. Shinoda, 3:52-62. ***For a power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the ***FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. The above described parallel circuit including ***first to fourth semiconductor switching elements (i.e., FETs 2A to 2D) operating as a full-bridge inverter circuit*** can apply an alternating-current output to the coil, thus enabling the wireless power transfer terminal to transmit power. Also, the parallel circuit including the ***first to fourth semiconductor switching elements operating as a rectifier circuit*** can rectify an alternating-current input applied from the coil, thus enabling the wireless power transfer terminal to receive power. In this way, the use of the parallel circuit including the first to fourth semiconductor switching elements as a full-bridge inverter circuit or a full-wave rectifier circuit can reduce the total number of the semiconductor switching elements,

Claim Limitation	Exemplary Prior Art Disclosures
	increase space savings of the circuit configuration of the wireless power transfer terminal 1, and reduce cost of manufacturing. For the present embodiment, an FET element is used as a semiconductor switching element. With this, the parallel circuit can operate as a full-wave rectifier circuit using a parasitic diode between the drain and the source of the FET element. However, embodiments consistent with the disclosure can also be suitably carried out using other semiconductor switching elements. For example, a combination of a bipolar transistor and a diode can also be used as substantially the same circuit configuration as that of the present embodiment, and with other embodiments consistent with this disclosure. Shinoda, 5:17-43.  FIG.5

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** Singh discloses switches 331, 332, 333, 334 that form a switch network that can operates an inverter or a rectifier under different modes. The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. The plurality of switches 331, 332, 333, 334 may be configured as a full-bridge circuit, such that the resonant tank 311 is coupled on one end at a node between the first switch 331 and the fourth switch 334, and at a node between the second switch 332 and the third switch 333 on the other end. In other words, the first switch 331 and the fourth switch 334 may be serially coupled having a first node therebetween, and the second switch 332 and the third switch 333 may be serially

Claim Limitation	Exemplary Prior Art Disclosures
	coupled having a second node therebetween. The resonant tank 311 may be coupled between the first node and the second node. Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. Singh-203, 7:10-8:12. Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality

Claim Limitation	Exemplary Prior Art Disclosures
	of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof. Singh-203, 8:51-9:5. The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3A Singh-203, Fig. 3A; *see also* FIGS. 3A-3D. If the receive mode is determined to be the desired mode of operation, the wireless power enabled operates in the receive mode at operation 430. While in receive mode, control logic may transmit control signals to the wireless charging transceiver. The control signals may control operation of the full-bridge circuit coupled with the resonant tank of the wireless charging transceiver to operate as a full-bridge rectifier. The wireless charging transceiver may receive an incoming wireless power signal and generate an AC current through the resonant tank through inductive coupling. The incoming wireless power signal may be generated by a wireless power transmitting apparatus, such as a wireless power charger. In some embodiments, the wireless power transmitting apparatus may likewise be a wireless power enabled device having multiple modes of operation. The wireless charging transceiver operating as a full-bridge rectifier receives the AC current generated by the resonant tank generates a DC current to be output to a load. Therefore, at operation 435, power may be generated from the energy transfer to provide power to a load. For

Claim Limitation	Exemplary Prior Art Disclosures
	example, the load may include an energy storage device (e.g., battery), system components of the wireless power enabled device, or other power consuming devices. Singh-203, 10:13-36. **Yeh** Yeh discloses a step up/step down unit, a first reverse current protector, a second reverse current protector, and/or a third reverse current protector, that comprise switches that operate differently under different modes. For example: The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, ***the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification***. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1.

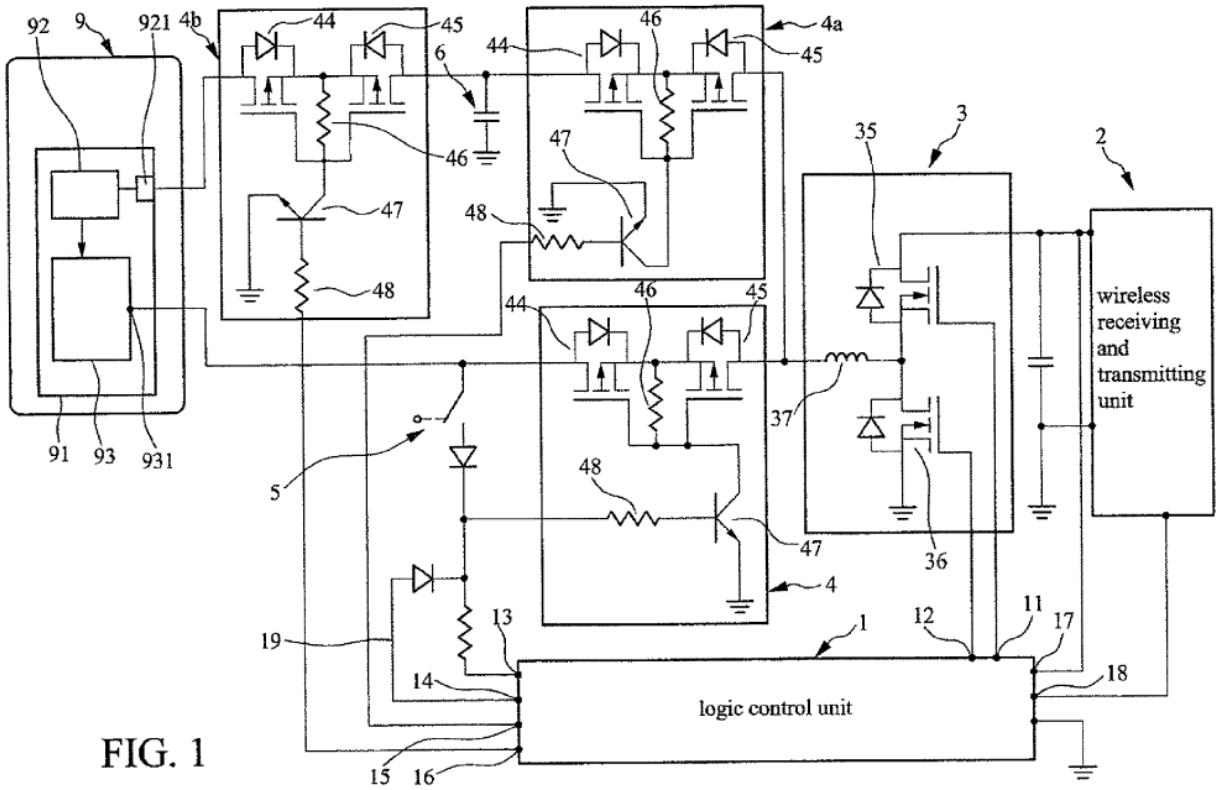
Claim Limitation	Exemplary Prior Art Disclosures
	Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. Yeh, 3:58-4:30. The second reverse current protector 4 a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1. Yeh, 4:40-47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4 b. The third reverse current protector 4 b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4 b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. Referring to FIGS. 1 and 2, ***each reverse current protector (4, 4 a, 4 b) comprises a first resistor 46 and serially-connected oppositely-directed first and second MOSFETs 44, 45***. Two ends of the two serially-connected MOSFETs are respectively the input terminal 41 and the output terminal 42 of the reverse current protector. The first and second MOSFETs 44, 45 each have a

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	control terminal (not labeled), and the two control terminals are electrically connected to the control terminal 43 of the reverse current protector. The first resistor 46 has an end electrically connected between the first and second MOSFETs 44, 45 and an opposite end also electrically connected to the control terminal 43 of the reverse current protector. Further, each reverse current protector (4, 4 a, 4 b) further comprises a transistor 47 and a second resistor 48. The transistor 47 has a first terminal electrically connected to the control terminals (not labeled) of the first and second MOSFETs 44, 45, and a second terminal of the transistor 47 is grounded. The second resistor 48 is electrically connected between a third terminal of the transistor 47 and the control terminal 43 of the reverse current protector. Yeh, 5:17-36. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. ***When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1***. Further, the second reverse current protector 4 a blocks the electrical power of the battery 93 from charging back. Yeh, 5:44-63. if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. ***With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power***

Claim Limitation	Exemplary Prior Art Disclosures
	of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. Yeh, 6:12-29. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 6:38-44. When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4 a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4 a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4 b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.)

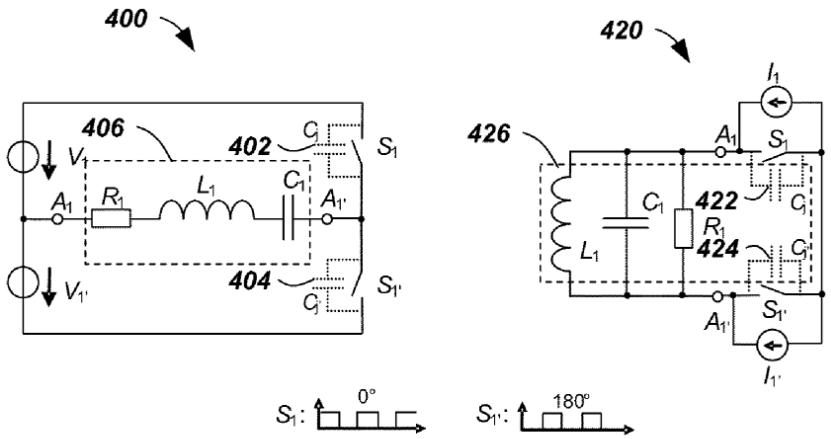
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Claim Limitation	Exemplary Prior Art Disclosures
	When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4 a in an ON condition. Yeh, 6:51-7:18.  FIG. 1 Yeh, Fig. 1; *see also id.* Figs. 2-3. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: Supercapacitors are arranged

Claim Limitation	Exemplary Prior Art Disclosures
	at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery. ***The first and second reverse current protectors 4, 4 a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized***. ***The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved***. ***The first to third reverse current protectors 4, 4 a, 4 b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency***. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. **Cook** Cook discloses a power conversion circuit that comprise synchronous switches that operate differently under different modes. For example: FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant

Claim Limitation	Exemplary Prior Art Disclosures
	relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes ***a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter***. Receiver 208 further includes ***a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter***. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). ***Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable***. Accordingly, the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device.

Claim Limitation	Exemplary Prior Art Disclosures
	Cook, ¶42. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and ***a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow)***. The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. ***The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein***. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, ***a bidirectional power conversion circuit 308*** and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324. ***Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane***. Cook, ¶50. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of ***a half bridge rectifier topology 400*** including a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. ***A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration.*** The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion.

Claim Limitation	Exemplary Prior Art Disclosures
	As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.  ***FIG. 8***

Claim Limitation	Exemplary Prior Art Disclosures
	Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration) with a ***half bridge active rectifier*** configured with the switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, ***a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , ***a half bridge passive diode rectifier*** 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures

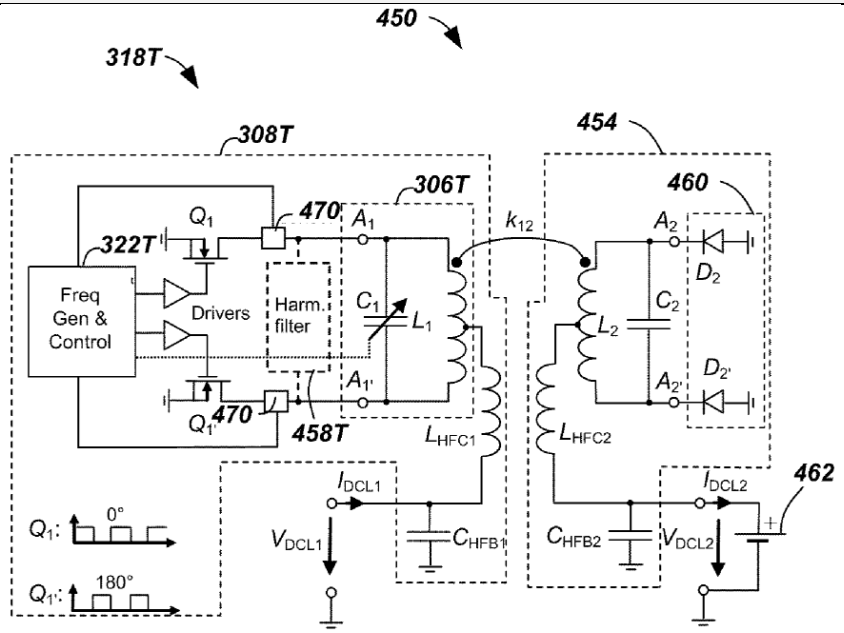


FIG. 9

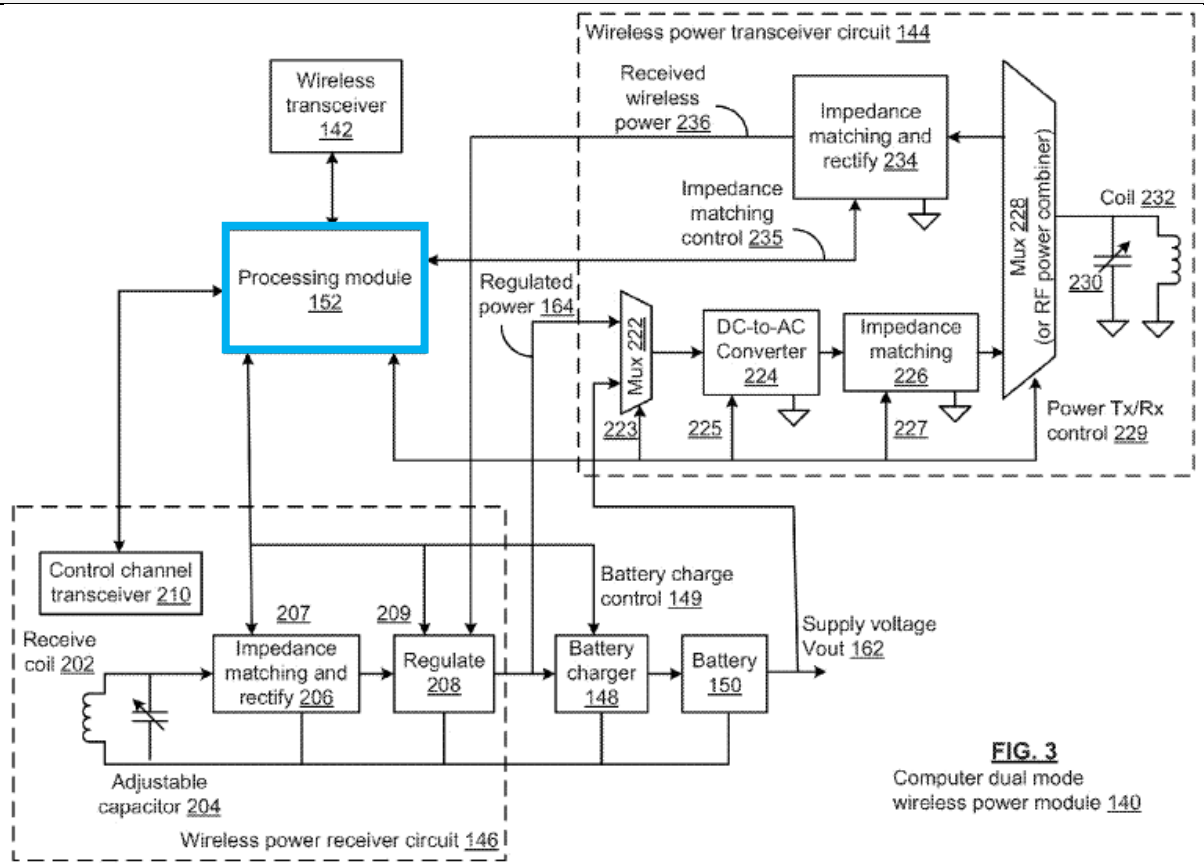
Cook, Fig. 9.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional ***power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna

Claim Limitation	Exemplary Prior Art Disclosures
	306T, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, ***a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratin***gs. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. ***In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier*** and switches are controlled based on sensed voltage. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶63.
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	Van Der Lee discloses or renders obvious this limitation. First, Van Der Lee discloses and/or renders obvious “a second circuitry comprising: a control logic circuit.” Van Der Lee discloses a processing module. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode based upon power information from the dual mode wireless power module 122, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit or a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 56. Moreover, the processing module **142 [sic]** provides a power selection signal **223** to the MUX **222** between the regulated power **164** and the supply voltage Vout **162** for wireless power transmission via the wireless power transceiver circuit **144**. Moreover, ***the processing module 132 implements a battery charge control 149, a regulate control 209, an impedance matching circuit control 207, 227, and 235, a DC-to-AC control 225***, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures



Van Der Lee, Fig. 3; *see also id.* ¶¶ 53, 55, 65, Fig. 4.

Second, Van Der Lee discloses and/or renders obvious “a second circuitry comprising: . . . a modulator/demodulator circuit.” Van Der Lee discloses that a wireless communication link and a wireless power link may be established over the same inductive link.

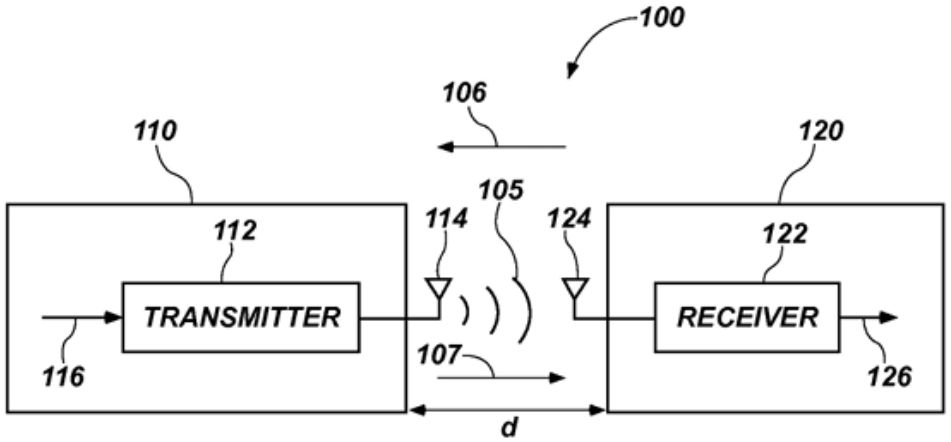
For example:

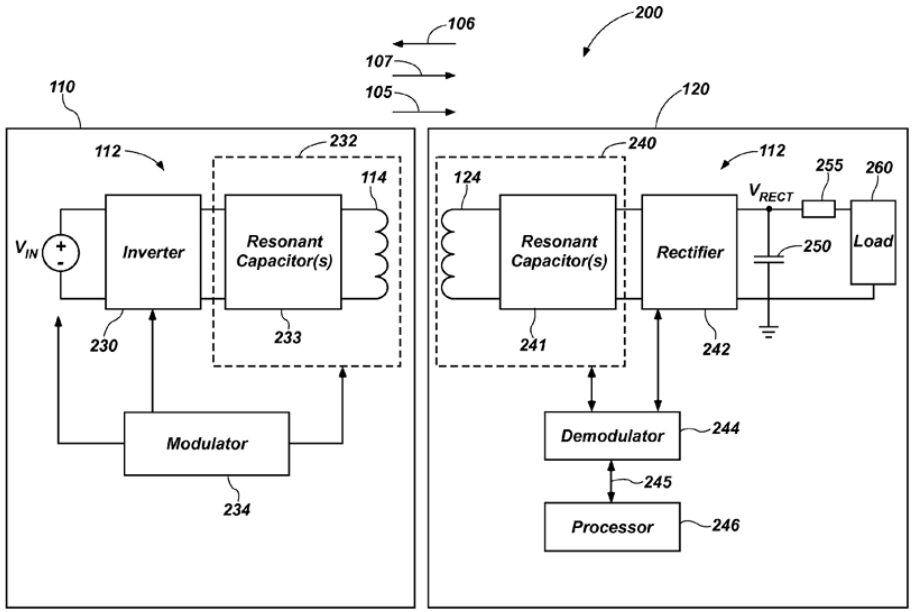
> ***The peripheral devices***, such as cell phone 104, smart phone 102, and personal A/V player 108 may be wirelessly powered concurrently from the computer 100 and/or sequentially. Each of the

Claim Limitation	Exemplary Prior Art Disclosures
	peripheral devices 102, 104, and 108, ***wirelessly communicates via control and communication links with the computer 100 using*** conventional wireless communication protocols (such as Bluetooth) and or use ***a wireless power control channel***. The foregoing method may further include establishing the wireless power link. The wireless power link may be established based on inductive (or non-resonant) coupling or on resonant inductive coupling. ***The wireless communication link and the wireless power link may also be established via the same inductive link***. The foregoing method may further include monitoring an amount of power wirelessly transferred to the portable electronic device and charging a user of the portable electronic device based on the monitored amount. Van Der Lee, ¶¶ 25, 8. To the extent it is argued that Van Der Lee does not teach "a second circuitry comprising: . . . modulator/demodulator circuit," Van Der Lee in view of the any of the following references would have rendered this limitation obvious. It would have been obvious to use a modulator/demodulator circuit disclosed in the following references in implementing Van Der Lee's wireless power module because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have had a reasonable expectation of success because modulator/demodulator circuits are well known in the art for providing communication data over a power signal. **Chatterjee** For example, Chatterjee discloses a modulator and demodulator: The communication circuit **415** is coupled to the bi-directional coil assembly **412** in order to transmit and receive data over the inductive link **430**. ***The communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such

Claim Limitation	Exemplary Prior Art Disclosures
	as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. Chatterjee, ¶¶ 51-54. **Shinoda** For example, Shinoda discloses: For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5. ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21

Claim Limitation	Exemplary Prior Art Disclosures
	and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20. **Singh-203** Singh-203 also discloses a modulator / demodulator. For example: The embodiments shown in FIG. 2, as well as in FIGS. 3A through 3D, are shown to demonstrate a wireless power enabled device being configured to operate in either a transmit mode or a receive mode, such as for wireless OTG charging. It should be recognized that the wireless power enabled device may include additional components to perform other features not specifically described herein. For example, the wireless power enabled device may include a modulator and/or a demodulator for communicating with other devices, foreign object detection modules, I/O modules for interfacing with a user, memory for storing instructions and data, various sensors, among other components. Singh-203, 9:26-37. **Singh-624** Singh-624 describes how the modulator/demodulator may be employed. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1

Claim Limitation	Exemplary Prior Art Disclosures
	 *FIG. 2* Singh-624, FIGS. 1-2; *see also id.*, FIG. 7. An inductive wireless power transfer device comprises a transmitter that comprises a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. An inductive wireless power receiving device comprises a receiver that comprises a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Related inductive wireless power transfer systems and methods for back-channel communication from the transmitter to the receiver of an inductive wireless power transfer system are disclosed.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, Abstract. During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Embodiments of the present disclosure include an inductive wireless power transfer device. The inductive wireless power transfer device comprises a transmitter that includes a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power receiving device. The inductive wireless power receiving device comprises a receiver having a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power transfer system. The inductive wireless power transfer system comprises a transmitter having a transmit coil configured to generate a modulated wireless power signal in a coupling region for wireless power transfer, and a receiver having a receive coil configured to couple with the transmit coil by receiving the modulated wireless power signal and to generate an output signal in response thereto to provide power to a load, wherein the modulated wireless power signal includes characters. Another embodiment of the present disclosure includes a method for communicating between a transmitter to a receiver in an inductive wireless power transfer system. The method comprises

Claim Limitation	Exemplary Prior Art Disclosures
	generating a wireless power signal through a transmit coil of a transmitter to a receive coil of a receiver, and modulating the wireless power signal on the transmitter side for communicating data over the wireless power signal from the transmitter to the receiver. Singh-624, 1:56-2:25. Embodiments of the present disclosure include a back-channel communication link 107 to transmit data from the transmitter 112 to the receiver 122. The transmitter 112 may be configured to establish the back-channel communication link 107 by modulating the wireless power signal 105. In particular, the conversion gain of the wireless power signal 105 may be modulated, which may be detected responsive to the wireless power signal 105 being received and demodulated by the receiver 122. While the back-channel communication link 107 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105, it should be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils (through transmit coil 114 and receive coil 124). Thus, the wireless power signal 105 carries the communication data of the back-channel communication link 107 when the wireless power signal 105 is modulated as described herein. The arrow for the back-channel communication link 107 is merely shown separately for the purpose of indicating a direction of communication data flow. Similar to conventional wireless power transfer systems, embodiments of the present disclosure may further include a forward-channel communication link 106 for transmitting data from the receiver 122 to the transmitter 112, such as via backscatter modulation. As discussed above, conventional wireless power transfer systems may be limited to one-way communication from the receiver 122 to the transmitter 112, or else require separate RF coils for transmitting data separately from the transmit coil 114 and receive coil 124. Like the back-channel communication link 107, the forward-channel communication link 106 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105; however, it should also be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils. Thus, the wireless power signal 105 carries the communication data of the forward-channel communication link 106 when the wireless power signal 105 is modulated according to the conventional principles of back scatter modulation. The arrow for the forward-channel communication link 106 is also shown separately for the purpose of indicating a direction of communication data flow.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, 5:38-6:11. The transmitter 112 may further include an inverter 230, a resonant tank 232, and a modulator 234. The resonant tank 232 may include one or more capacitors (e.g., resonant capacitor(s) 233) coupled with an inductor (e.g., the transmit coil 114). The capacitors and inductors may be configured in an LC network, such as being coupled in series or parallel. The inverter 230 is coupled between the input voltage (VIN) and the resonant tank 232. The modulator 234 may be coupled with one or more of the inverter 230, the resonant tank 232, and the input voltage (VIN) in order to modulate the wireless power signal 105 such that communication may be achieved from the transmitter 112 to the receiver 122, as will be described in more detail below. The transmitter 112 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions such as power monitoring, foreign object detection, etc. It will also be appreciated that the transmitter 112 may include a demodulator for receiving and demodulating communication received from the receiver 122. The receiver 122 may further include a resonant tank 240, a rectifier 242, a demodulator 244, and a processor 246. The resonant tank 240 may include an inductor (e.g., receive coil 124) coupled with one or more capacitor (e.g., resonant capacitor(s) 241). The resonant tank 240 is coupled with the rectifier 242, which may further be coupled to the load 260. The demodulator 244 may be coupled with one or more of the resonant tank 240, the rectifier 242, and the processor 246 in order to demodulate the received wireless power signal 105 and transmit a demodulated signal 245 to the processor 246 for analysis or other processing. The receiver 122 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions, such as power monitoring, foreign object detection, etc. It will also be appreciated that the receiver 122 may include a modulator for modulating communication to the receiver 122. Singh-624, 6:55-7:22. **Schuessler** For example: The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile

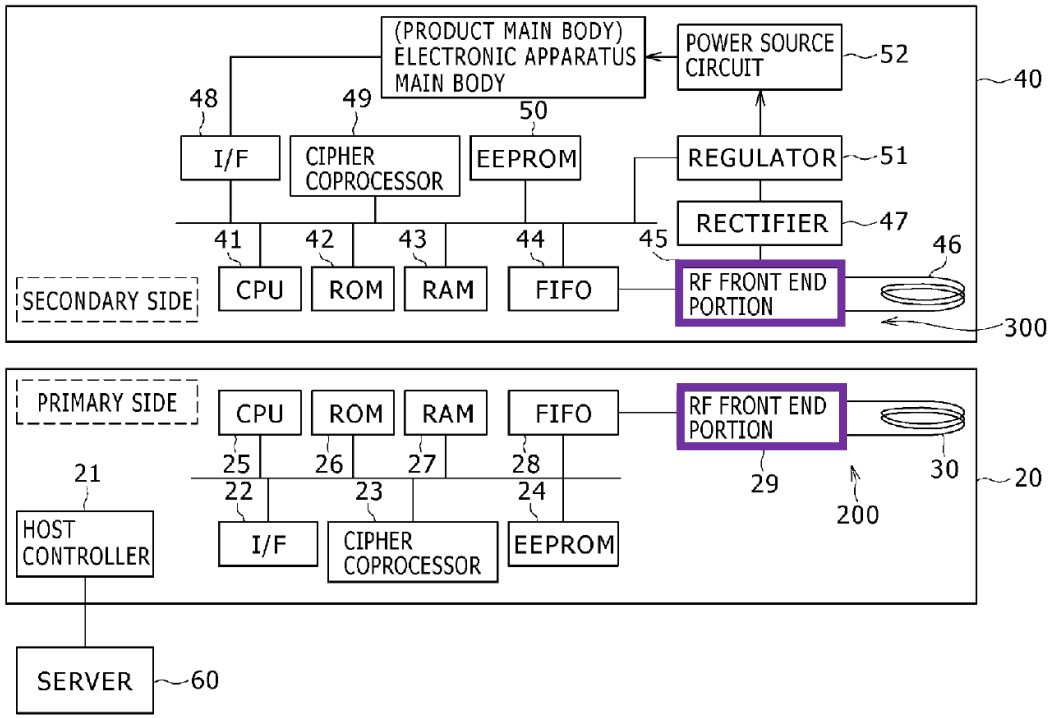
Claim Limitation	Exemplary Prior Art Disclosures
	devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Schuessler, 5:5-21. One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. wherein the wireless communication mechanism is selected from Bluetooth, WiFi, other public or proprietary wireless protocols, ***modulation on the energy transfer itself, modulating a low frequency protocol on a high frequency energy transfer, by modulating a high frequency protocol on a low frequency energy transfer or an infrared interface***; Schuessler, cl. 1. **Corbridge** For example: On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422

Claim Limitation	Exemplary Prior Art Disclosures
	includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. Corbridge, ¶55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.***

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶57. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0”

Claim Limitation	Exemplary Prior Art Disclosures
	values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95. **Teramoto** For example, Teramoto discloses: Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like.

Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto, ¶ 52.

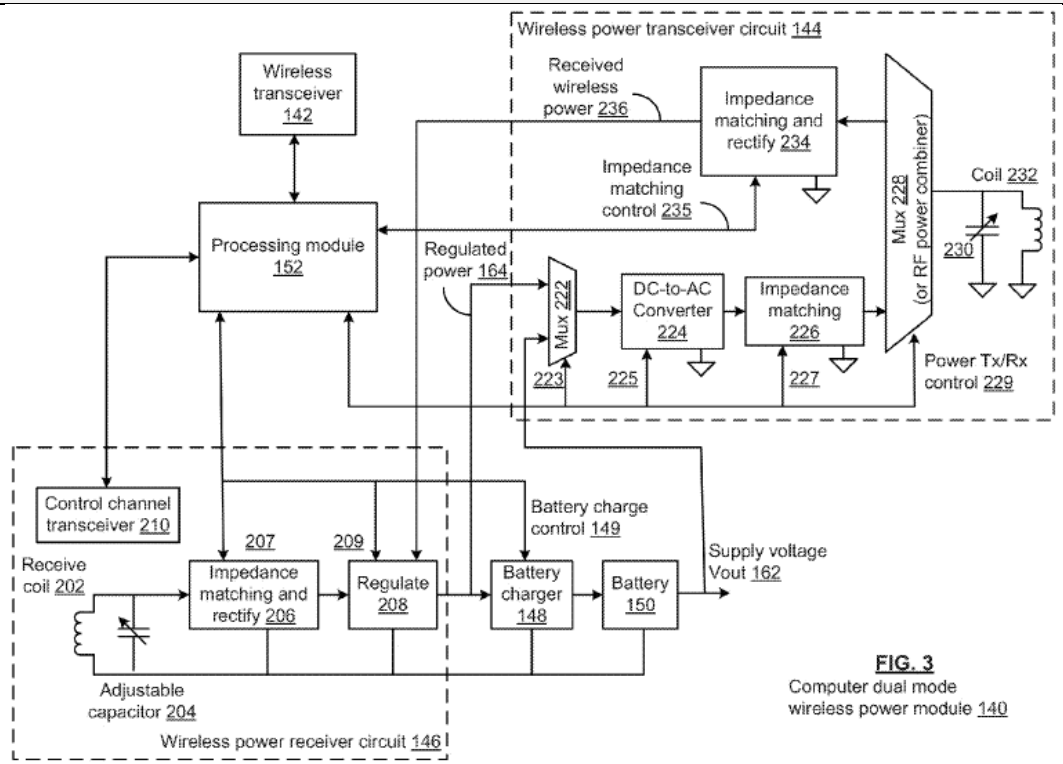


Teramoto, Fig. 1; *see also id.* ¶ 55.

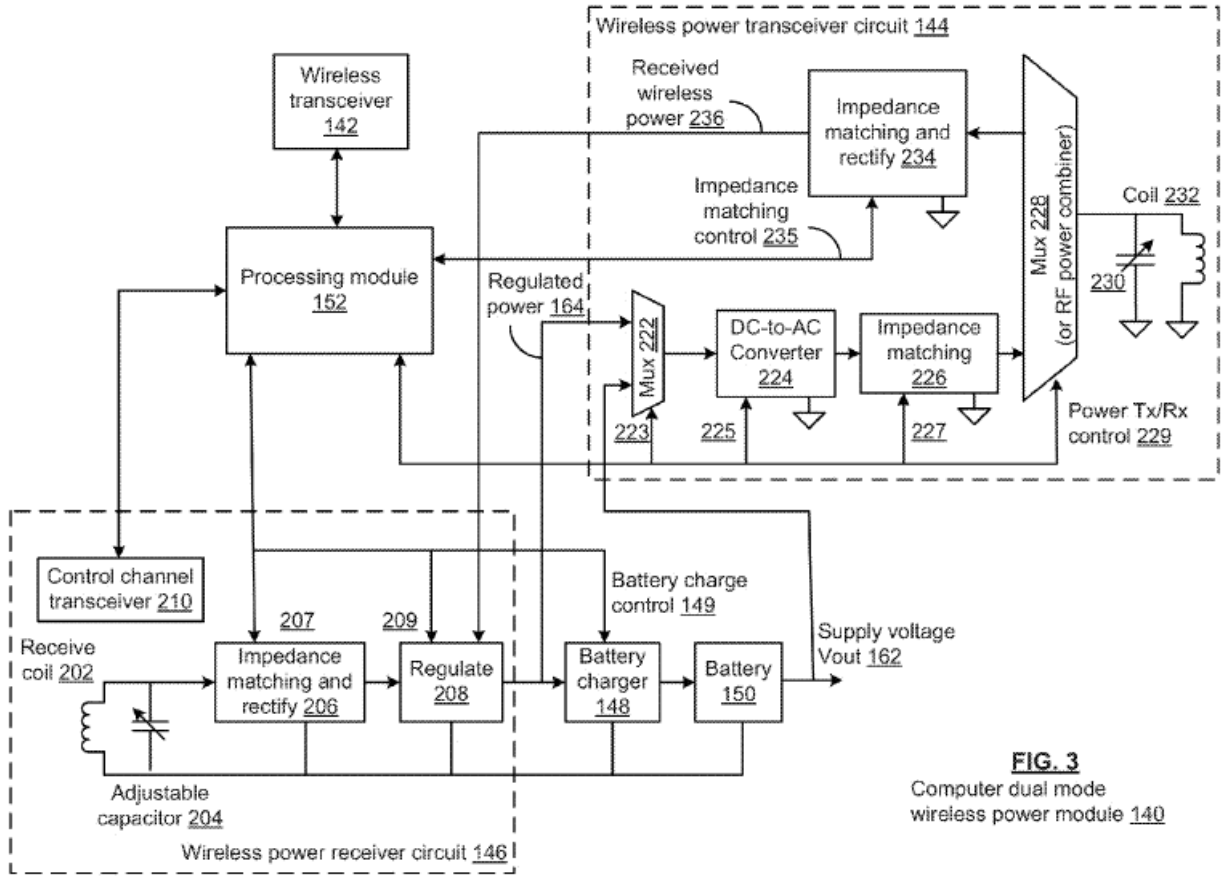
> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17. **WPT** The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, ***the communications modulator typically consists of a capacitor in series with a switch*** (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power

Claim Limitation	Exemplary Prior Art Disclosures
	Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme").
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Van Der Lee discloses and/or renders "said first circuitry configured to receive said power from a wireless power transmitter." Van Der Lee discloses a wireless power receive mode. For example: ***When in a wireless power receive mode, the wireless power transceiver circuit 144 receives an electromagnetic field*** that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122. ***The wireless power transceiver circuit 144 converts the wireless power link into a voltage delivered to the battery charger 148, which in turn charges the battery 150***. Van Der Lee, ¶ 46.

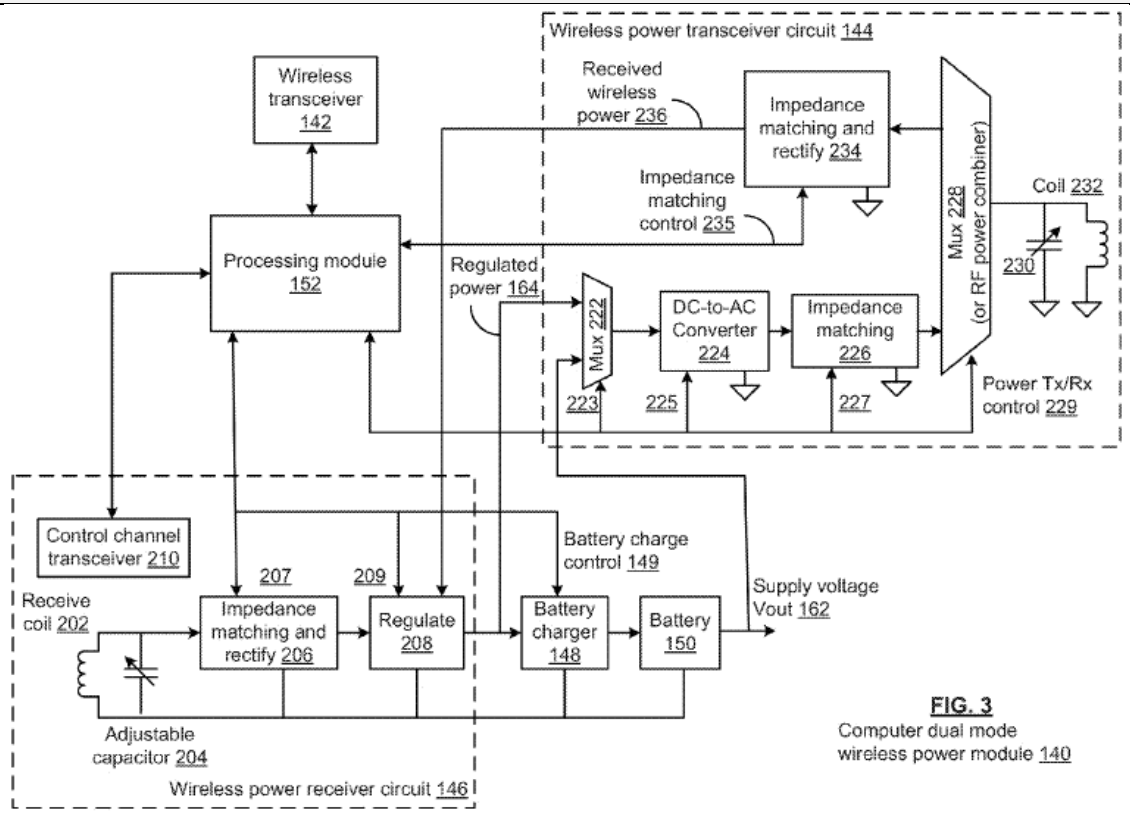
Claim Limitation	Exemplary Prior Art Disclosures
	 Van Der Lee, Fig. 3; *see also id.* ¶ 43, Fig. 4. *See generally* Limitation [1p].
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network	Van Der Lee discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network." Van Der Lee discloses a capacitor and/or a coil whose impedance is adjustable and a rectifier, an inverter, and a multiplexer that chooses between the two modes of operation, as explained above in claim limitation [1b]. Van Der Lee further discloses and/or renders obvious that changing "impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device" is "based on an input from said control logic circuit." Van

Claim Limitation	Exemplary Prior Art Disclosures
to obtain a modified form of said received power, and apply said modified form of said power to said load device;	Der Lee discloses that the processing module controls the wireless power module to operate in a power receive mode. For example: ***The processing module 152 places the wireless power transceiver circuit 144 in either of*** a wireless power transmit mode or ***a wireless power receive mode*** based upon power information from the dual mode wireless power module 122, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. When in a wireless power receive mode, such as when the computer dual mode wireless power module 140 does not receive wireless power via the wireless power receiver circuit 146, as indicated through the power Tx/Rx control 229 from the processing module 152, the coil 232 of the wireless power transceiver circuit 144 receives a wireless power signal transmitted by the coil another device having a peripheral device dual mode wireless power module. In this mode, ***the impedance matching and rectify circuit 234 converts the AC voltage into a received wireless power 236, which is rectified to a DC voltage***. ***The DC voltage is regulated via the regulate circuit 208 for the battery charger 148, which in turn charges the battery 150***. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in*** either of a wireless power transmit or ***a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶¶ 55–56. Moreover, the processing module 142 [sic] provides a power selection signal 223 to the MUX 222 between the regulated power 164 and the supply voltage Vout 162 for wireless power transmission via the wireless power transceiver circuit 144. Moreover, the processing module 132 implements a battery charge control 149, a regulate control 209, an impedance matching circuit control 207, 227, and 235, a DC-to-AC control 225, and provide for RF/MMW and/or NFC baseband processing.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee, ¶ 58.  FIG. 3 Computer dual mode wireless power module 140 Van Der Lee, Fig. 3; *see also id.* Fig. 4. *See generally* Limitation [1b], [1c].
[1f] said first circuitry, based on an input from said control logic	Van Der Lee discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network." Van Der Lee discloses a capacitor and/or a

Claim Limitation	Exemplary Prior Art Disclosures
circuit, configured to change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	coil whose impedance is adjustable and a rectifier, an inverter, and a multiplexer that chooses between the two modes of operation, as explained above in claim limitation [1b]. Van Der Lee further discloses and/or renders obvious that changing "said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver" is "based on an input from said control logic circuit." Van Der Lee discloses a processing module that controls the electronic device to operate in a power transmit mode. For example: ***When in a wireless power transmit mode, as dictated by the power Tx/Rx control 229 from the processing module 152, the wireless power transceiver circuit 144 is powered*** by two possible sources, the first being the regulated power 164 (that is, a regulated rail voltage) when receiving wireless power from wireless power receiver circuit 146, and the second being ***the battery 150 via the supply voltage Vout 162 when the computer is in a battery operated mode (further presuming the battery 150 has sufficient energy to charge other devices***, as is discussed later in further detail with respect to FIGS. 5 and 6). In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. ***The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224*** at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. ***The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module.*** Van Der Lee, ¶¶ 53, 54.

Claim Limitation	Exemplary Prior Art Disclosures
	Moreover, the processing module 142 [sic] provides a power selection signal 223 to the MUX 222 between the regulated power 164 and the supply voltage Vout 162 for wireless power transmission via the wireless power transceiver circuit 144. Moreover, the processing module 132 implements a battery charge control 149, a regulate control 209, ***an impedance matching circuit control*** 207, ***227***, and 235, ***a DC-to-AC control 225***, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 56. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit*** or a wireless power receive ***mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures
	 Van Der Lee, Fig. 3. *See generally* Limitation [1b], [1c].
[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said	Van Der Lee discloses and/or renders obvious this limitation. Van Der Lee discloses that the processing module receives information including, for example, the identifier, the power capability, and the power priority, as well as the communication protocol, from another wireless power module. For example: A dual mode wireless power module for a device includes a wireless transceiver and a wireless power transceiver circuit. ***The wireless transceiver circuit is operable to communicate peripheral***

Claim Limitation	Exemplary Prior Art Disclosures
secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	***power information indicating a wireless power configuration***. The wireless power transceiver circuit is operable to determine, based upon the power information, a power status of another device identified by the peripheral power information. When the power status of the another device is favorable, the wireless power transceiver circuit is placed in a wireless power receive mode in which the wireless power transceiver circuit converts wireless power into a voltage. When the power status of the another device is unfavorable, the wireless power transceiver circuit is placed in a wireless power transmit mode in which the wireless power transceiver circuit converts a power source of the device into the wireless power. Van Der Lee, Abstract. The determination a power status of one of the devices, such as the smart phone 102, the cell phone 104, the personal A/V player 108, may be with regard to power information communicated via the control and communication link between the device. For example, ***the power information may include power source identifier for the peripheral device, a wireless power capability of the device, whether dual mode wireless power is enabled for the device, wireless power transmit capability, or wireless power receive capability. Moreover, the power information may include a device power priority giving precedence over lower prioritized devices for limited or discrete power resources in a battery-based system (that is, a system in which a power transmitter circuit 110 is unavailable to provide virtually bottomless power resources).*** For example, a device may be designated in a factory setting as having priority for finite power resources (such as a cell phone 104) in the need to communicate in emergencies, or lower based upon purely entertainment function (such as the personal A/V player 108). In other contexts, a user may configure the device power priority based upon their individual preferences, such as via a user interface for the device. ***The power information may further include at least one of a communication protocol, input data, input command, output data, and output command***. For example, with interaction with a user input device (such as a touch or tactile screen, keypad, mouse, keyboard, et cetera), the user input device may generate data and/or a command for execution by the display device, such as a display screen on the personal A/V player 108. As another example, if the device setup includes a memory device such as a wireless disk drive or flash drive, and the peripheral device is a user output device such as the display screen and speakers of the personal A/V player 108, the memory device provides data to the user output device for display of audible and/or visual data.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee, ¶¶30-31. The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode based upon ***power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. The power information indicates a wireless power configuration, including one or more of full battery capacity, charging history (e.g., times, durations, charge voltage, charge current, trickle charge reached, etc.), current battery life, current loading, loading history, etc. Moreover, the ***power information includes a power source identifier identifying the device or devices, wireless power capability (for example, whether dual mode capable, transmit capable, or receive capable)***; device power priority (indicating the power reception priority for conveying or receiving wireless power); and ***at least one of a communication protocol***, input data, input command, output data; and output command. Van Der Lee, ¶ 76. The foregoing method may further include establishing the wireless power link. The wireless power link may be established based on inductive (or non-resonant) coupling or on resonant inductive coupling. ***The wireless communication link and the wireless power link may also be established via the same inductive link***. The foregoing method may further include monitoring an amount of power wirelessly transferred to the portable electronic device and charging a user of the portable electronic device based on the monitored amount. Van Der Lee, ¶ 8. Van Der Lee discloses and/or renders obvious that identifying "a type of said secondary wireless power receiver" and "wireless protocol of said secondary wireless power receiver" happens "on power-up of said secondary wireless power receiver." Van der Lee discloses and/or renders obvious transmitting data over the same wireless power link as explained above in claim limitation [1c].

Claim Limitation	Exemplary Prior Art Disclosures
	To the extent it is argued that Van Der Lee does not teach this limitation, it would have been obvious to do so in view of the teachings of any of the references below. It would have been obvious to apply the teachings of the following references in implementing Van Der Lee's wireless power module because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improved functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Chatterjee** For example, Chatterjee discloses a processor in the inductive signal interface that receives and process data from a second electronic device via a modulator/demodulator, including data about type identification, status, authentication, enumeration, presence of the other device, protocol, and wireless power needs: > The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. > The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. > In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that

Claim Limitation	Exemplary Prior Art Disclosures
	designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the

Claim Limitation	Exemplary Prior Art Disclosures
	second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as***

Claim Limitation	Exemplary Prior Art Disclosures
	the power receiver) to signal back real-time information about its power needs. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The communication circuit includes a modulator 416 and a demodulator 417.*** The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**.

Claim Limitation	Exemplary Prior Art Disclosures
	According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶¶ 51-55. **Corbridge** For example, Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange,

Claim Limitation	Exemplary Prior Art Disclosures
	in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path). Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include

Claim Limitation	Exemplary Prior Art Disclosures
	resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out

Claim Limitation	Exemplary Prior Art Disclosures
	and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0” values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode

Claim Limitation	Exemplary Prior Art Disclosures
	863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step 1120)***. Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement.

Claim Limitation	Exemplary Prior Art Disclosures
	In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

Claim Limitation	Exemplary Prior Art Disclosures

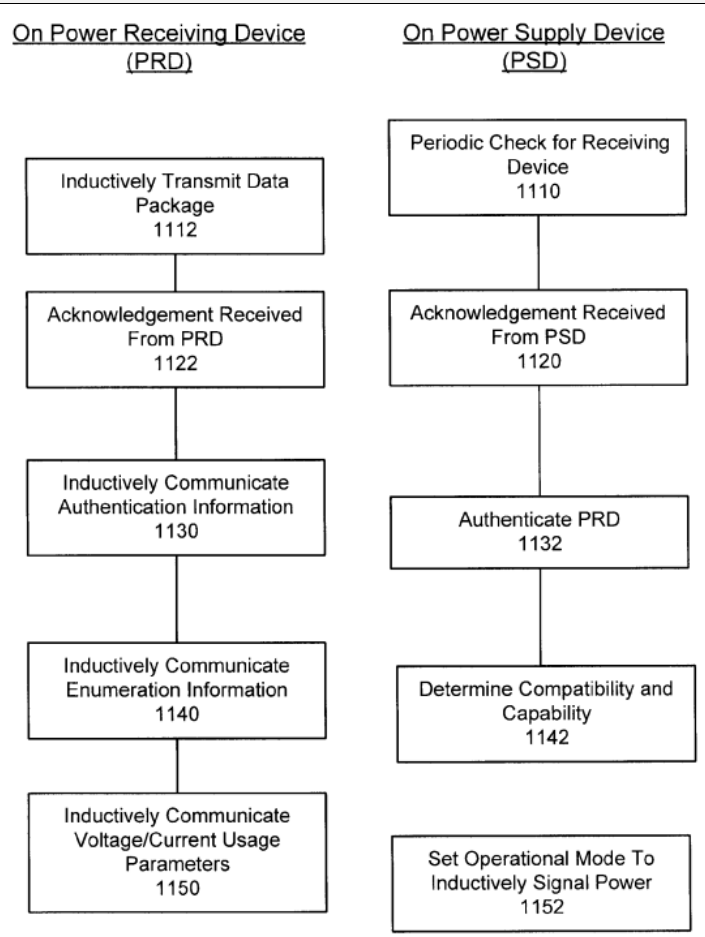


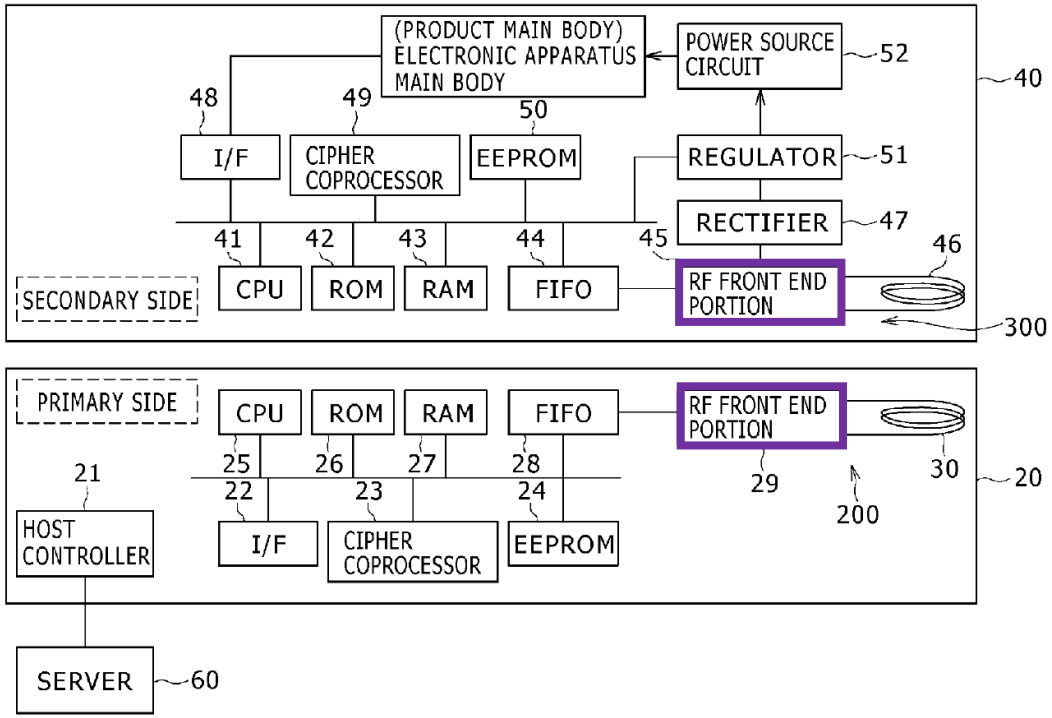
FIG. 11

Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

Teramoto

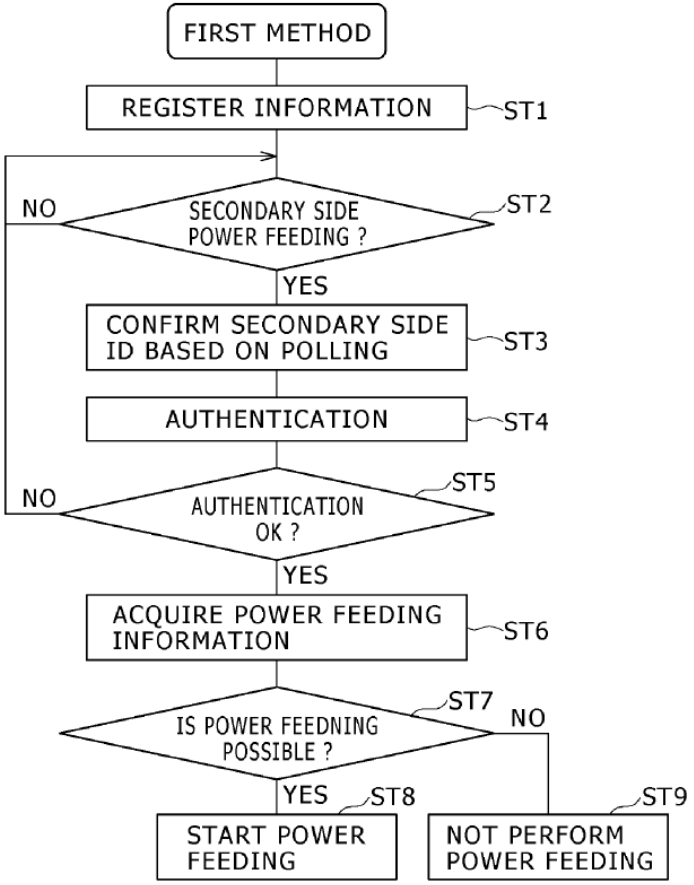
Claim Limitation	Exemplary Prior Art Disclosures
	For example, Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

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Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** For example, the WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of

Claim Limitation	Exemplary Prior Art Disclosures
	data defined in the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator

Claim Limitation	Exemplary Prior Art Disclosures
	The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme") From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 Signal Strength Value **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 End Power Transfer Code

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6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two’s complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

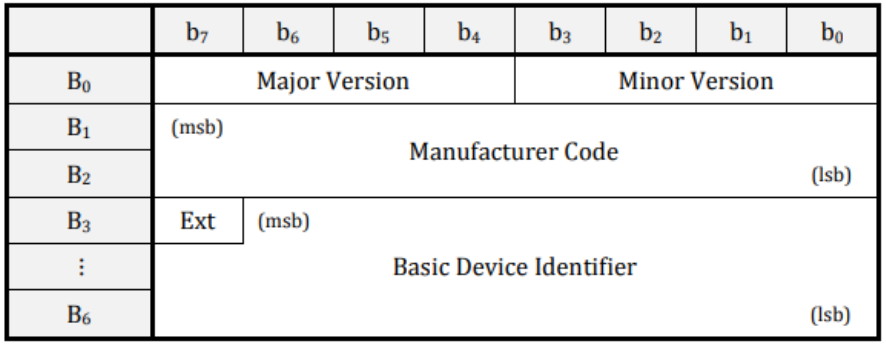
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

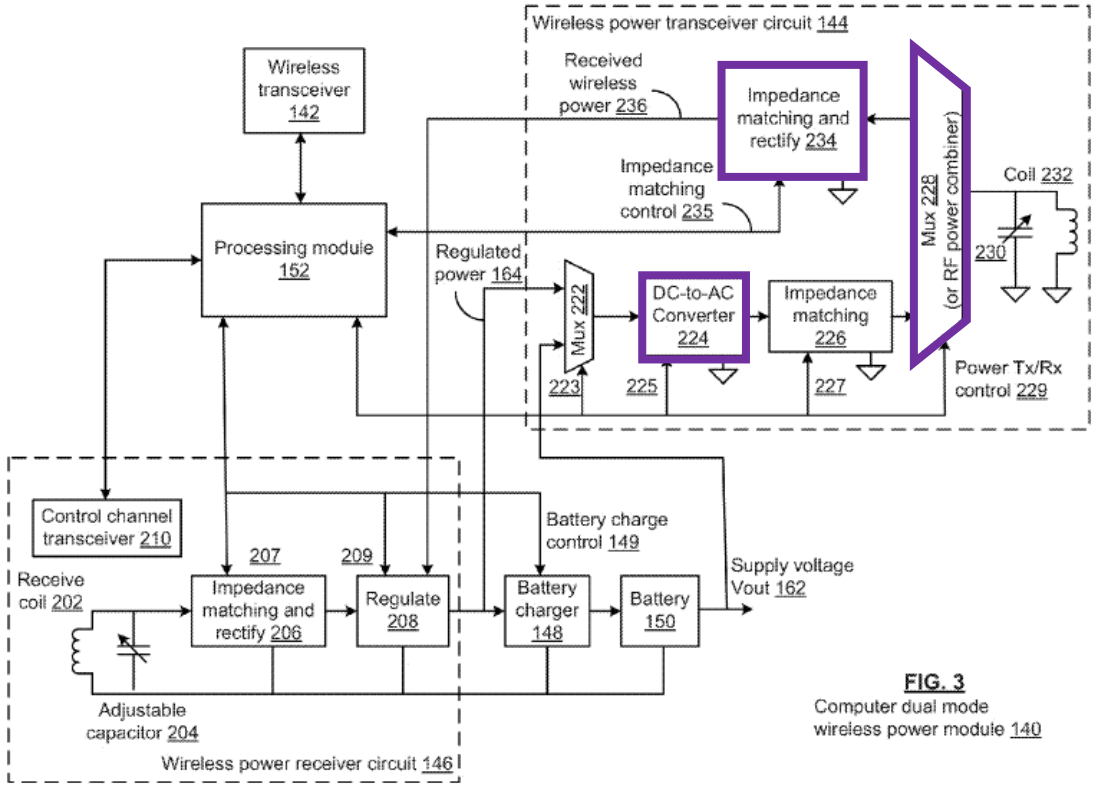
Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Van Der Lee, alone or in view of one or more references cited above for claim limitations [1c] and [1g], discloses and/or renders obvious this limitation. Van Der Lee discloses that the processing module receives and processes data (such as power information) from another wireless power module in the identified wireless power protocol. For example: ***The processing module 152*** places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode ***based upon power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. The power information indicates a wireless power configuration, including one or more of full battery capacity, charging history (e.g., times, durations, charge voltage, charge current, trickle charge reached, etc.), current battery life, current loading, loading history, etc. Moreover, the ***power information includes a power source identifier identifying the device or devices, wireless power capability (for example, whether dual mode capable, transmit capable, or receive capable)***; device power priority (indicating the power reception priority for conveying or receiving

Claim Limitation	Exemplary Prior Art Disclosures
	wireless power); and ***at least one of a communication protocol***, input data, input command, output data; and output command. Van Der Lee, ¶ 76. This limitation would also have been obvious in view of one or more references cited above for claim limitations [1c] and [1g]. A POSA would have found it obvious to apply the communication techniques taught in one or more of those references in implementing Van Der Lee dual mode wireless power module to provide a second circuitry that is configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improve functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See supra* Limitations [1c], [1g].
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Van Der Lee, alone or in view of one or more references cited above for claim limitations [1c] and [1g], discloses and/or renders obvious this limitation. Van Der Lee discloses that the processing module sets the mode of operation, such as a power transmit mode, based on interpretation of the received data. For example: ***The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode*** or a wireless power receive mode ***based upon power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. ***The processing module 142 provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit*** or a wireless power receive mode of operation. The MUX **228** may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit **144** either receives or transmits wireless power.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee, ¶ 56; *see also id*. Figs. 5-6. It would also have been obvious to apply the teachings of one or more references discussed in Limitations [1c] and [1g] in implementing Van Der Lee dual mode wireless power module because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer, such as to perform a function associated with said transmitted power in conjunction with said first circuitry based on interpretation of data received from the receiver. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See also supra* Limitations [1c], [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured as one of an inverter and a rectifier.	Van Der Lee discloses and/or renders obvious this limitation. For example: ***In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228***. ***The DC-to-AC converter 224 includes a full bridge inverter topology*** to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, ***the DC-to-AC converter 224 may include a half bridge inverter topology***. The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232 to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. ***When in a wireless power receive mode***, such as when the computer dual mode wireless power module 140 does not receive wireless power via the wireless power receiver circuit 146, as indicated through the power Tx/Rx control 229 from the processing module 152, the coil 232 of the wireless power transceiver circuit 144 receives a wireless power signal transmitted by the coil another device having a peripheral device dual mode wireless power module. In this mode, ***the***

Claim Limitation	Exemplary Prior Art Disclosures
	impedance matching and rectify circuit 234 converts the AC voltage into a received wireless power 236, which is rectified to a DC voltage. The DC voltage is regulated via the regulate circuit 208 for the battery charger 148, which in turn charges the battery 150. Van Der Lee, ¶¶ 54–55.  FIG. 3 Computer dual mode wireless power module 140 Van Der Lee, Fig. 3; *see also* claim limitation [1b].

U.S. Pat. No. 8,400,801 (“Shinoda”)

The asserted claims of U.S. No. 10,038,339 (the “’339 patent”) are anticipated and/or rendered obvious by U.S. Pat. No. 8,400,801 (“Shinoda”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. 2011/0018356 (“Chatterjee”), U.S. Patent Application Publication No. 2013/0026981 (“Van Der Lee”), U.S. Pat. No. 9,837,203 (“Singh-203”), U.S. Pat. No. 8,698,450 (“Yeh”), U.S. Patent Application Publication No. 2010/0148723 (“Cook”), U.S. 2010/0083012 (“Corbridge”), U.S. 2012/0049646 (“Teramoto”), and/or WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 (“WPT Standard” or “WPT”).

Shinoda was filed on October 25, 2011, published on February 16, 2012, and issued on March 19, 2013. It qualifies as prior art under pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Chatterjee was filed on December 1, 2009 and published on January 27, 2011. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Van Der Lee was filed on July 28, 2011 and published on January 31, 2013. It qualifies as prior art under either pre-AIA 102(e), or post-AIA 102(a)(2).

Singh-203 was filed on March 29, 2012, published on October 3, 2013, and issued on December 5, 2017. It qualifies as prior art under pre-AIA 102(e), or post AIA 102(a)(2).

Yeh was filed on December 27, 2011 and published on June 27, 2013. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(2).

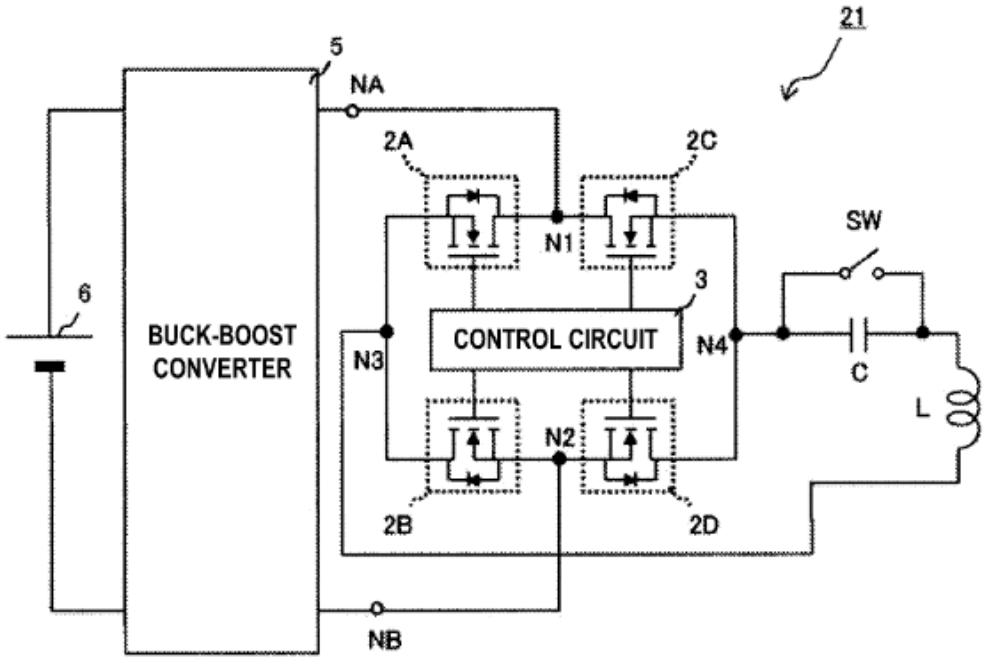
Cook was filed on September 1, 2009 and published on June 17, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Corbridge was filed on June 4, 2009 and published on April 1, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

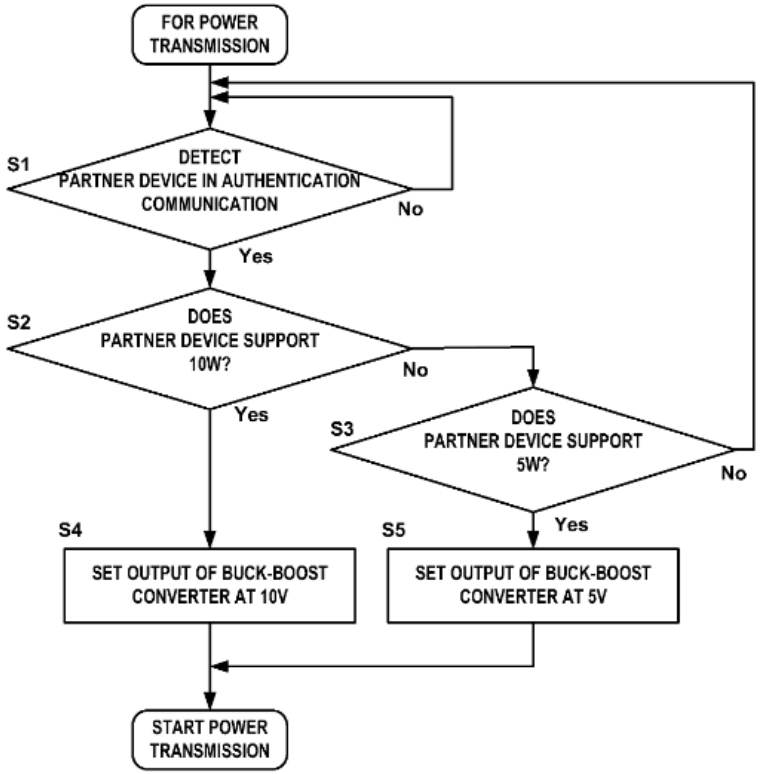
Teramoto was filed on August 23, 2011 and published on March 1, 2012. It qualifies as prior art under either pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

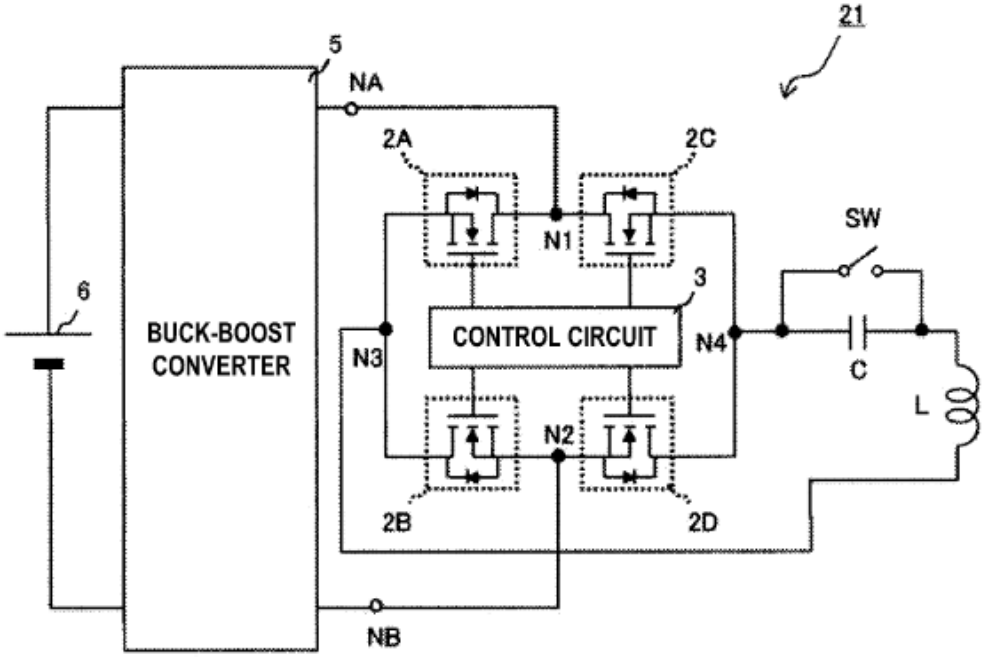
WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1).

Claim Limitation	Exemplary Prior Art Disclosures
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	To the extent the preamble is limiting, Shinoda teaches and renders obvious a “dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver.” Shinoda discloses a wireless power transfer terminal that enables a power device to be used for both power transmission and power reception. For example: This disclosure provides ***a wireless power transfer terminal that enables a power device to be used for both power transmission and power reception*** and allows space savings of circuits and a reduction in the cost of manufacturing. Shinoda, Abstract. The present invention relates ***to a wireless power transfer terminal that transmits and receives power to and from an electronic device*** in a noncontact manner. Shinoda, 1:15-17 Traditionally, ***a wireless power transfer terminal used for both transmission and reception that can both receive and transmit power by wireless power transfer*** has been proposed. See, for example, Japanese Unexamined Patent Application Publication No. 2006-60910 (Patent Literature 1). Such a wireless power transfer terminal can be utilized as an auxiliary power source of an electronic device, such as a cellular phone terminal or a potable player, and in giving power to and receiving power from other electronic devices. FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. ***The power transmission circuit 103 includes an inverter for converting an input voltage from, for example, a battery, into an alternating-current output***. ***The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device***. The power reception circuit 104 includes a

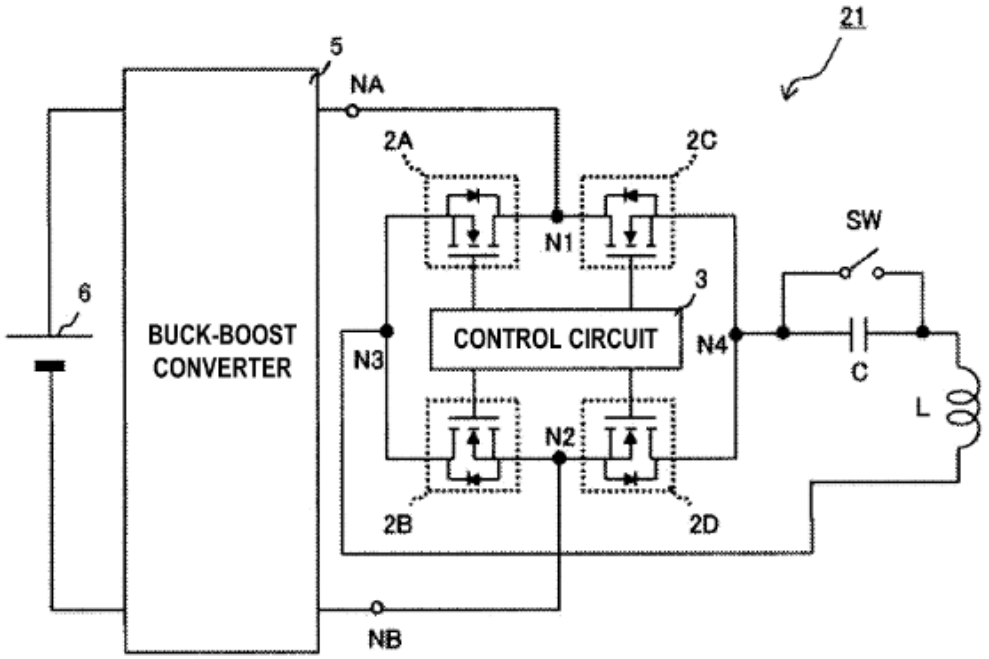
Claim Limitation	Exemplary Prior Art Disclosures
	rectifier circuit for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 2:22-46. FIGS. 2A to 3B are circuit diagrams of a wireless power transfer terminal 1 according to the present embodiment. The arrows with the broken lines in FIGS. 2A and 2B indicate a current for ***power transmission mode*** and those in FIGS. 3A and 3B indicate a current ***for power reception mode***. Shinoda, 3:23-27.  FIG.5 Shinoda Figs. 5; *see also id.* Figs. 1-5, 7.

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda also discloses communication between the wireless power transfer terminal and a partner device to before transmitting power to charge the partner device. For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.6 Shinoda, Fig. 6. ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20.

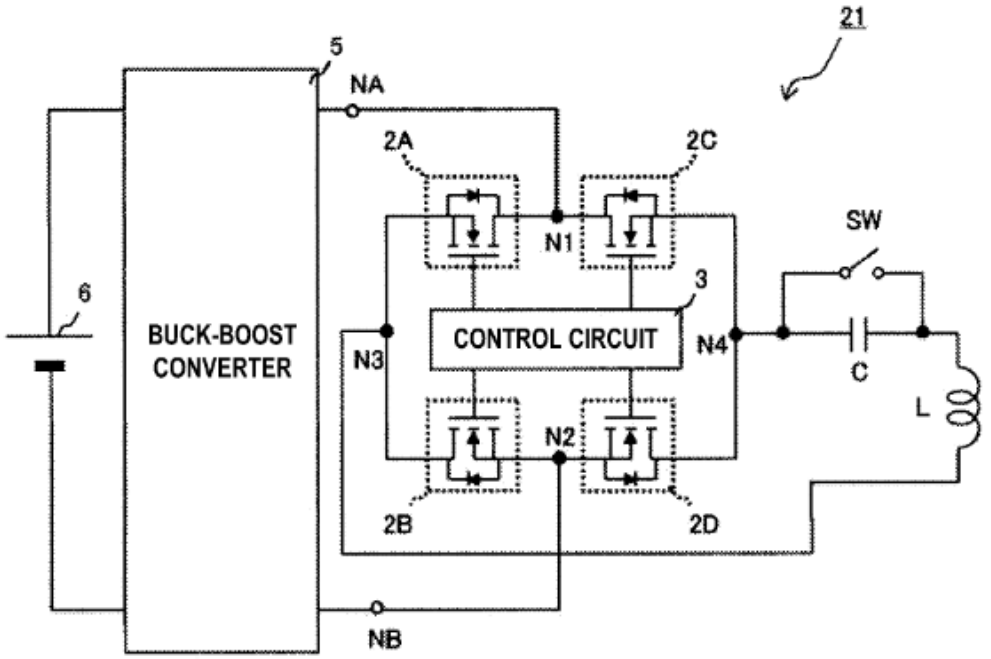
Claim Limitation	Exemplary Prior Art Disclosures
[1a] one of coil and capacitor electrodes;	Shinoda discloses or renders obvious this limitation. Shinoda discloses coils. For example: This wireless power transfer terminal 101 includes ***a coil 102*** used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. Shinoda, 1:33-36. The wireless power transfer terminal 1 includes FETs 2A to 2D, ***a coil L***, and a control circuit 3. Shinoda, 3:28-29.  FIG.5 Shinoda, Figs. 5; *see also id.* Figs. 1-5, 7.

Claim Limitation	Exemplary Prior Art Disclosures
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	Shinoda discloses and/or renders obvious this limitation. First, Shinoda discloses and/or renders obvious “a first circuitry comprising: an impedance network.” Shinoda discloses a resonant capacitor that can be connected or bypassed in different modes. For example: > The wireless power transfer terminal 11 includes the FETs 2A to 2D, coil L, control circuit 3, a switch SW, and a resonant capacitor C. The resonant capacitor C is provided between the node N4 and the coil L, and the switch SW is provided in parallel with the resonant capacitor C. ***The capacitance of the resonant capacitor C is set such that it is connected to the coil L and resonates in series therewith***. > ***For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:52-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 4, 7. Second, Shinoda discloses and/or renders “a first circuitry comprising: . . . a switch network”. Shinoda discloses switching elements (FETs 2A to 2D) that operate as different circuits depending on the mode of operation. For example: FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via ***a respective power transmission circuit 103 and a power reception circuit 104***. ***The power transmission circuit 103 includes an inverter*** for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used,

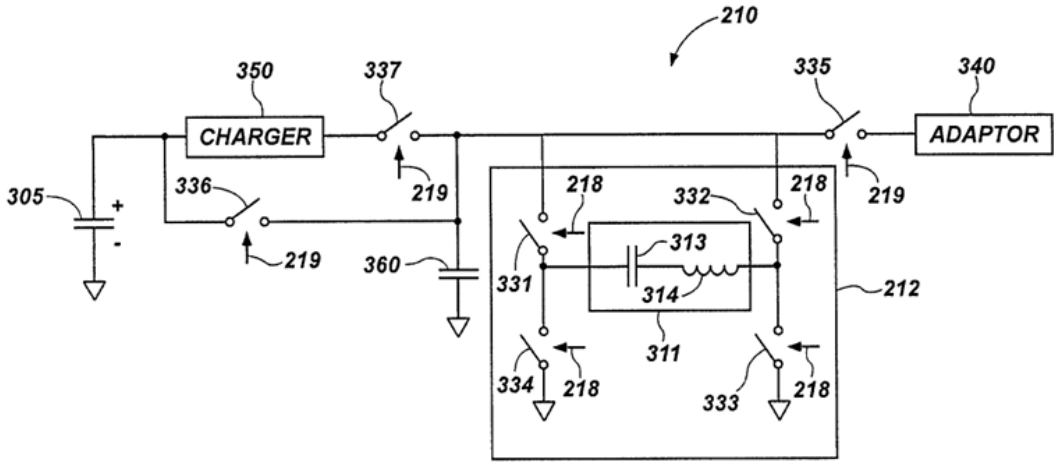
Claim Limitation	Exemplary Prior Art Disclosures
	for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit*** for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 1:31-46. ***For a power transmission mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the ***FETs 2A to 2D function as a full-bridge inverter circuit***. Shinoda, 3:52-62. ***For a power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the ***FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. The above described parallel circuit including ***first to fourth semiconductor switching elements (i.e., FETs 2A to 2D) operating as a full-bridge inverter circuit*** can apply an alternating-current output to the coil, thus enabling the wireless power transfer terminal to transmit power. Also, the parallel circuit including the ***first to fourth semiconductor switching elements operating as a rectifier circuit*** can rectify an alternating-current input applied from the coil, thus enabling the wireless power transfer terminal to receive power. In this way, the use of the parallel circuit

Claim Limitation	Exemplary Prior Art Disclosures
	including the first to fourth semiconductor switching elements as a full-bridge inverter circuit or a full-wave rectifier circuit can reduce the total number of the semiconductor switching elements, increase space savings of the circuit configuration of the wireless power transfer terminal 1, and reduce cost of manufacturing. For the present embodiment, an FET element is used as a semiconductor switching element. With this, the parallel circuit can operate as a full-wave rectifier circuit using a parasitic diode between the drain and the source of the FET element. However, embodiments consistent with the disclosure can also be suitably carried out using other semiconductor switching elements. For example, a combination of a bipolar transistor and a diode can also be used as substantially the same circuit configuration as that of the present embodiment, and with other embodiments consistent with this disclosure. Shinoda, 5:17-43.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. Third, Shinoda, in view of the teachings of the following references, renders obvious “a first circuitry comprising . . . a filter capacitor.” A POSA would have found it obvious to add the filter capacitor taught in one or more of the following references in implementing Shinoda’s wireless power transfer terminal because it involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA would have appreciated the benefit of adding a filter capacitor for filtering out the unwanted frequencies. A POSA would have had a reasonable expectation of success because filter capacitors are well known in the art. **Chatterjee**

Claim Limitation	Exemplary Prior Art Disclosures
	For example, Chatterjee discloses: The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. ***The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode)***. The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. Chatterjee, ¶ 37. The power circuit 414 operates in a similar fashion as the power circuit 314 of FIG. 3 to handle current received in either the power transfer mode or the power receive mode. The power bridge circuit 411 operates in a similar fashion as the power bridge circuit 311 of FIG. 3. Chatterjee, ¶ 44. FIG. 10 illustrates a power bridge circuit and a bi-directional coil assembly, together **1010**, coupled to current conditioning circuitry, under an embodiment. The power bridge circuit and bi-directional coil assembly combination **1010**, which may be any of the above described embodiments, is coupled via a signal line Power I/O to a decoupling circuit 1020. ***The decoupling circuit 1020 operates to act as a filter for certain signal frequencies and prevents those signals from passing through.*** Chatterjee, ¶¶ 89; *see also id.* Fig. 10. **Van Der Lee** For example, Van Der Lee discloses: The primary device and/or the peripheral device may include an integrated circuit (IC) to support the above-described functions. For example, an IC may include at least a portion of the wireless power transceiver circuit (for example, one or more of the coil, capacitor, and diodes of the rectifying circuit may be off-chip), ***at least a portion of the battery charger (for example***, one or

Claim Limitation	Exemplary Prior Art Disclosures
	more of the switching transistors, ***the output filter capacitor***, the inductor may be off-chip), the transceiver, and the processing module. Van Der Lee, ¶ 36. **Singh-203** The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25; *see also* FIGS. 3A-3D.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3A **Yeh** For example, Yeh discloses a supercapacitor. > An objective of the present invention is to provide a bidirectional wireless charging and discharging device, which makes use of the arrangement of supercapacitors in specific locations and ***the supercapacitors having resistances lower than a battery to allow, in a charging operation, the supercapacitors to be charged first for blocking surges occurring in the charging operation*** and thus realizing protection against accumulated damage caused by charging of the battery; makes use of the function of preventing reverse current by first and second reverse current protectors to eliminate electrical leakage to thereby save power. Yeh, 2:52-62. > To realize the above objectives, the present invention provides a bidirectional wireless charging and discharging device, which is applicable to a portable electronic device having a circuit device. The circuit device is electrically connected to a power receiving terminal and a battery. The bidirectional wireless charging and discharging device comprises a logic control unit, a wireless receiving and transmitting unit, a step-up/step-down unit, a first reverse current protector, a second

Claim Limitation	Exemplary Prior Art Disclosures
	reverse current protector, a control switch, and a first supercapacitor, wherein the logic control unit comprises a plurality of pins; the wireless receiving and transmitting unit has a transmission terminal and a test terminal, the test terminal being electrically connected to a detection pin of the logic control unit; the step-up/step-down unit has a first voltage regulation terminal, a second voltage regulation terminal, and two control terminals, the second voltage regulation terminal being electrically connected to the transmission terminal of the wireless receiving and transmitting unit, the two control terminals being respectively and electrically connected to first and second control pins of the logic control unit; a power pin of the logic control unit being electrically connected to the second voltage regulation terminal and the transmission terminal that are connected to each other; the first reverse current protector has an input terminal, an output terminal, and a control terminal, the input terminal and the output terminal being respectively and electrically connected to a discharging terminal of the battery and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a third control pin of the logic control unit; the control switch has an end electrically connected to the discharging terminal of the battery and an opposite end electrically connected to the control terminal of the first reverse current protector and the third control pin of the logic control unit; the second reverse current protector has an input terminal, an output terminal, and a control terminal, the output terminal and the input terminal being respectively and electrically connected to the power receiving terminal of the circuit device and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a fifth control pin of the logic control unit; and the ***first supercapacitor has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounde***d. As such, ***the supercapacitor may be used block surges occurring in each charging operation in order to protect a battery from accumulated damaged caused by charging***. Further, the first and second the reverse current protectors provide a function of preventing reverse current so as to eliminate electrical leakage and thus save power. Yeh, 2:20-3:3. ***The first supercapacitor 6 has an end electrically connected to connection between the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the output***

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Claim Limitation	Exemplary Prior Art Disclosures
	terminal 42 of the second reverse current protector 4 a and forms a first node 61 there. Another end of the first supercapacitor 6 is grounded. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4 b. The third reverse current protector 4 b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4 b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). ***The second supercapacitor is connected in parallel to the battery 93***. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. ***Since resistances of the first supercapacitor 6 and the second supercapacitor are lower than that of the battery 93, each time a charging operation is performed, the supercapacitors are charged first, whereby the supercapacitors may function to resist the surge occurring in the charging operation. Further, the supercapacitors can be easily charged in full and then immediately charge the battery 93***. Yeh, 4:48-5:15. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4 a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4 a and ***the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4 b)*** to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the

Claim Limitation	Exemplary Prior Art Disclosures
	protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) Yeh, 6:59-7:10. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: ***Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery***. The first and second reverse current protectors 4, 4 a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4 a, 4 b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. a first supercapacitor, which has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded. Yeh, cl. 1.

Claim Limitation	Exemplary Prior Art Disclosures
	2. The bidirectional wireless charging and discharging device as claimed in claim 1 further comprising a second supercapacitor, the second supercapacitor being connected in parallel with the battery. Yeh, cl. 2; *see also* Yeh, Figs. 1-3. **Cook** For example, Cook discloses: FIG. 2 shows a simplified schematic diagram of a wireless power transmission system. The transmitter 104, driven by input power 102, includes an oscillator 122, a power amplifier or power stage 124 and a ***filter*** and matching circuit 126. The oscillator is configured to generate a desired frequency, which may be adjusted in response to adjustment signal 123. The oscillator signal may be amplified by the power amplifier 124 with a power output responsive to control signal 125. The filter and matching circuit 126 may be included to ***filter out harmonics or other unwanted frequencies*** and match the impedance of the transmitter 104 to the transmit antenna 114. Cook, ¶ 30. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd ***harmonics filtering in form of a series resonant L-C circuits*** e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶56. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), ***odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T***, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶60; *see also id.* ¶62.

Claim Limitation	Exemplary Prior Art Disclosures
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	Shinoda discloses and/or renders obvious this limitation. First, Shinoda discloses and/or renders obvious “a second circuitry comprising: a control logic circuit.” Shinoda discloses a control unit or control circuit. For example: In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power transmission mode of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, ***the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods***. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the FETs 2A to 2D function as a full-bridge inverter circuit. Shinoda, 3:52-62. For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, ***the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D***

Claim Limitation	Exemplary Prior Art Disclosures
	function as a full-wave rectifier circuit using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the ***control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.

Claim Limitation	Exemplary Prior Art Disclosures

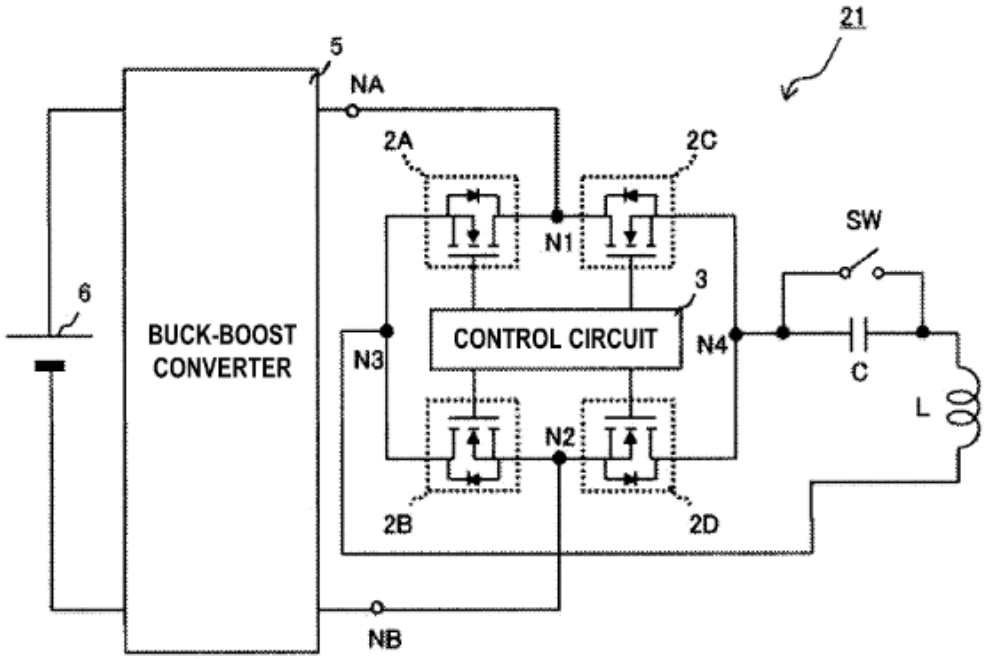


FIG.5

Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7.

Second, Shinoda discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit."

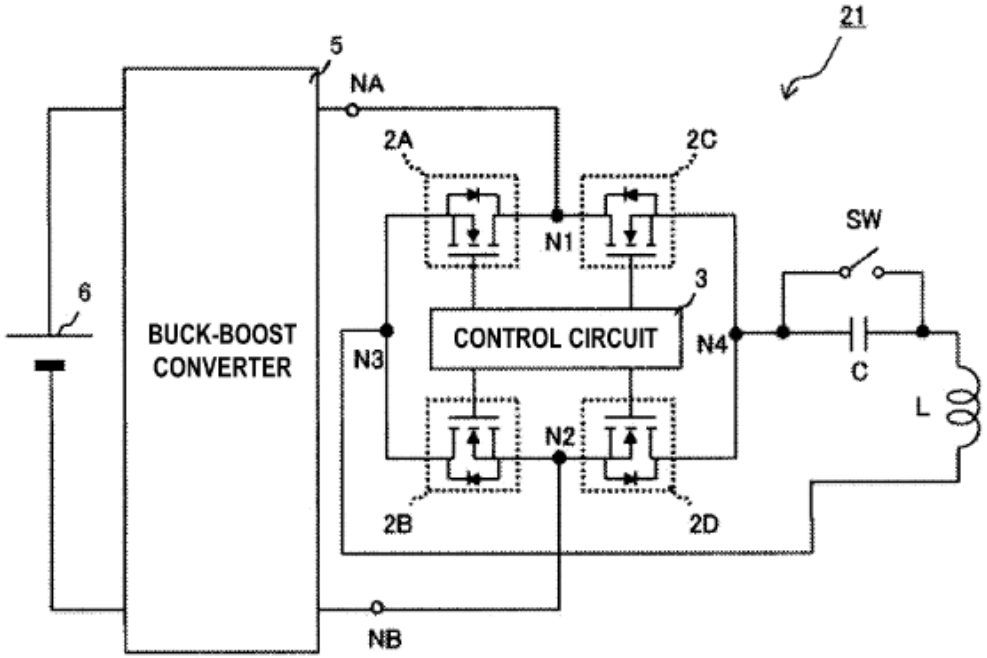
For example:

> For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the

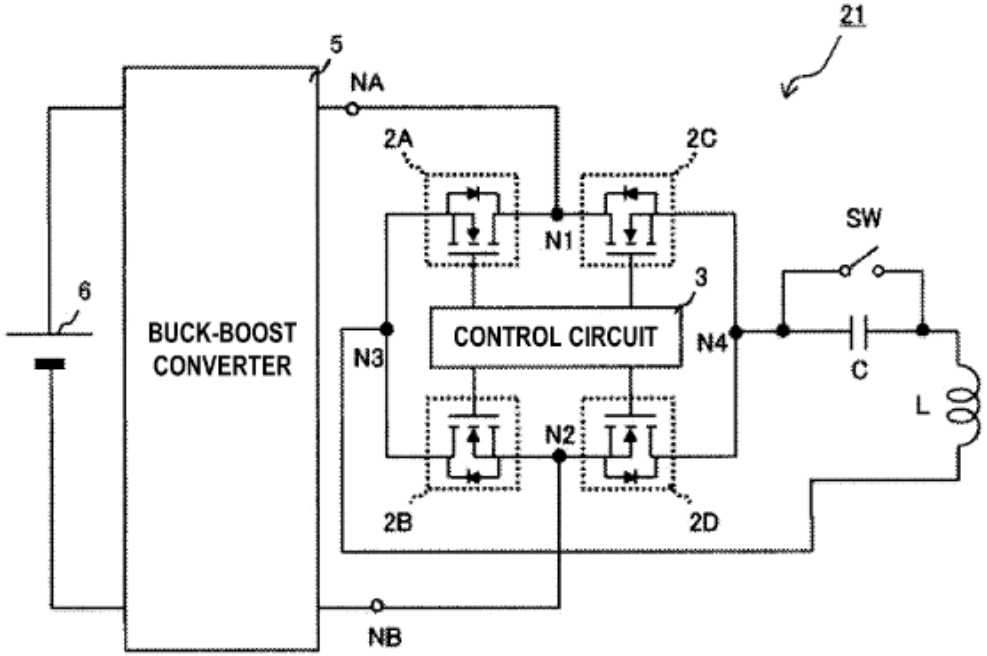
Claim Limitation	Exemplary Prior Art Disclosures
	opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5. ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20.
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Shinoda discloses and/or renders obvious this limitation. Shinoda discloses a power reception mode for the wireless power transfer terminal. For example: FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. The power transmission circuit 103 includes an inverter for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage***. Shinoda, 1:31-46.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 3A illustrates a state in which a positive voltage is excited at one end of the coil L that is connected to the node N3 and a negative voltage is excited at another end of the coil L that is connected to the node N4 in a half period of an alternating-current input. ***In this state, a current from one end of the coil L at which the positive voltage is excited passes through the node N3, FET 2A, node N1, and input/output node NA and enters a power reception load. The current flowing from the power reception load passes through the input/output node NB, node N2, FET 2D, and node N4 and returns to one end of the coil L at which the negative voltage is excited***. Therefore, the positive voltage from the input/output node NA and the negative voltage from the input/output node NB are applied to the power reception load. Shinoda, 4:34-47. FIG. 3B illustrates a state in which a negative voltage is excited at one end of the coil L that is connected to the node N3 and a positive voltage is excited at another end of the coil L that is connected to the node N4 in a half period of an alternating-current input. ***In this state, a current from one end of the coil L at which the positive voltage is excited passes through the node N4, FET 2C, node N1, and input/output node NA and enters the power reception load. The current flowing from the power reception load passes through the input/output node NB, node N2, FET 2B, and node N3 and returns to one end of the coil L at which the negative voltage is excited***. Therefore, the positive voltage from the input/output node NA and the negative voltage from the input/output node NB are applied to the power reception load. Shinoda, 4:52-65. For a ***power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. *See generally* Limitation [1p].

Claim Limitation	Exemplary Prior Art Disclosures
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device;	Shinoda discloses and/or renders obvious “said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network.” Shinoda discloses a bi-directional coil assembly whose impedance is changeable and a power bridge circuit that form different circuits depending on the mode of operation, as explained above in claim limitation [1b]. Shinoda discloses and/or renders obvious that changing “impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device” is “based on an input from said control logic circuit.” Shinoda discloses a control unit or control circuit that controls the switches to operate in a power reception mode. For example: > In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. > For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, ***the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33.

Claim Limitation	Exemplary Prior Art Disclosures
	For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; ***for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.  FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7.

Claim Limitation	Exemplary Prior Art Disclosures
	See also Limitation [1b] and [1c].
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	Shinoda discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network. " Shinoda discloses a bi-directional coil assembly whose impedance is changeable and a power bridge circuit that form different circuits depending on the mode of operation, as explained above in claim limitation [1b]. Shinoda also discloses and/or renders obvious that changing "said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver" is "based on an input from said control logic circuit." Shinoda discloses a processor that controls the switches to operate in a power transmission mode. For example: In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power transmission mode of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, ***the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods***. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the FETs 2A to 2D function as a full-bridge inverter circuit.

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda, 3:52-62. For ***a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series***; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.  FIG.5

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. *See also* Limitation [1b] and [1c].
[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	Shinoda discloses and/or renders obvious this limitation. Shinoda discloses the control unit or control circuit receiving and detecting code from the partner device, such as identification code, device code, and code specifying power specification, and that such code is sent from the partner device via load modulation. For example: In another more specific embodiment, ***the control unit may be configured to carry out mutual device authentication communication with a partner device*** coupled to the coil ***and variably control transmitting power or received power according to the partner device***. Shinoda, 2:52-56. FIG. 6 is a diagram that illustrates an operational flow for power transmission of the wireless power transfer terminal 21. For a power transmission mode of the wireless power transfer terminal 21, ***authentication communication is carried out and a response from a partner device is awaited (step S1)***. This authentication communication can be carried out by, for example, amplitude-modulating voltage in power transmission with constant periods using, for example, ***identification code or device code*** and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). This determination is made by, for example, ***demodulating the response from the partner device and detecting code specifying the power specification***. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Next, the output of the buck-boost converter is set such that it is voltage in power transmission corresponding to the power specification of the partner device, and power transmission is started under this setting (steps S4 and S5).

Claim Limitation	Exemplary Prior Art Disclosures
	The wireless power transfer terminal 21 transmits power according to the above-described operational flow. With this operation, even if there are a plurality of specifications for voltage in power transmission, power transmission supporting such various specifications can be achieved. Hence, the wireless power transfer terminal 21 can transmit and receive power to and from a plurality of partner devices having different specifications of power used in power transmission and power used in power reception. Shinoda, 6:52-7:5.

Claim Limitation	Exemplary Prior Art Disclosures

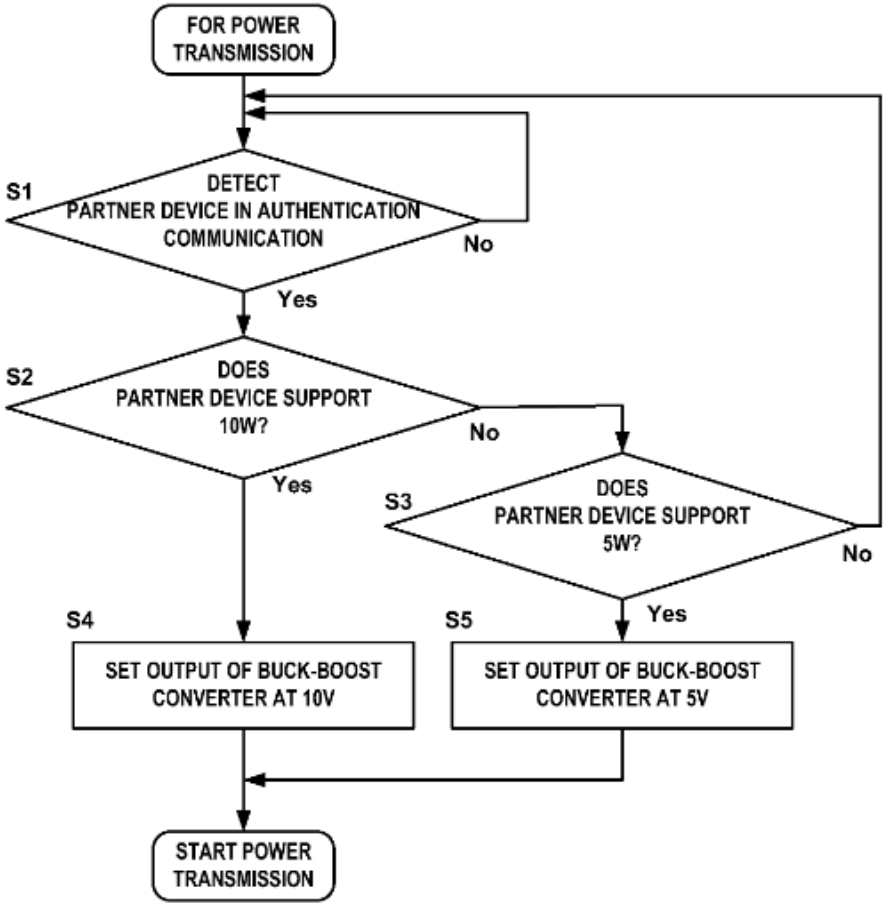


FIG.6

Shinoda, Fig. 6.

The partner device may preferably respond by the ***load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21

Claim Limitation	Exemplary Prior Art Disclosures
	and using various kinds of code set in the partner device. Therefore, the wireless power transfer terminal 21 may preferably be provided with a load modulating unit in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-26. To the extent it is argued that Shinoda does not teach this limitation, this limitation would have been obvious in view of the teachings of one or more of the following references. A POSA would have found it obvious to apply communication techniques taught in one or more of the following references in implementing Shinoda's wireless power transfer terminal because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improved functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Chatterjee** For example, Chatterjee discloses a processor in the inductive signal interface that receives and process data from a second electronic device via a modulator/demodulator, including data about type identification, status, authentication, enumeration, presence of the other device, protocol, and wireless power needs: The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving

Claim Limitation	Exemplary Prior Art Disclosures
	mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In

Claim Limitation	Exemplary Prior Art Disclosures
	the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the

Claim Limitation	Exemplary Prior Art Disclosures
	dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled “Inductive Signal Transfer System for Computing Devices”; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50.

Claim Limitation	Exemplary Prior Art Disclosures
	The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The communication circuit includes a modulator 416 and a demodulator 417. The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶¶ 51-55.

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge For example, Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path).

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated

Claim Limitation	Exemplary Prior Art Disclosures
	to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0” values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is

Claim Limitation	Exemplary Prior Art Disclosures
	positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step***

Claim Limitation	Exemplary Prior Art Disclosures
	1120). Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

Claim Limitation	Exemplary Prior Art Disclosures

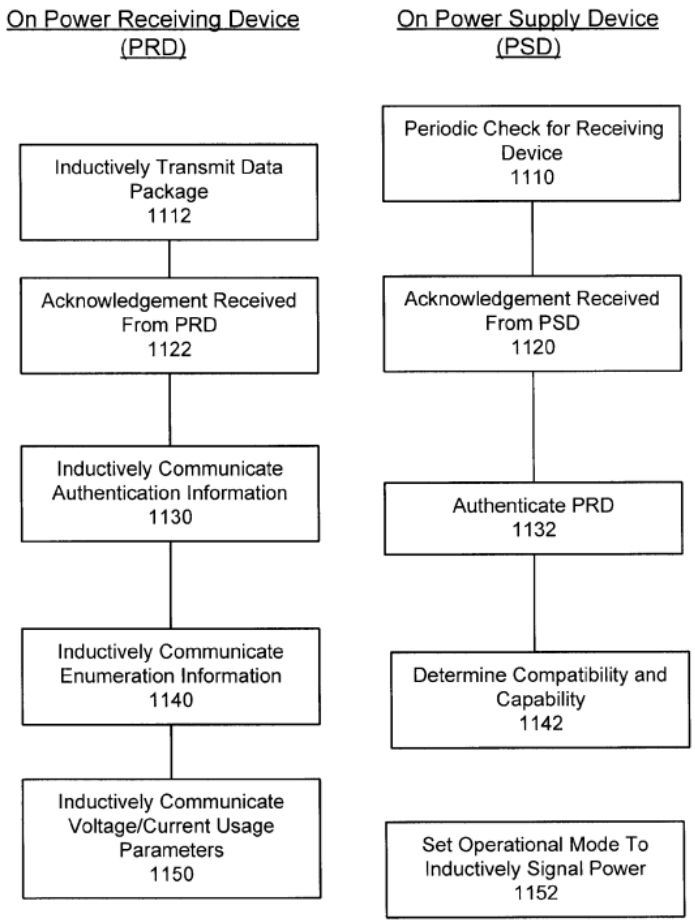


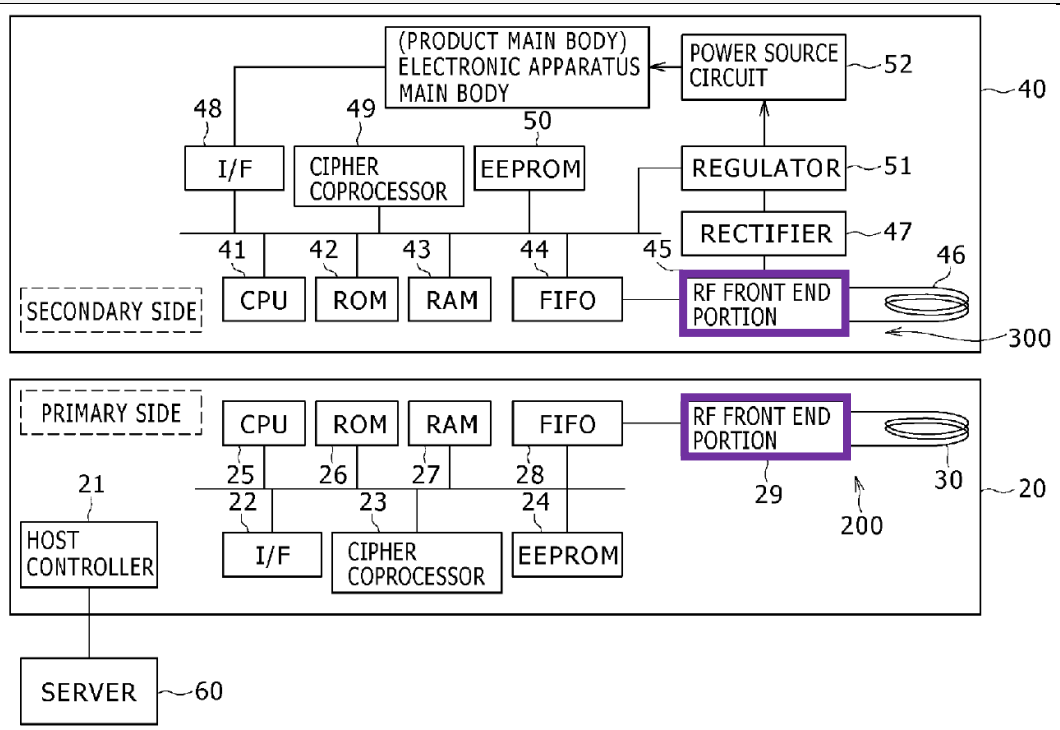
FIG. 11

Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

Teramoto

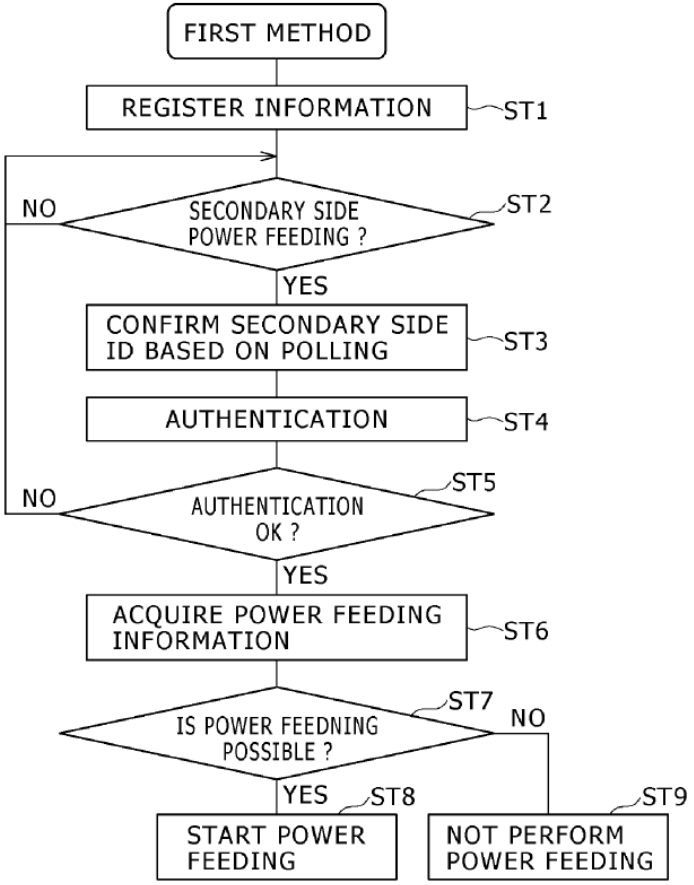
Claim Limitation	Exemplary Prior Art Disclosures
	For example, Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** For example, the WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of

Claim Limitation	Exemplary Prior Art Disclosures
	data defined in the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator

Claim Limitation	Exemplary Prior Art Disclosures
	The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme") From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 Signal Strength Value **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 End Power Transfer Code

Claim Limitation	Exemplary Prior Art Disclosures

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two's complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

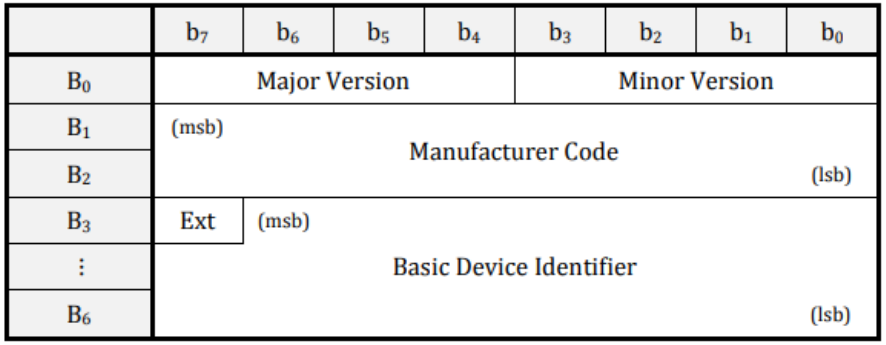
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Shinoda, alone or in combination with one or more of the references cited above for claim limitation [1g], discloses and/or renders obvious this limitation. Shinoda discloses that the control unit or control circuit variably controls transmitting power or received power according to the partner device. For example, Shinoda discloses: In another more specific embodiment, ***the control unit may be configured to carry out mutual device authentication communication with a partner device*** coupled to the coil ***and variably control transmitting power or received power according to the partner device***. Shinoda, 2:52-56. FIG. 6 is a diagram that illustrates an operational flow for power transmission of the wireless power transfer terminal 21. For a power transmission mode of the wireless power transfer terminal 21, ***authentication communication is carried out and a response from a partner device is awaited (step S1)***. This authentication communication can be carried out by, for example, amplitude-modulating voltage in power transmission with constant periods using, for example, ***identification code or device code*** and detecting a response from the partner device from a change in voltage between the opposed

Claim Limitation	Exemplary Prior Art Disclosures
	ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). This determination is made by, for example, ***demodulating the response from the partner device and detecting code specifying the power specification***. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Next, the output of the buck-boost converter is set such that it is voltage in power transmission corresponding to the power specification of the partner device, and power transmission is started under this setting (steps S4 and S5). The wireless power transfer terminal 21 transmits power according to the above-described operational flow. With this operation, even if there are a plurality of specifications for voltage in power transmission, power transmission supporting such various specifications can be achieved. Hence, the wireless power transfer terminal 21 can transmit and receive power to and from a plurality of partner devices having different specifications of power used in power transmission and power used in power reception. Shinoda, 6:52-7:5. This limitation would also have been obvious in view of one or more references cited above for claim limitations [1c] and [1g]. A POSA would have found it obvious to apply the communication techniques taught in one or more of those references in implementing Shinoda’s wireless power transfer terminal to provide a second circuitry that is configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improve functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See supra* Limitations [1c], [1g].

Claim Limitation	Exemplary Prior Art Disclosures
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Shinoda, alone or in combination with one or more of the references cited above for claim [1g], discloses and/or renders obvious this limitation. Shinoda discloses that the control unit or control circuit variably controls transmitting power or received power according to the partner device. In another more specific embodiment, the control unit may be configured to carry out mutual device authentication communication with a partner device coupled to the coil ***and variably control transmitting power or received power according to the partner device***. Shinoda, 2:52-56. It would also have been obvious to apply the teachings of one or more references discussed in Limitations [1c] and [1g] in implementing Shinoda's wireless power transfer terminal because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer, such as to perform a function associated with said transmitted power in conjunction with said first circuitry based on interpretation of data received from the receiver. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See also supra* Limitations [1c], [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured as one of an inverter and a rectifier.	Shinoda discloses and/or renders obvious this limitation. For example: ***For a power transmission mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the ***FETs 2A to 2D function as a full-bridge inverter circuit***. Shinoda, 3:52-62.

Claim Limitation	Exemplary Prior Art Disclosures
	For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the ***FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33; *see also supra* claim limitation [1b].

U.S. Pat. No. 9,837,203 (“Singh-203”)

The asserted claims of U.S. No. 10,038,339 (the “’339 patent”) are anticipated and/or rendered obvious by U.S. Pat. No. 9,837,203 (“Singh-203”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. Patent No. 8,942,624 (“Singh-624”); U.S. Patent Pub. No. 2013/0257167 (“Singh-167”).

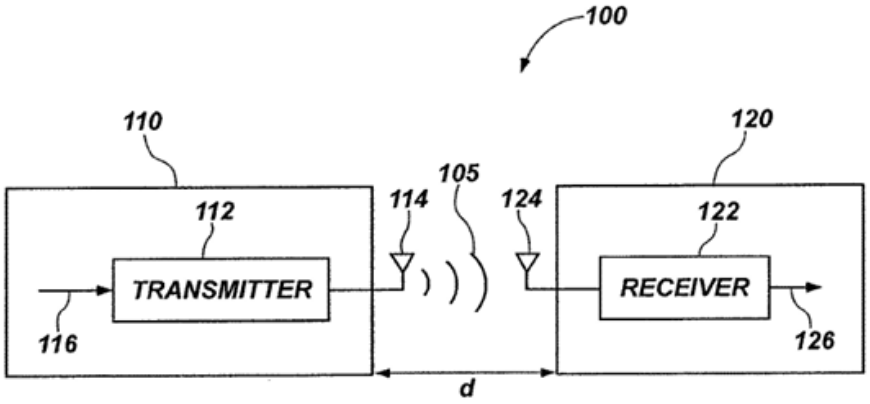
Singh-203 was filed on March 29, 2012, published on October 3, 2013, and issued on December 5, 2017. It qualifies as prior art under pre-AIA 102(e), or post AIA 102(a)(2).

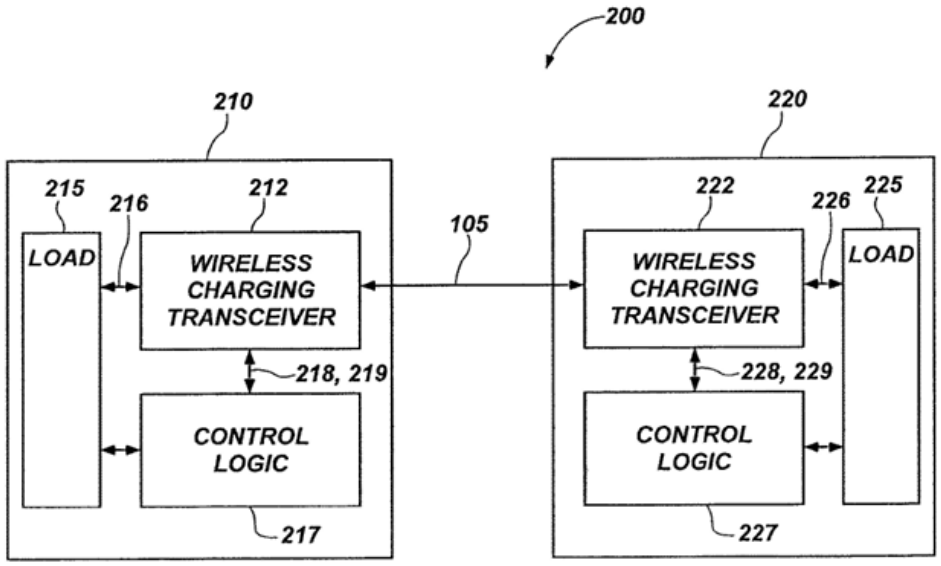
Singh-624 was filed on March 30, 2012, published on October 3, 2012, and issued on January 27, 2015. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Singh-167 was filed on March 29, 2012 and published on October 3, 2013. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Claim Limitation	Exemplary Prior Art Disclosures
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver’s load device, said dual mode wireless power receiver comprising:	To the extent the preamble is limiting, Singh-203 teaches and renders obvious a “dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver.” Singh-203 discloses an electronic device that can wirelessly share power by an inductive method, and that the electronic device can operate in a load mode in which it can be supplied power from another device, or a source mode in which it can provide power to another device. For example: Embodiments of the present disclosure relate generally to inductive wireless power transfer and, more particularly, to apparatuses and related method for having different modes of operation for inductive wireless power transfer. Singh-203, 1:8-11. Embodiments of the present disclosure include an inductive wireless power enabled device. The inductive wireless power enabled device comprises a transceiver including a plurality of switches coupled with a resonant tank, and control logic configured to drive the plurality of switches to operate the resonant tank in one of a transmit mode and a receive mode.

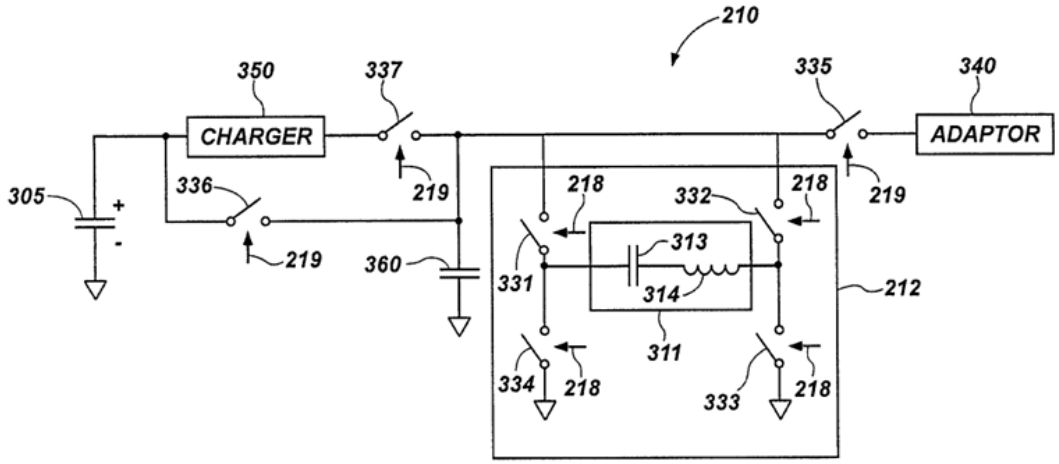
Claim Limitation	Exemplary Prior Art Disclosures
	Another embodiment of the present disclosure includes an inductive wireless power enabled device. The inductive wireless power enabled device comprises a transceiver including a plurality of switches coupled with a resonant tank. The transceiver is configured to both transmit a wireless power signal through the resonant tank and generate power from an incoming wireless power signal through the resonant tank depending on a current operational mode. Singh-203, 1:45-59. FIG. 1 is a schematic block diagram of an inductive wireless power transfer system 100. The inductive wireless power transfer system 100 includes a wireless power transmitting apparatus 110, and a wireless power receiving apparatus 120. The wireless power transmitting apparatus 110 includes a transmitter 112 having a transmit coil 114 configured to generate an electromagnetic field 105 for providing energy transfer to the wireless power receiving apparatus 120. The wireless power receiving apparatus 120 includes a receiver 122 having a receive coil 124 configured to couple with the electromagnetic field 105. The transmit coil 114 and the receive coil 124 may be sized according to the particular devices and applications to be associated therewith. The electromagnetic field 105 may also be referred to as the wireless power signal 105 for energy transfer from the transmitter 112 to the receiver 122. An input signal 116 may be provided to the transmitter 112 for providing the transmitter 112 with the power for generating the wireless power signal 105 that provides an energy transfer to the wireless power receiving apparatus 120. The receiver 122 may couple to the wireless power signal 105 and generates an output signal 126 in response thereto. The output signal 126 may provide the power that is used by the wireless power receiving apparatus 120 for storing (e.g., charging a battery), consumption (e.g., providing system power), or both. Singh-203, 3:39-64.

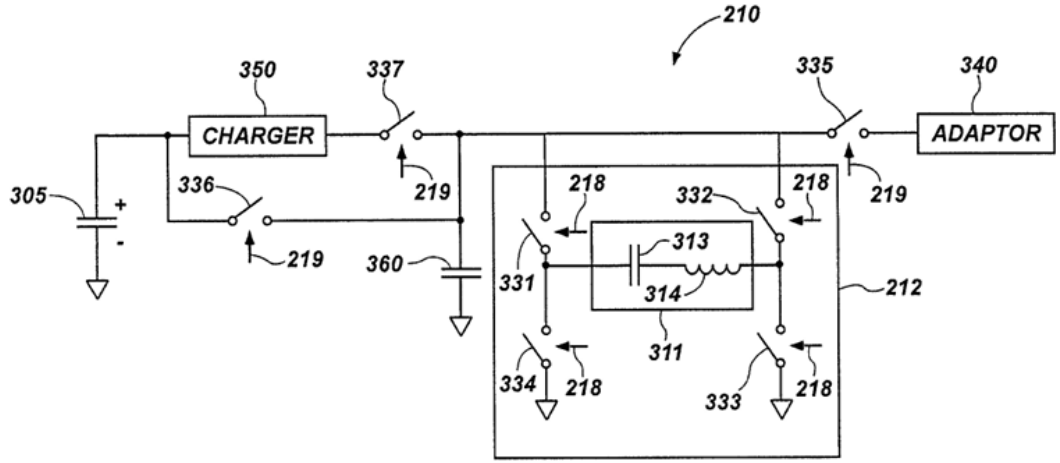
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1 The wireless power transmitting apparatus 110 may be a wireless power charger. The wireless power receiving apparatus 120 may be a mobile electronic device, such as a cell phone, smart phone, media player (e.g., mp3 player, DVD player, etc.), electronic reader, tablet computer, personal digital assistant (PDA), camera, laptop computer, and personal electronic device in which wireless power may be received. The wireless power receiving apparatus 120 may also be a less mobile electronic device, such as a television, personal computer, media player (e.g., DVD player, Blu-ray player, etc.) or any other device that may operate by, and/or store electrical power. The wireless power receiving apparatus 120 may be one of a number of other items, such as an automobile or any other devices that may include batteries that may be charged through the wireless power transmitting apparatus 110. Singh-203, 4:44-59. FIG. 2 is a schematic block diagram of an inductive wireless power transfer system 200 according to an embodiment of the present disclosure. The inductive wireless power transfer system 200 includes a first wireless power enabled device 210 and a second wireless power enabled device 220. The first wireless power enabled device 210 may include a wireless charging transceiver 212, a load 215, and control logic 217. Similarly, the second wireless

Claim Limitation	Exemplary Prior Art Disclosures
	power enabled device 220 may include a wireless charging transceiver 222, a load 225, and control logic 227. Singh-203, 5:3-12.  *FIG. 2* The first wireless power enabled device 210 and the second wireless power enabled device 220 may each be configured to either transmit or receive the wireless power signal 105 depending on its mode of operation. For example, the first wireless power enabled device 210 may be configured to have a transmit mode and a receive mode. In the transmit mode, the first wireless power enabled device 210 may generate the wireless power signal 105 for energy transfer another device. In the receive mode, the first wireless power enabled device 210 may receive the wireless power signal 105 and generate an output power signal 216 for a load 215. Likewise, the second wireless power enabled device 220 may be configured to have a transmit mode and a receive mode. In the transmit mode, the second wireless power enabled device 220 may generate the wireless power signal 105 for energy transfer another

Claim Limitation	Exemplary Prior Art Disclosures
	device. In the receive mode, the second wireless power enabled device 220 may receive the wireless power signal 105 and generate an output power signal 226 for a load 225. The control logic 217, 227 may be configured to determine which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. The control signals 218, 219, 228, 229 may be transmitted to the wireless charging transceivers 212, 222 to drive the desired operations. As an example, the control logic 217, 227 may include a processor (e.g., microcontroller) that is configured (e.g., programmed) to determine whether the respective wireless charging transceiver 212, 222 is to operate in transmit mode or receive mode. The control logic 217, 227 may further include computer-readable media (e.g., memory) storing computing instructions for execution by the processor related to performing processes of the embodiments of the present disclosure. Memory may include volatile and non-volatile memory. The loads 215, 225 may include energy storage devices (e.g., batteries), system components of the wireless power enabled devices 210, 220, or both. Thus, the output power signals 216, 226 may be a charging signal for an energy storage device, or a system power signal for the various system components. Because each of the wireless power enabled devices 210, 220 may be configured for either transmitting or receiving power, the wireless power enabled devices 210, 220 may be configured for wireless power “charging on the go” (OTG charging). For example, each of the wireless power enabled devices 210, 220 may be an electronic device (e.g., cell phone, tablet, laptop, etc.) that may provide power to, or receive power from, another electronic device (e.g., cell phone, tablet, laptop, etc.). Of course, a wireless power enabled devices that is configured for OTG charging may inductively couple with wireless power devices that are only configured for one-way charging. For example, the first wireless power enabled device 210 may operate in receive mode to receive the wireless power signal 105 generated from a wireless power transmitting apparatus that only operates in a transmit mode. Likewise, the first wireless power enabled device 210 may operate in transmit mode to generate the wireless power signal 105 for reception from a wireless power receiving apparatus that only operates in a receive mode. In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This

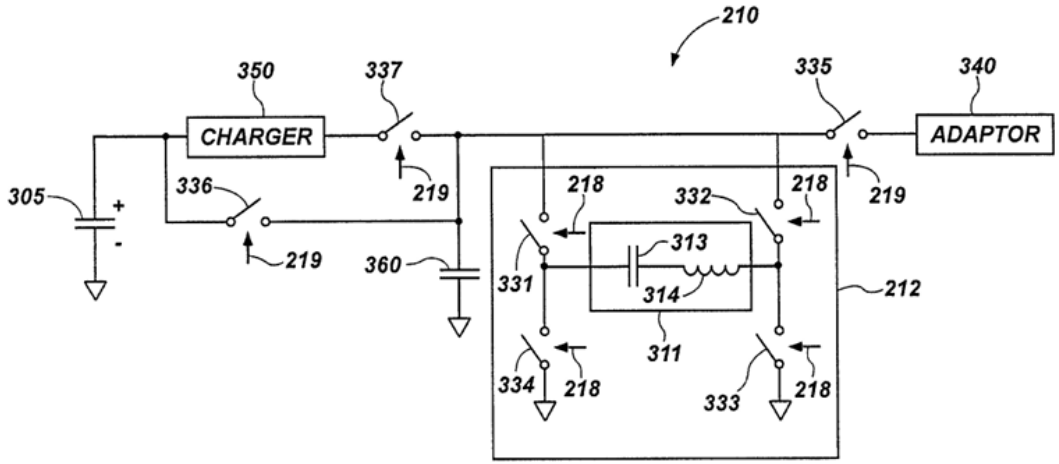
Claim Limitation	Exemplary Prior Art Disclosures
	determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated. Singh-203, 5:13-6:38. Referring specifically to FIG. 3A, the wireless power enabled device 210 may include a wireless charging transceiver 212 that is coupled to an energy storage device 305. As discussed above, the energy storage device 305 may be included as part of the load 215 (FIG. 2) that receives the power from the wireless energy transfer. The wireless charging transceiver 212 may provide power to the energy storage device 305 through a charger 350 during receive mode. Although not specifically shown in FIGS. 3A through 3D, it is recognized that other system components of the wireless power enabled device 210 may receive power from the wireless charging transceiver 212, and that a path for system power may also be provided. The wireless charging transceiver 212 may receive power from the energy storage device 305 through the path parallel to the charger 350 to generate the

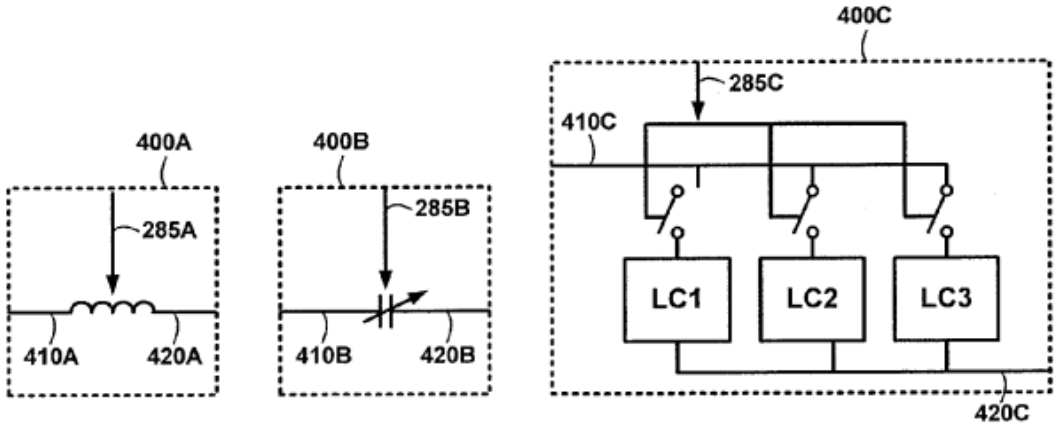
Claim Limitation	Exemplary Prior Art Disclosures
	wireless power signal 105 (FIG. 2) during transmit mode. In some embodiments, the wireless power enabled device 210 may receive power through non-wireless methods, such as being coupled with an adaptor 340 that may be plugged in to a traditional AC outlet. A plurality of switches 335, 336, 337 are coupled with the wireless charging transceiver 212 to control the power flow for the appropriate mode of operation. The plurality of switches 335, 336, 337 may be controlled by control signals 219 from the control logic 217 (FIG. 2). Singh-203, 6:39-7:9; *see also* FIGs 3A & 3B and descriptions thereof.  FIG. 3A Singh-203, FIG. 3A.
[1a] one of coil and capacitor electrodes;	Singh-203 discloses or renders obvious this limitation. Singh-203 discloses at least one of coil and capacitor electrodes. For example: The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional

Claim Limitation	Exemplary Prior Art Disclosures
	capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. Singh-203, 7:10-22. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. Singh-203, 7:31-39.  FIG. 3A
[1b] a first circuitry comprising: an impedance	Singh-203 discloses and renders obvious this limitation.

Claim Limitation	Exemplary Prior Art Disclosures
network; a switch network; a filter capacitor;	For instance, Singh-203 describes first circuitry that includes a coil 314 and/or capacitor 313 which are an impedance network, switches 331, 332, 333, and 334 which form a switch network, and capacitor 360 is a filter capacitor. For example: The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. The plurality of switches 331, 332, 333, 334 may be configured as a full-bridge circuit, such that the resonant tank 311 is coupled on one end at a node between the first switch 331 and the fourth switch 334, and at a node between the second switch 332 and the third switch 333 on the other end. In other words, the first switch 331 and the fourth switch 334 may be serially coupled having a first node therebetween, and the second switch 332 and the third switch 333 may be serially coupled having a second node therebetween. The resonant tank 311 may be coupled between the first node and the second node.

Claim Limitation	Exemplary Prior Art Disclosures
	Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. Singh-203, 7:10-8:12. The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected

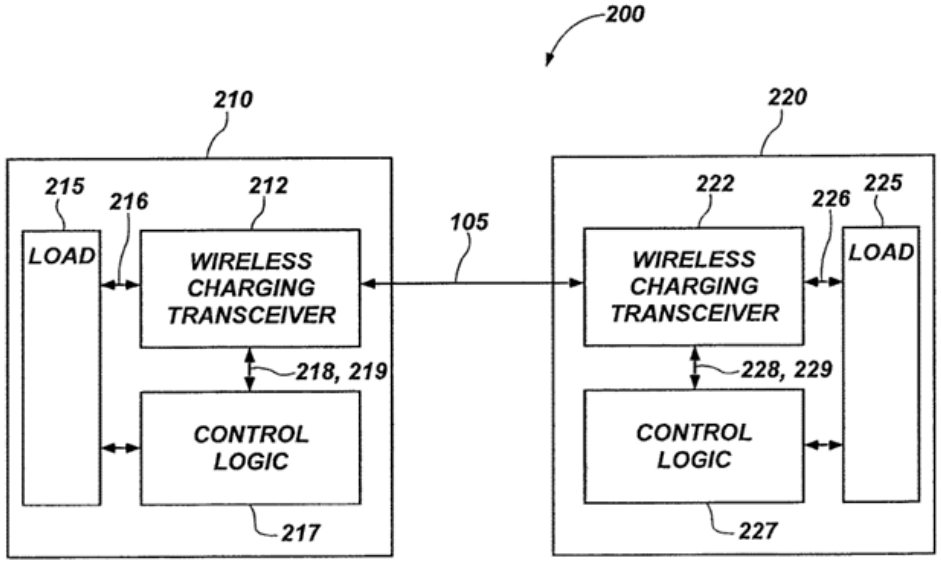
Claim Limitation	Exemplary Prior Art Disclosures
	from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25; *see also* FIGS. 3A-3D.  *FIG. 3A* Even if Singh-203 does not teach an “impedance network,” it is disclosed in Singh-167. It would have been obvious to include an impedance adjuster based on Singh-167 in the electronic device of Singh-203 to achieve the benefit of adjusting the power transmitter and/or receiver’s resonant frequencies to control the amount of power transferred. It would have merely used a known technique for its intended purpose to produce only expected results. For instance, Singh-167 teaches an impedance adjuster 400 that provides variable impedance. For example:

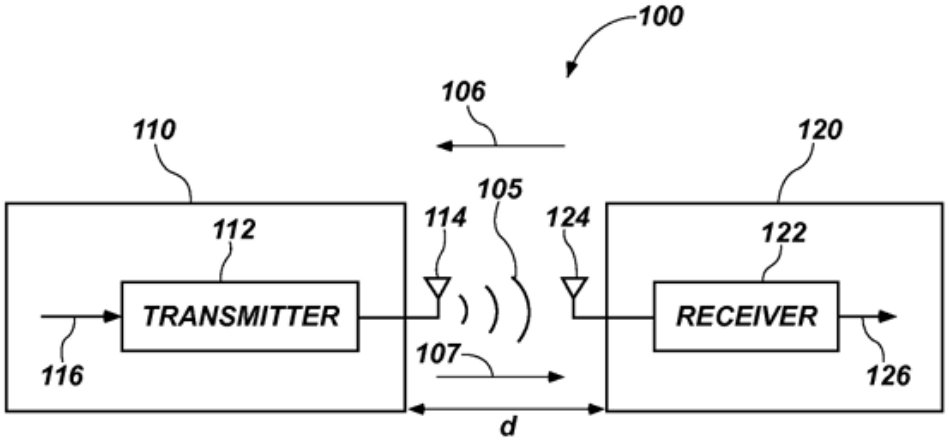
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 4A FIG. 4B FIG. 4C Singh-167 at Figs. 4A-4C; *see also* Singh-167, Figs. 2-3. Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN. Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above. Singh-167, ¶¶ 48-49.

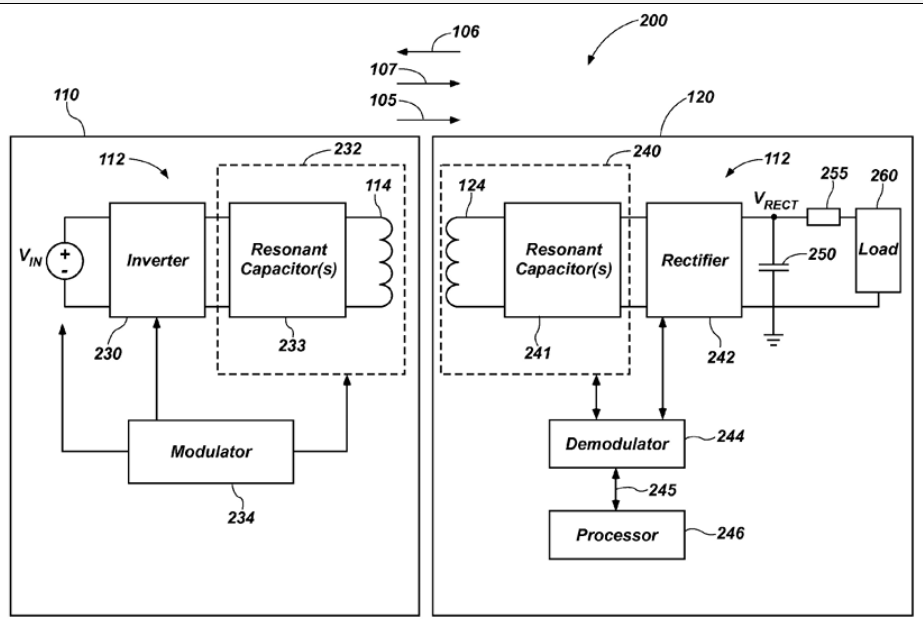
Claim Limitation	Exemplary Prior Art Disclosures
	FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53.
[1c] a second circuitry comprising: a control logic circuit; and a	Singh-203 discloses and renders obvious this limitation. Singh-203 describes second circuity in which control logic 217 is a control logic circuit and a modulator / demodulator circuit is included for communicating with other devices.

Claim Limitation	Exemplary Prior Art Disclosures
modulator/demodulator circuit;	FIG. 2 is a schematic block diagram of an inductive wireless power transfer system 200 according to an embodiment of the present disclosure. The inductive wireless power transfer system 200 includes a first wireless power enabled device 210 and a second wireless power enabled device 220. The first wireless power enabled device 210 may include a wireless charging transceiver 212, a load 215, and control logic 217. Similarly, the second wireless power enabled device 220 may include a wireless charging transceiver 222, a load 225, and control logic 227. Singh-203, 5:3-12. The control logic 217, 227 may be configured to determine which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. The control signals 218, 219, 228, 229 may be transmitted to the wireless charging transceivers 212, 222 to drive the desired operations. As an example, the control logic 217, 227 may include a processor (e.g., microcontroller) that is configured (e.g., programmed) to determine whether the respective wireless charging transceiver 212, 222 is to operate in transmit mode or receive mode. The control logic 217, 227 may further include computer-readable media (e.g., memory) storing computing instructions for execution by the processor related to performing processes of the embodiments of the present disclosure. Memory may include volatile and non-volatile memory. The loads 215, 225 may include energy storage devices (e.g., batteries), system components of the wireless power enabled devices 210, 220, or both. Thus, the output power signals 216, 226 may be a charging signal for an energy storage device, or a system power signal for the various system components. Singh-203, 5:31-51. In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually

Claim Limitation	Exemplary Prior Art Disclosures
	establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. Singh-203, 6:5-24; *see also id.*, 7:7-9 (“The plurality of switches 335, 336, 337 may be controlled by control signals 219 from the control logic 217 (FIG. 2).”). The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Singh-203, 7:23-31.

Claim Limitation	Exemplary Prior Art Disclosures
	 *FIG. 2* Singh-203 also discloses a modulator / demodulator. For example, > The embodiments shown in FIG. 2, as well as in FIGS. 3A through 3D, are shown to demonstrate a wireless power enabled device being configured to operate in either a transmit mode or a receive mode, such as for wireless OTG charging. It should be recognized that the wireless power enabled device may include additional components to perform other features not specifically described herein. For example, the wireless power enabled device may include a modulator and/or a demodulator for communicating with other devices, foreign object detection modules, I/O modules for interfacing with a user, memory for storing instructions and data, various sensors, among other components. Singh-203, 9:26-37. Even if this was not taught by Singh-203, it is disclosed in Singh-624. For example, Singh-624 describes an analogous system and shows how the modulator/demodulator may be employed. Not only is including a modulator/demodulator explicitly disclosed in Singh-203, it would have been obvious to include such a

Claim Limitation	Exemplary Prior Art Disclosures
	modulator based on Singh-624 because it would have allowed for modulation and demodulation of data over a communication channel between devices as was conventional at the time of the alleged invention and disclosed, for instance, by Singh-624. It would have merely used a known technique for its intended purpose to produce only expected results. For instance:  FIG. 1

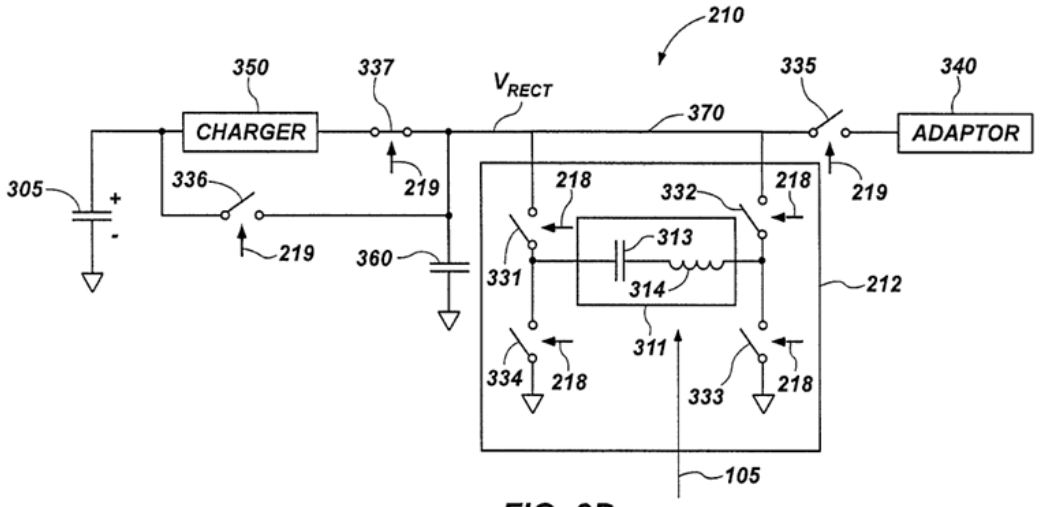
Claim Limitation	Exemplary Prior Art Disclosures
	 *FIG. 2* Singh-624, FIGS. 1-2; *see also id.*, FIG. 7. An inductive wireless power transfer device comprises a transmitter that comprises a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. An inductive wireless power receiving device comprises a receiver that comprises a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Related inductive wireless power transfer systems and methods for back-channel

Claim Limitation	Exemplary Prior Art Disclosures
	communication from the transmitter to the receiver of an inductive wireless power transfer system are disclosed. Singh-624, Abstract. During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Embodiments of the present disclosure include an inductive wireless power transfer device. The inductive wireless power transfer device comprises a transmitter that includes a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power receiving device. The inductive wireless power receiving device comprises a receiver having a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power transfer system. The inductive wireless power transfer system comprises a transmitter having a transmit coil configured to generate a modulated wireless power signal in a coupling region for wireless power transfer, and a receiver having a receive coil configured to couple with the transmit coil by receiving the modulated wireless power signal and to generate an output

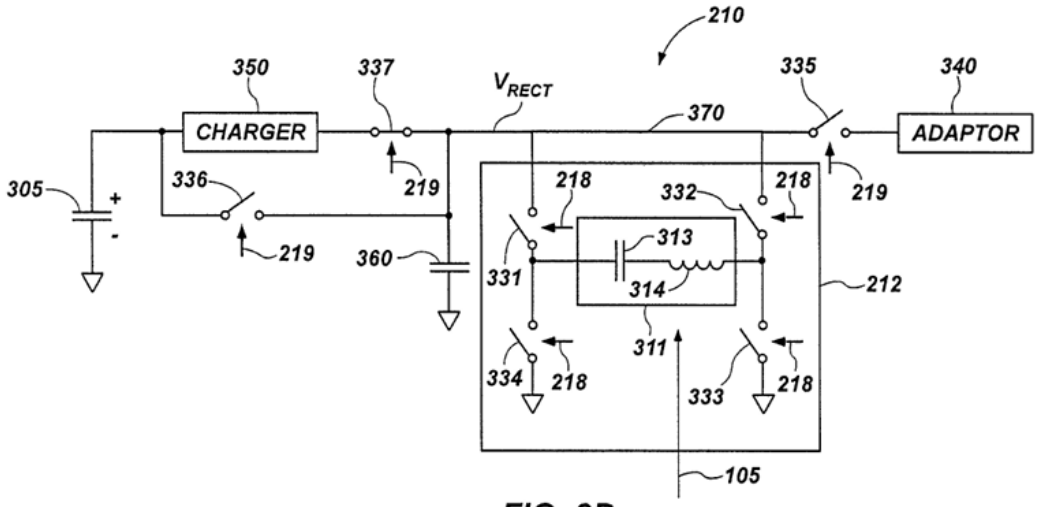
Claim Limitation	Exemplary Prior Art Disclosures
	signal in response thereto to provide power to a load, wherein the modulated wireless power signal includes characters. Another embodiment of the present disclosure includes a method for communicating between a transmitter to a receiver in an inductive wireless power transfer system. The method comprises generating a wireless power signal through a transmit coil of a transmitter to a receive coil of a receiver, and modulating the wireless power signal on the transmitter side for communicating data over the wireless power signal from the transmitter to the receiver. Singh-624, 1:56-2:25. Embodiments of the present disclosure include a back-channel communication link 107 to transmit data from the transmitter 112 to the receiver 122. The transmitter 112 may be configured to establish the back-channel communication link 107 by modulating the wireless power signal 105. In particular, the conversion gain of the wireless power signal 105 may be modulated, which may be detected responsive to the wireless power signal 105 being received and demodulated by the receiver 122. While the back-channel communication link 107 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105, it should be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils (through transmit coil 114 and receive coil 124). Thus, the wireless power signal 105 carries the communication data of the back-channel communication link 107 when the wireless power signal 105 is modulated as described herein. The arrow for the back-channel communication link 107 is merely shown separately for the purpose of indicating a direction of communication data flow. Similar to conventional wireless power transfer systems, embodiments of the present disclosure may further include a forward-channel communication link 106 for transmitting data from the receiver 122 to the transmitter 112, such as via backscatter modulation. As discussed above, conventional wireless power transfer systems may be limited to one-way communication from the receiver 122 to the transmitter 112, or else require separate RF coils for transmitting data separately from the transmit coil 114 and receive coil 124. Like the back-channel communication link 107, the forward-channel communication link 106 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal

Claim Limitation	Exemplary Prior Art Disclosures
	105; however, it should also be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils. Thus, the wireless power signal 105 carries the communication data of the forward-channel communication link 106 when the wireless power signal 105 is modulated according to the conventional principles of back scatter modulation. The arrow for the forward-channel communication link 106 is also shown separately for the purpose of indicating a direction of communication data flow. Singh-624, 5:38-6:11. The transmitter 112 may further include an inverter 230, a resonant tank 232, and a modulator 234. The resonant tank 232 may include one or more capacitors (e.g., resonant capacitor(s) 233) coupled with an inductor (e.g., the transmit coil 114). The capacitors and inductors may be configured in an LC network, such as being coupled in series or parallel. The inverter 230 is coupled between the input voltage (VIN) and the resonant tank 232. The modulator 234 may be coupled with one or more of the inverter 230, the resonant tank 232, and the input voltage (VIN) in order to modulate the wireless power signal 105 such that communication may be achieved from the transmitter 112 to the receiver 122, as will be described in more detail below. The transmitter 112 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions such as power monitoring, foreign object detection, etc. It will also be appreciated that the transmitter 112 may include a demodulator for receiving and demodulating communication received from the receiver 122. The receiver 122 may further include a resonant tank 240, a rectifier 242, a demodulator 244, and a processor 246. The resonant tank 240 may include an inductor (e.g., receive coil 124) coupled with one or more capacitor (e.g., resonant capacitor(s) 241). The resonant tank 240 is coupled with the rectifier 242, which may further be coupled to the load 260. The demodulator 244 may be coupled with one or more of the resonant tank 240, the rectifier 242, and the processor 246 in order to demodulate the received wireless power signal 105 and transmit a demodulated signal 245 to the processor 246 for analysis or other processing. The receiver 122 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions, such as power monitoring, foreign object

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	detection, etc. It will also be appreciated that the receiver 122 may include a modulator for modulating communication to the receiver 122. Singh-624, 6:55-7:22.
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Singh-203 discloses and renders obvious this limitation. For instance, in Singh-203, a first circuitry 210 operates in receive mode to receive power signal 105 from a wireless transmitter. For example: Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3D Singh-203, 8:51-9:5, FIG. 3D.
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device;	Singh-203 discloses and renders this limitation obvious. For instance, Singh-203 explains that control logic 217 generates control signal 218 to configure switches 331-334 as a full-bridge rectifier. The voltage at the output of the rectifier is a rectified DC voltage that is provided to a load device 215 (e.g., battery 305). Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank

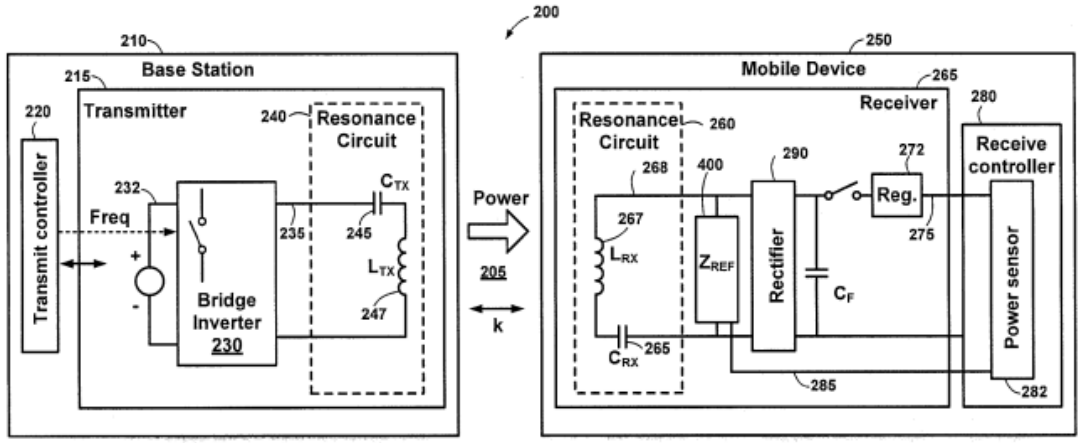
Claim Limitation	Exemplary Prior Art Disclosures
	311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof. Singh-203, 8:51-9:5. If the receive mode is determined to be the desired mode of operation, the wireless power enabled operates in the receive mode at operation 430. While in receive mode, control logic may transmit control signals to the wireless charging transceiver. The control signals may control operation of the full-bridge circuit coupled with the resonant tank of the wireless charging transceiver to operate as a full-bridge rectifier. The wireless charging transceiver may receive an incoming wireless power signal and generate an AC current through the resonant tank through inductive coupling. The incoming wireless power signal may be generated by a wireless power transmitting apparatus, such as a wireless power charger. In some embodiments, the wireless power transmitting apparatus may likewise be a wireless power enabled device having multiple modes of operation. The wireless charging transceiver operating as a full-bridge rectifier receives the AC current generated by the resonant tank generates a DC current to be output to a load. Therefore, at operation 435, power may be generated from the energy transfer to provide power to a load. For example, the load may include an energy storage device (e.g., battery), system components of the wireless power enabled device, or other power consuming devices. Singh-203, 10:13-36.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3D As another example, Singh-203 and Singh-624 teach modulation as explained above in limitation [1c], which WiPQTUS contends meets the limitation of “change impedance of said impedance network.” (*See, e.g.*, Infringement Contentions, Ex. 2 at 29-33.) It would have been obvious to adjust the impedance of the impedance work in the power receiving mode in Singh-203 based on Singh-624 to achieve the benefit of controlling how the power transmitter and receiver’s resonant frequencies match to control the amount of power transferred. It would have merely used a known technique for its intended purpose to produce only expected results. For instance, Singh-624 discloses “backscatter modulation in which the load is modulated on the receiver side,” which WiPQTUS contends meets the limitation of “change impedance of said impedance network.” (*See, e.g.*, Infringement Contentions, Ex. 2 at 29-33.) For example: > During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a

Claim Limitation	Exemplary Prior Art Disclosures
	result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Even if Singh-203 does not teach “change impedance of said impedance network,” it is disclosed in Singh-167. For example, Singh-167 teaches a receive impedance adjuster 400 that is configured to adjust a resonant frequency of the receive resonance circuit “by selectively modifying an impedance of the receive impedance adjuster.” It would have been obvious to adjust the impedance of the impedance network in the power receiving mode in Singh-203 based on Singh-167 to achieve the benefit of controlling how the power transmitter and receiver’s resonant frequencies match to control the amount of power transferred. It would have merely used a known technique for its intended purpose to produce only expected results. For example: The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the

Claim Limitation	Exemplary Prior Art Disclosures
	receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the

Claim Limitation	Exemplary Prior Art Disclosures
	rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285.

Claim Limitation	Exemplary Prior Art Disclosures
	The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.  *FIG. 2* Singh-167, Fig. 2.

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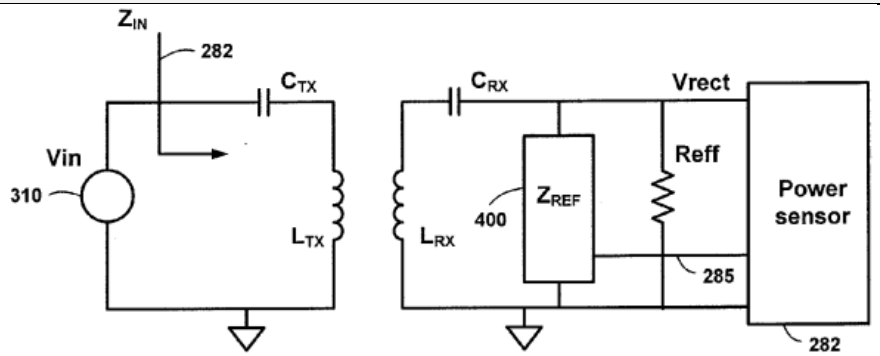


FIG. 3

Singh-167, Fig. 3.

> Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN.
>
> Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above.

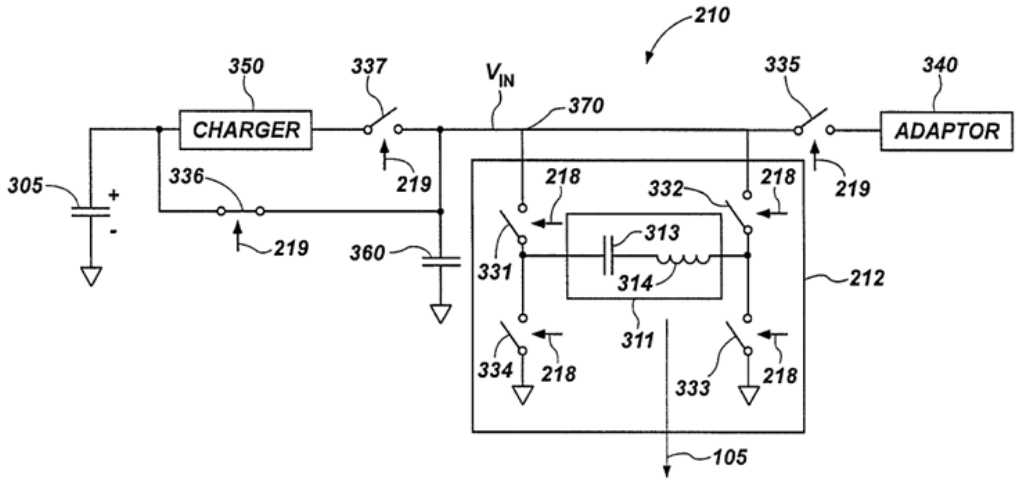
Singh-167, ¶¶ 48-49.

> FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive

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	impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line 520. This larger impedance will result in less

Claim Limitation	Exemplary Prior Art Disclosures
	power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7.
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch	Singh-203 discloses and renders this limitation obvious. For instance, Singh-203 explains that control logic 217 generates control signal 218 to configure switches 331-334 as a full-bridge inverter and may vary switching frequency, duty cycle of the switching, and phase of the switching, etc. The switch

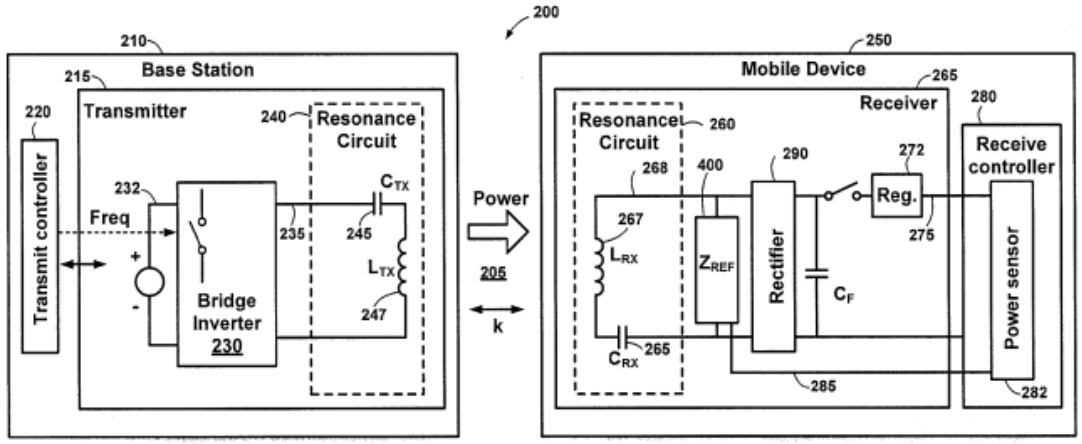
Claim Limitation	Exemplary Prior Art Disclosures
network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	network thus generates an AC current through tank 331 to transmit power from battery 305 to power up device 220. For example: Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. In this example, the power used to generate the wireless charging signal can be provided by the energy storage device 305 rather than through the adaptor 340. Thus, the fifth switch 335 may be open to disconnect the wireless charging transceiver 212 from the adaptor 340, and the sixth switch 336 may be closed to connect the energy storage device 305 to the wireless charging transceiver 212. In addition, the seventh switch 337 may be opened so that current may not flow through the charger 350 to the energy storage device 305. As a result, the voltage at node 370 may be the input signal (VIN) to the wireless charging transceiver 212 for enabling current flow through the resonant tank 311 to generate the wireless power signal

Claim Limitation	Exemplary Prior Art Disclosures
	105. Capacitor 360 may be coupled to node 370 may act as an input capacitor during transmit mode. Singh-203, 7:51-8:27. If the transmit mode is determined to be the desired mode of operation, the wireless power enabled operates in the transmit mode at operation 420. While in transmit mode, control logic may transmit control signals to a wireless charging transceiver. The control signals may control operation of a full-bridge circuit coupled with a resonant tank of the wireless charging transceiver to operate as a full-bridge inverter. The wireless charging transceiver operating as a full-bridge inverter receives a DC input signal and generates an AC current through the resonant tank. Therefore, at operation 425, the wireless power signal may be generated for energy transfer to a wireless power receiving device. The wireless power receiving apparatus may be an electronic device that is configured to receive the wireless power signal. In some embodiments, the wireless power receiving apparatus may likewise be a wireless power enabled device having multiple modes of operation. Singh-203, 9:63-10:12.  FIG. 3B

Claim Limitation	Exemplary Prior Art Disclosures
	Even if Singh-203 does not teach “change … said impedance of said impedance network,” it is disclosed in Singh-167. It would have been obvious to adjust the impedance of the impedance work in the power transmitting mode based on Singh-167 to achieve the benefit of controlling how the power transmitter and receiver’s resonant frequencies match to control the amount of power transferred. It would have merely used a known technique for its intended purpose to produce only expected results. For instance, Singh-167 teaches adjusting “the resonant frequencies of the transmit resonance circuit 240.” For example: > The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. > Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive

Claim Limitation	Exemplary Prior Art Disclosures
	resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8.

Claim Limitation	Exemplary Prior Art Disclosures
	The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some

Claim Limitation	Exemplary Prior Art Disclosures
	embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.  *FIG. 2* Singh-167, Fig. 2.

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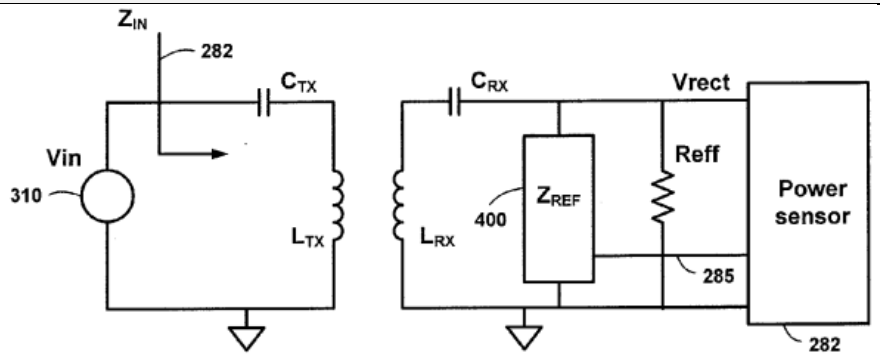


FIG. 3

Singh-167, Fig. 3.

> Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN.
>
> Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above.

Singh-167, ¶¶ 48-49.

> FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive

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	impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line 520. This larger impedance will result in less

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	power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7.
[1g] said second circuitry, on power-up of said secondary wireless power	Singh-203 discloses and renders obvious this limitation. For instance, in Singh-203, on power-up of the secondary wireless power receiver, control logic 217 of device 210 determines the mode of operation according to a wireless power protocol, establishing a communication link. The protocol identifies the

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receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	device type. In the alternative, Singh-624 discloses identification of a device type and it would have been obvious to have Singh-203’s circuitry identify the device type on power-up. For example, Singh-203 discloses: > In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated. Singh-203, 6:5-38. > Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging

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	transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. In this example, the power used to generate the wireless charging signal can be provided by the energy storage device 305 rather than through the adaptor 340. Thus, the fifth switch 335 may be open to disconnect the wireless charging transceiver 212 from the adaptor 340, and the sixth switch 336 may be closed to connect the energy storage device 305 to the wireless charging transceiver 212. In addition, the seventh switch 337 may be opened so that current may not flow through the charger 350 to the energy storage device 305. As a result, the voltage at node 370 may be the input signal (VIN) to the wireless charging transceiver 212 for enabling current flow through the resonant tank 311 to generate the wireless power signal 105. Capacitor 360 may be coupled to node 370 may act as an input capacitor during transmit mode. Singh-203, 7:51-8:27. **Singh-624:** Even if the identification of the secondary wireless power receiver was not disclosed in Singh-203, this would have been obvious over Singh-624. It would have been obvious to enable Singh-203’s second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said

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	secondary wireless power receiver because doing so was a known technique to allow the second circuity to authenticate the different types of receivers to allow for verification of authorization, or to learn about the battery being charged, etc. This would have been nothing more than the use of a known technique used to improve a similar device in the same way and would not produce unexpected results. For example, Singh-624 teaches: > Having two-way communication enables the transmitter 112 and the receiver 122 to establish a secure communication for a variety of different purposes, such as the transmitter 112 authenticating the type of receiver 122 that the transmitter 112 is talking to, or to authenticate a particular battery type to know that the battery of the receiver 122 is legitimate prior to generating the wireless power signal 105. Other data may be shared between the transmitter 112 and receiver 122 regarding the performance of the inductive wireless power transfer system 100, to assist with foreign object detection, among other reasons. Singh-624, 6:12-22.
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Singh-203 discloses and renders obvious this limitation. For instance, in Singh-203, device 210 establishes a communication link with a second device 220 to establish the desired relationship. The control logic determines the relationship between devices. For example: > In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a

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	software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated. Singh-203, 6:5-37. In some embodiments, the wireless power enabled device may automatically make the determination regarding the desired mode of operation. For example, the wireless power enabled device may detect an incoming wireless power signal and automatically enter a receive mode for receiving that wireless power signal. In some embodiments, the wireless power enabled device may make the determination based on communication with another device. For example, the wireless power enabled device may receive communication data from another device with instructions on which mode of operation the wireless power enabled device is desired for operation. Singh-203, 9:56-63.
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Singh-203 discloses and renders obvious this limitation. For instance, in Singh-203, the two devices 210 and 220 perform a function associated with said transmitter power in conjunction with said first circuity. According to Singh-203, control logic 217 sets the device in transmit mode or receive mode based on communication over the communication link. For example: In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless

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	power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated. Singh-203, 6:5-37. FIG. 4 is a flow chart 400 illustrating a method for operating a wireless power enabled device according to an embodiment of the present disclosure. At operation 410, the mode of operation for the wireless power enabled device may be determined. For example, the wireless power enabled device may be configured to have a transmit mode and a receive mode. In some embodiments, the determination of which mode of operation is desired at a given time may be determined manually by a user. For example, the wireless power enabled device may include a software application or other feature (e.g., switch) for the user to interface with for the user to select which mode of operation is to be used for the wireless power enabled device. In some embodiments, the wireless power enabled device may automatically make the determination regarding the desired mode of operation. For example, the wireless power enabled device may detect an incoming wireless power signal and

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	automatically enter a receive mode for receiving that wireless power signal. In some embodiments, the wireless power enabled device may make the determination based on communication with another device. For example, the wireless power enabled device may receive communication data from another device with instructions on which mode of operation the wireless power enabled device is desired for operation. Singh-203, 9:38-62; *see also id.*, FIG. 4.
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured as one of an inverter and a rectifier.	Singh-203 discloses and renders obvious this claim. According to Singh-203, switches 331-334 operate as a rectifier in receive mode and an inverter in transmit mode. For example: Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314.

Claim Limitation	Exemplary Prior Art Disclosures
	In this example, the power used to generate the wireless charging signal can be provided by the energy storage device 305 rather than through the adaptor 340. Thus, the fifth switch 335 may be open to disconnect the wireless charging transceiver 212 from the adaptor 340, and the sixth switch 336 may be closed to connect the energy storage device 305 to the wireless charging transceiver 212. In addition, the seventh switch 337 may be opened so that current may not flow through the charger 350 to the energy storage device 305. As a result, the voltage at node 370 may be the input signal (VIN) to the wireless charging transceiver 212 for enabling current flow through the resonant tank 311 to generate the wireless power signal 105. Capacitor 360 may be coupled to node 370 may act as an input capacitor during transmit mode. Singh-203, 7:51-8:27. If the transmit mode is determined to be the desired mode of operation, the wireless power enabled operates in the transmit mode at operation 420. While in transmit mode, control logic may transmit control signals to a wireless charging transceiver. The control signals may control operation of a full-bridge circuit coupled with a resonant tank of the wireless charging transceiver to operate as a full-bridge inverter. The wireless charging transceiver operating as a full-bridge inverter receives a DC input signal and generates an AC current through the resonant tank. Therefore, at operation 425, the wireless power signal may be generated for energy transfer to a wireless power receiving device. The wireless power receiving apparatus may be an electronic device that is configured to receive the wireless power signal. In some embodiments, the wireless power receiving apparatus may likewise be a wireless power enabled device having multiple modes of operation. Singh-203, 9:63-10:12.

Claim Limitation	Exemplary Prior Art Disclosures

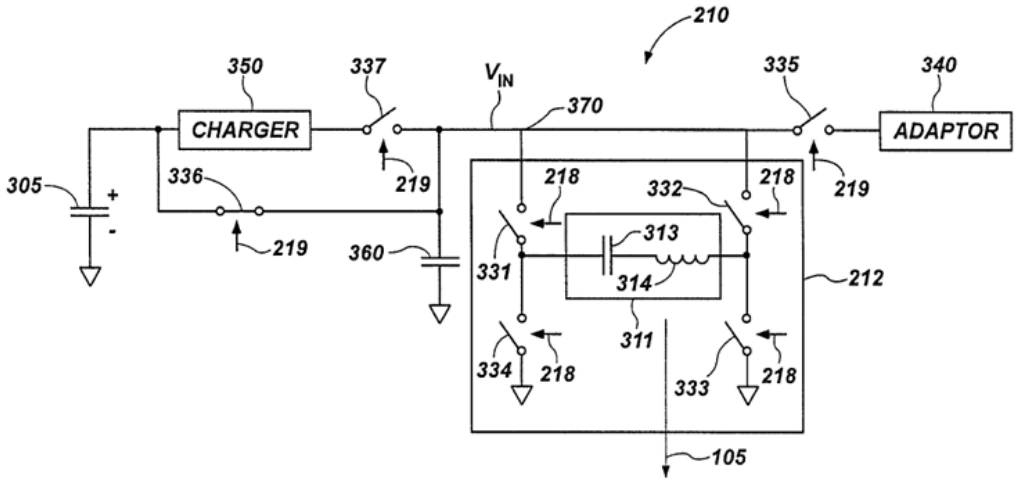
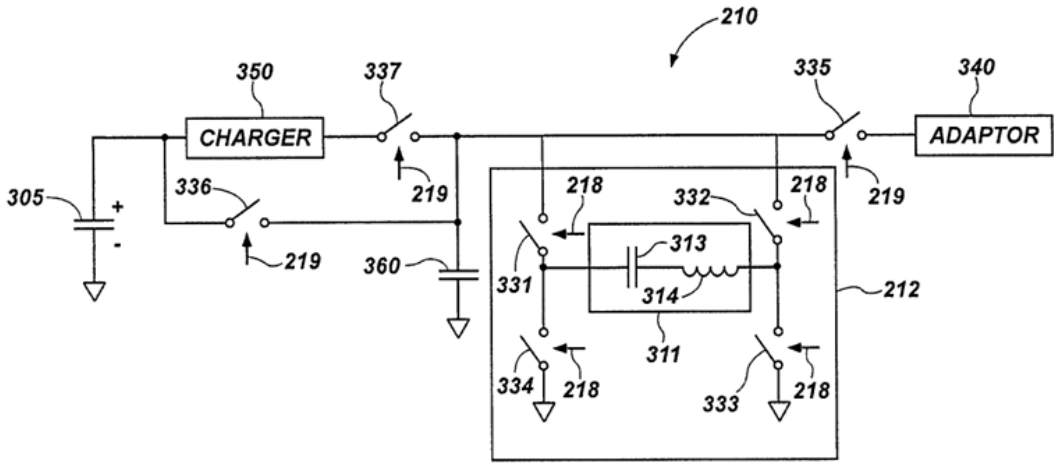


FIG. 3B

The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved.

The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the

Claim Limitation	Exemplary Prior Art Disclosures
	inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. The plurality of switches 331, 332, 333, 334 may be configured as a full-bridge circuit, such that the resonant tank 311 is coupled on one end at a node between the first switch 331 and the fourth switch 334, and at a node between the second switch 332 and the third switch 333 on the other end. In other words, the first switch 331 and the fourth switch 334 may be serially coupled having a first node therebetween, and the second switch 332 and the third switch 333 may be serially coupled having a second node therebetween. The resonant tank 311 may be coupled between the first node and the second node. Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, 7:10-8:12. The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25; *see also* FIGS. 3A-3D.  FIG. 3A

U.S. Pat. No. 7,791,311 (“Sagoo”)

The asserted claims of U.S. No. 10,038,339 (the “’339 patent”) are anticipated and/or rendered obvious by U.S. Pat. No. 7,791,311 (“Sagoo”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. 2011/0018356 (“Chatterjee”), U.S. Patent Application Publication No. 2013/0026981 (“Van Der Lee”), U.S. 8,400,801 (“Shinoda”), U.S. Pat. No. 9,837,203 (“Singh-203”), U.S. Patent No. 8,942,624 (“Singh-624”), U.S. Patent Pub. No. 2013/0257167 (“Singh-167”), U.S. Pat. No. 8,901,875 (“Schuessler”), U.S. Pat. No. 8,698,450 (“Yeh”), U.S. Patent Application Publication No. 2010/0148723 (“Cook”), U.S. 2010/0083012 (“Corbridge”), U.S. 2012/0049646 (“Teramoto”), and/or WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 (“WPT Standard” or “WPT”).

Sagoo was filed on October 25, 2011, published on February 16, 2012, and issued on March 19, 2013. It qualifies as prior art under pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Chatterjee was filed on December 1, 2009 and published on January 27, 2011. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Van Der Lee was filed on July 28, 2011 and published on January 31, 2013. It qualifies as prior art under either pre-AIA 102(e), or post-AIA 102(a)(2).

Shinoda was filed on October 25, 2011, published on February 16, 2012, and issued on March 19, 2013. It qualifies as prior art under pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Singh-203 was filed on March 29, 2012, published on October 3, 2013, and issued on December 5, 2017. It qualifies as prior art under pre-AIA 102(e), or post AIA 102(a)(2).

Singh-624 was filed on March 30, 2012, published on October 3, 2012, and issued on January 27, 2015. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Singh-167 was filed on March 29, 2012 and published on October 3, 2013. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Schuessler was filed on March 3, 2011 and published on September 13, 2012. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Yeh was filed on December 27, 2011 and published on June 27, 2013. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(2).

Cook was filed on September 1, 2009 and published on June 17, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Corbridge was filed on June 4, 2009 and published on April 1, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Teramoto was filed on August 23, 2011 and published on March 1, 2012. It qualifies as prior art under either pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

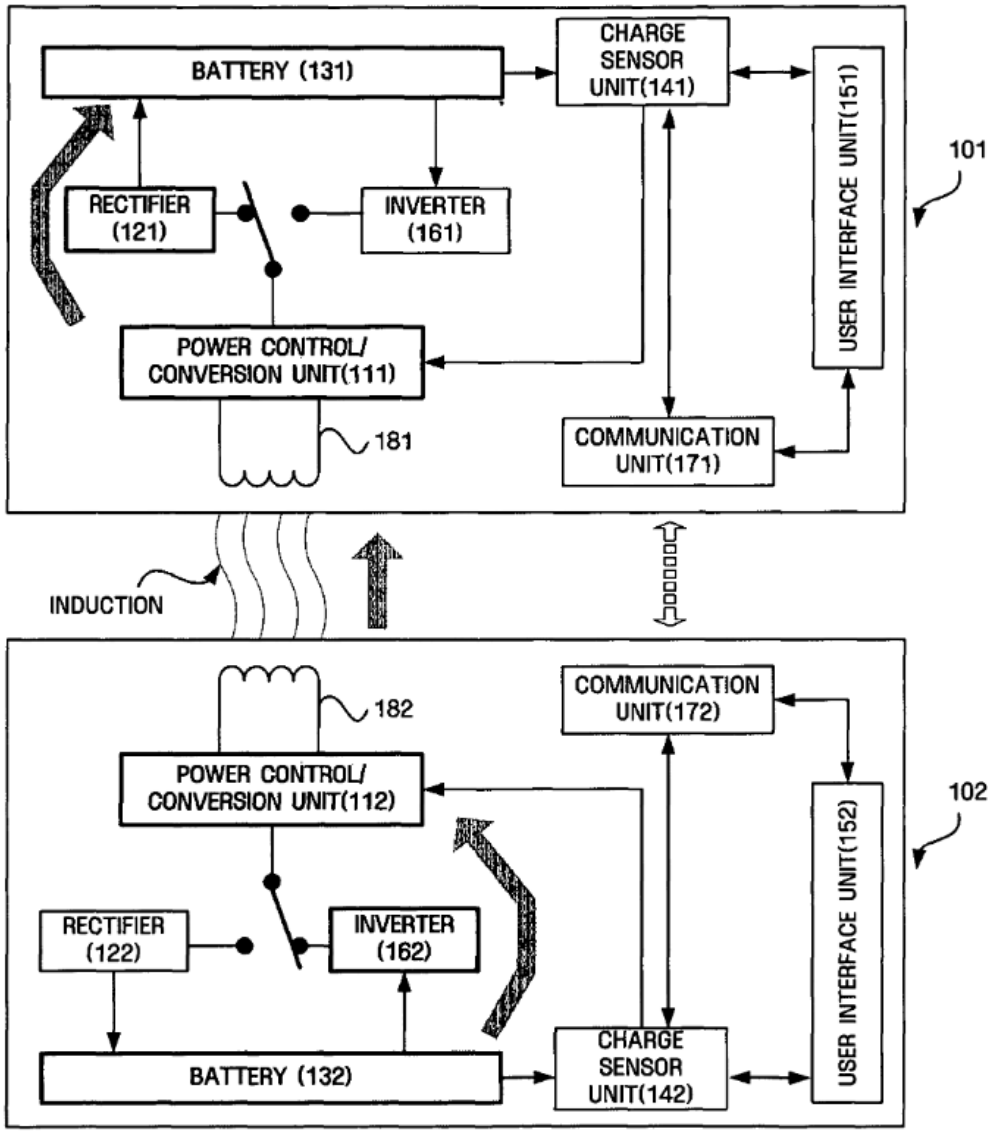
WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1).

Claim Limitation	**Exemplary Prior Art Disclosures**
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	To the extent the preamble is limiting, Sagoo teaches and renders obvious a "dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver." Sagoo discloses an electronic device that can wirelessly share power by an inductive method, and that the electronic device can operate in a load mode in which it can be supplied power from another device, or a source mode in which it can provide power to another device. For example: Apparatuses and methods consistent with the present invention relate to ***charging a power supply in a non-contact manner***, and more particularly, to ***wirelessly sharing power by an inductive method***. Sagoo, 1:16-19. The present invention provides a method of ***inductively charging a battery in a non-contact or wireless manner***, and more particularly, a method of charging a battery by providing a common interface among mobile/portable devices and sharing power supplies in a wireless or non-contact manner. The present invention also provides ***a device which detects other devices to enable charging or discharging in a non-contact manner***. Sagoo, 2:9-16. According to an aspect of the invention, there is provided an apparatus for wirelessly sharing power by induction, the apparatus including a first battery supplying power; a rectifier supplied with an AC voltage, converts the AC voltage into a DC voltage, and outputs the DC voltage; an

Claim Limitation	Exemplary Prior Art Disclosures
	inverter supplied with the DC voltage, converts the DC voltage into the AC voltage, and outputs the AC voltage; a power control/conversion unit connected to the rectifier or the inverter and supplying power to charge the first battery or a second battery that is provided in an external device as a power supply for the first battery; and a local communication unit communicating with the external device. According to another aspect of the invention, ***there is provided a method of wirelessly loading power by induction***, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil***. According to still another aspect of the invention, ***there is provided a method of wirelessly supplying power by induction***, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil***. Sagoo, 2:22-55. Hereinafter, a mode in which a mobile device provides energy to another device is referred to as a ***source mode***, and a mode in which the battery of the mobile device is charged by energy from another device is referred to as a ***load mode***. Sagoo, 4:30-33. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode)***. The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion

Claim Limitation	Exemplary Prior Art Disclosures
	unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. The charge sensor unit 140 checks the charge state of the battery 130 and supplies the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160. Sagoo, 4:56-5:4.

FIG. 4



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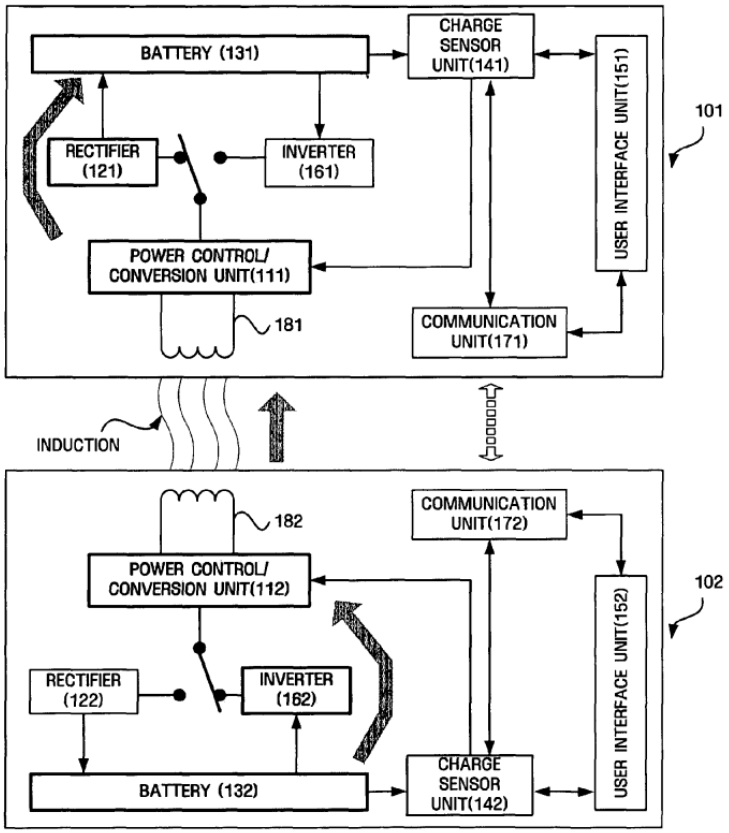
Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Fig. 4; *see also id.* Figs. 3-8. FIG. 4 is a view showing two mobile devices according to an exemplary embodiment of the invention, which perform charging in a non-contact manner. ***In FIG. 4, a first device 101 is in the load mode, and a second device 102 is in the source mode***. Sagoo, 5:40-44. FIG. 6 is a flowchart showing ***an operation in the load mode in which a mobile device according to an exemplary embodiment of the invention receives energy from another mobile device***. First, the charge state of the battery is checked (S210). The charge state of the battery is checked by the charge sensor unit. When the battery needs to be charged (Yes in S220), a process of receiving energy is performed. When the battery does not need to be charged (No in S220), the charge sensor unit periodically checks the charge state of the battery (S210). When the battery needs to be charged, a device capable of operating in the source mode is detected among neighboring devices (S230). The mobile device performs local area communication with the neighboring devices through a local area communication unit so as to detect the amounts of charge in the neighboring devices. The detected charge states of the neighboring devices are output (S240). A specific device is selected among the neighboring devices through the user interface unit (S250). Alternatively, it is possible to automatically select a special device without requiring input from the user. It is checked whether the selected mobile device can operate in the source mode (S260). For example, the selected mobile device may be set so as not to operate in the source mode. Further, in a case in which the selected mobile device operates in the source mode only when the two devices authenticate each other, if the authentication fails, the selected mobile device does not operate in the source mode. When the selected mobile device cannot operate in the source mode, another mobile device can be selected. When the selected mobile device (hereinafter, referred to as a source device) can operate in the source mode, ***the mobile device to be charged is switched to the load mode (S270). When the mobile device to be charged is switched to the load mode, the rectifier is connected to the battery and the power control/conversion unit such that energy can be received from the outside. Further, the inductive coil is set as the secondary coil (S280). Energy is received from the secondary coil and the primary coil of the source device (S290)***. The charge state of the battery

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Claim Limitation	Exemplary Prior Art Disclosures
	can be checked while the energy is being received such that the battery is prevented from being excessively charged. FIG. 7 is a flowchart showing ***the operation of the mobile device according to an exemplary embodiment of the invention when the mobile device is in the source mode for providing energy to another mobile device.*** The charge state of the battery is transmitted to a mobile device requiring charging (referred to as a charge device) (S310). The source device receives data instructing the source device to operate in the source mode from the charge device (S320). The source device performs an authentication process with respect to the charge device (S330). This is to prevent the source device from being discharged by an unauthenticated device. Next, it is determined whether the authentication process succeeded (S340). When the authentication fails, the source device does not provide energy. When the authentication succeeds, the source device performs an operation for supplying energy. ***First, the source device is switched to the source mode (S350). As described above, in order for the source device to be switched to the source mode, the inverter is connected to the battery and the power control/conversion unit such that the power of the battery can be supplied to the charge device. Then, the inductive coil is set to the primary coil (S360). Next, the source device provides energy to the charge device by using the power of the battery (S370).*** While providing energy, the source device can check the charge state of the battery such that the battery is prevented from being excessively discharged. Sagoo, 7:4-8:6. Sagoo discloses or renders obvious the “dual mode wireless power receiver configured to . . . communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver’s load device.” Sagoo discloses communication between the two electronic devices that results in charging of the second electronic device. ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another

Claim Limitation	Exemplary Prior Art Disclosures
	device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. An example of a process in which the two mobile devices share energy in a non-contact manner will now be described. A user having the first device 101 is informed through a user interface unit 151 that the battery does not have enough charge. The charge sensor unit 141 measures the charge state of the battery and communicates with the communication unit about the charge state of the battery. Rechargeable batteries such as the battery 131 of the first device 101 can be installed in devices, such as a notebook computer, a PDA, an MP3 player, and a game console, and have different voltages, currents, and capacities. The battery can be formed of, for example, a nickel metal hydride (NiMH) battery or a lithium-ion battery. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device and outputs the received information to the user interface unit 151***. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:4-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, the communication units can perform authentication with respect to each other such that charging is performed between authenticated devices. Sagoo, 6:43-48.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 4  Sagoo, Fig. 4; *see also id.* Figs. 3-7.
[1a] one of coil and capacitor electrodes;	Sagoo discloses or renders obvious this limitation. Sagoo discloses coils. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; ***setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil***. Sagoo, 2:34-45. FIG. 2 is a view showing a transformer according to a first exemplary embodiment of the invention including a mobile device. The transformer includes a primary coil 51 and a secondary coil 52. Transformers are essentially composed of the primary and secondary coils, and ***energy is transferred from the primary coil to the secondary coil by an induced voltage***. According to an exemplary embodiment of the invention, ***the primary coil and the secondary coil are separately mounted in two different devices and charging can be performed when the two devices are close to each other without being contacted with each other***, unlike the related art in which primary and secondary coils are in one device. For example, the ***primary coil 51*** is provided in a first device 31 and the ***secondary coil 52*** is provided in a second device 32. When the distance between the two devices is smaller than a predetermined distance, the primary coil 51 and the secondary coil 52 constitute a transformer such that energy can be transferred. In this case, the first device serves as a charger, and the second device is charged by energy from the first device. Sagoo, 3:52-4:4. An ***inductive coil 180 serves as the primary coil or the secondary coil*** according to whether the mobile device supplies energy or is supplied with energy, as described with reference to FIG. 2. The ***inductive coil 180*** performs the function of the secondary coil when the mobile device is in the load mode, and performs the function of the primary coil when the mobile device is in the source mode. Sagoo, 5:22-30.

Claim Limitation	Exemplary Prior Art Disclosures
	In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode. The second device 102 is in the source mode and the power control/conversion unit 112 is connected to the inverter 162. DC energy of the battery 132 is converted into an alternating current by the inverter 162, and the alternating current is supplied to the first device 101 through the inductive coil 182 serving as a primary coil of a transformer. The charge sensor unit 142 checks the amount of charge in the battery 132 and provides information on the charge of the battery to the power control/conversion unit 112 to prevent excessive charging of the battery. Sagoo, 6:26-42. A first device 103 and a second device 106 receive energy from a third device 104. The second device 106 and the third device 104 each have ***two inductive coils***, and can operate in the load mode or the source mode. ***An inductive coil 184 of the third device 104 is coupled with an inductive coil 183 of the first device 103 so as to supply energy, and an inductive coil 185 of the third device 104 is coupled with an inductive coil 187 of the second device 106 so as to supply energy***. Sagoo, 6:52-60; *see also id.* Figs. 2-7.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	Sagoo, in view of one or more of the references cited below, renders obvious this limitation. First, Sagoo, in view of one or more of the references cited below, renders obvious “a first circuitry comprising: an impedance network.” Sagoo discloses a power control/conversion unit coupled to the coil. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; setting ***an inductive coil coupled***

Claim Limitation	Exemplary Prior Art Disclosures
	with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device; setting an ***inductive coil coupled with the power control/conversion unit*** as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:35-55; *see also id.* Figs. 3-5. In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. ***An inductive coil 181 coupled with the power control/conversion unit 111*** serves as a secondary coil of a transformer. The first device is switched to the load mode. Sagoo, 6:26-32. A POSA would have found it obvious to implement an impedance network as part of the power control/conversion unit of Sagoo, or in addition to the power control/conversion unit of Sagoo's mobile device, as taught in one or more of the following references, because doing so involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA would have appreciated the benefit of providing an impedance network to provide changeable impedance to improve the power charging efficiency in different use cases. A POSA would have had a reasonable expectation of success because adjusting impedance for wireless power charging is well known in the art. **Chatterjee** Chatterjee discloses a bi-directional coil assembly whose impedance is changeable. For example:

Claim Limitation	Exemplary Prior Art Disclosures

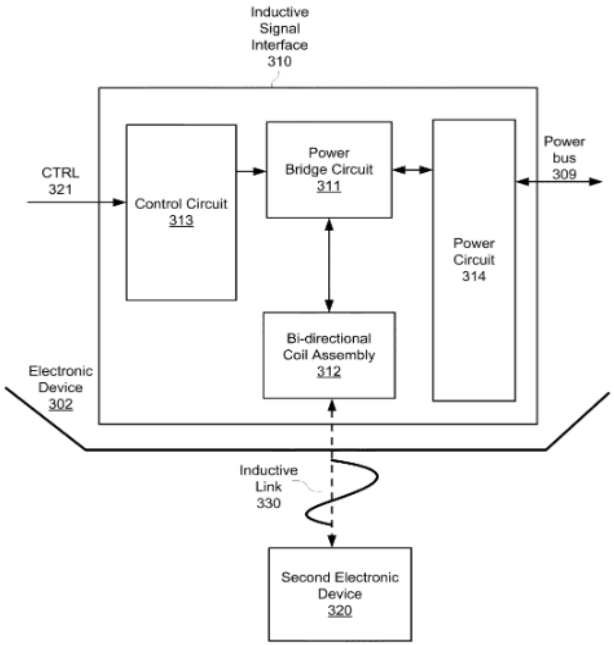
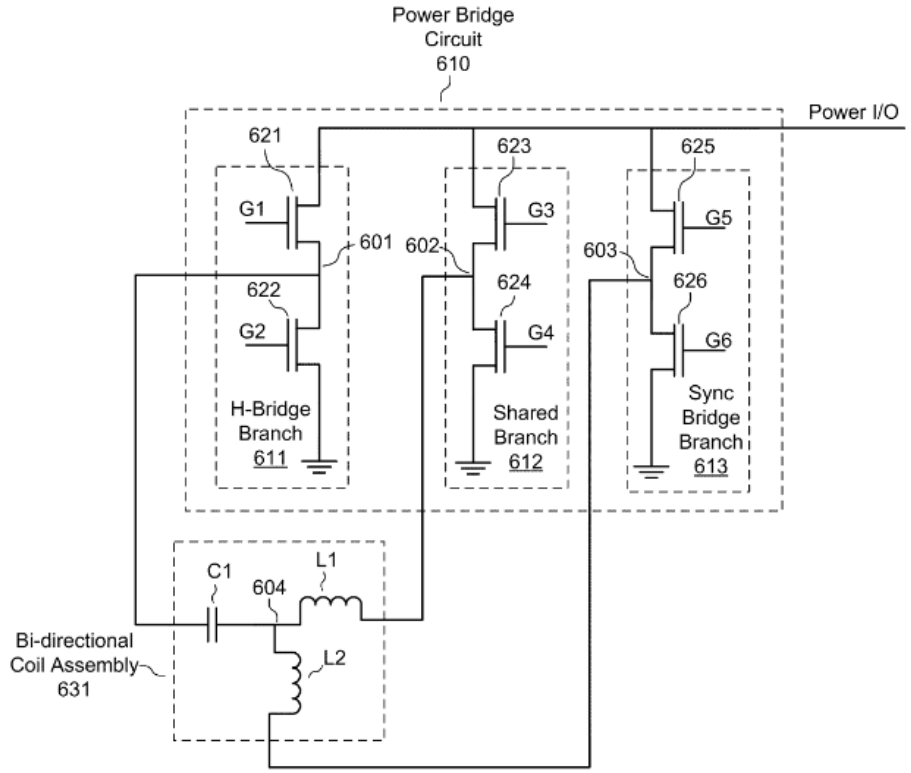


FIG. 3

Chatterjee, Fig. 3; *see also id.* Fig. 4.

> By selectively turning off the H-bridge branch 611 or the sync bridge branch 613, the power bridge circuit 610 is configurable to ***selectively turn off current paths in the bi-directional coil assembly 631 to change the impedance of the bi-directional coil assembly 631 based on the mode of operation of the inductive signal interface***. For example, in the power receive mode of the inductive signal interface, the current paths through the bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the capacitor C1 and the inductive coil L1. In the power transmit mode, the current path through bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the inductive coils L1 and L2.

Chatterjee, ¶ 66.

Claim Limitation	Exemplary Prior Art Disclosures
	 Chatterjee, Figs. 6A; *see also id*. Figs. 6B-6D, ¶¶ 61-73. *See generally* Chatterjee, Figs. 7, 9, 10. **Van Der Lee** Van Der Lee discloses and/or renders obvious a capacitor and/or a coil whose impedance is adjustable. For example:

Claim Limitation	Exemplary Prior Art Disclosures

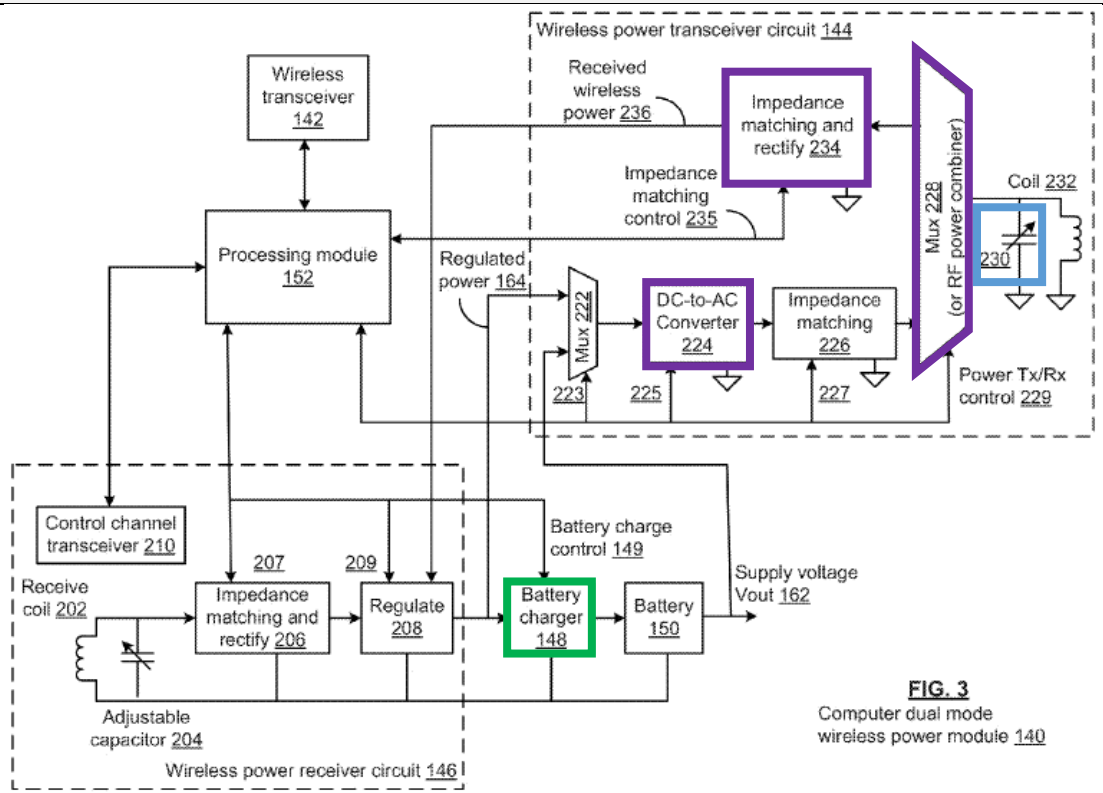


FIG. 3
Computer dual mode wireless power module 140

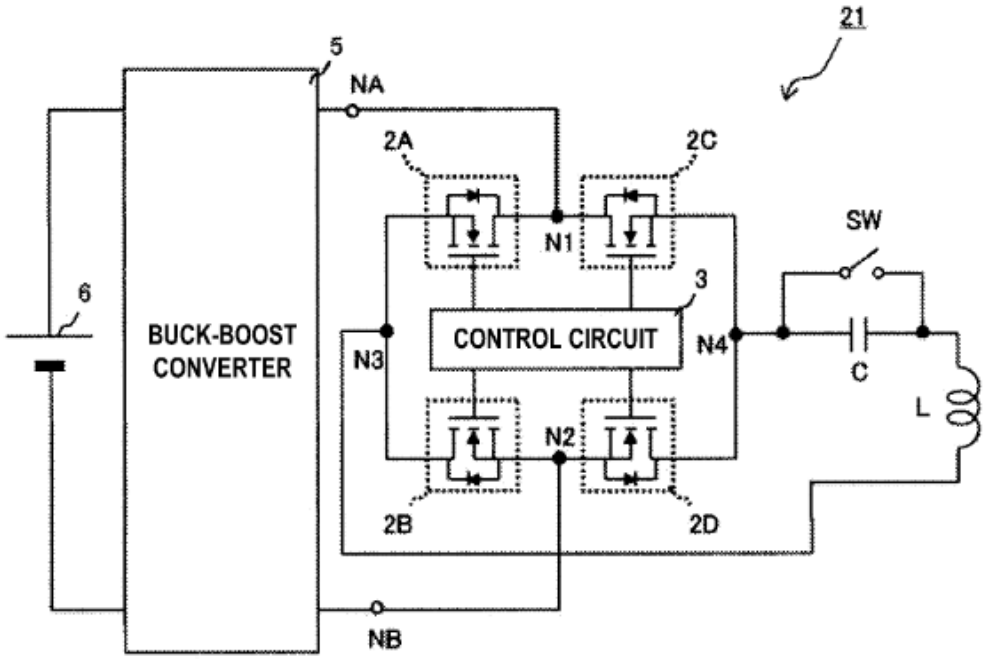
Van Der Lee, Fig. 3.

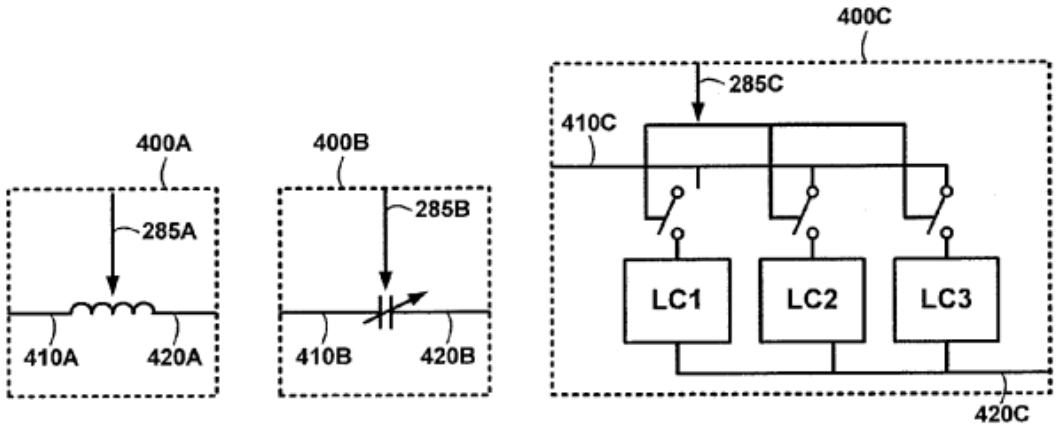
> The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, a DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, ***an adjustable capacitor 230***, and a coil 232.

Van Der Lee, ¶ 51.

> In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and

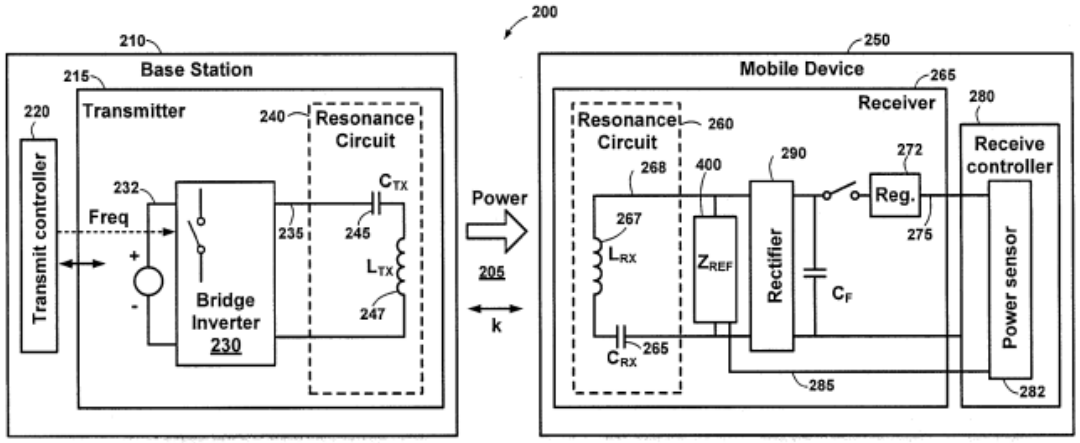
Claim Limitation	Exemplary Prior Art Disclosures
	MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. ***As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit***. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54, Fig. 3; *see also id.* ¶¶ 62, 73, Fig. 4. **Shinoda** Shinoda discloses a resonant capacitor that can be connected or bypassed in different modes. For example: The wireless power transfer terminal 11 includes the FETs 2A to 2D, coil L, control circuit 3, a switch SW, and a resonant capacitor C. The resonant capacitor C is provided between the node N4 and the coil L, and the switch SW is provided in parallel with the resonant capacitor C. ***The capacitance of the resonant capacitor C is set such that it is connected to the coil L and resonates in series therewith***. ***For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:52-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 4, 7. **Singh-167** Singh-167 teaches an impedance adjuster 400 that provides variable impedance.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 4A FIG. 4B FIG. 4C Singh-167 at Figs. 4A-4C; *see also* Singh-167, Figs. 2-3. The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive

Claim Limitation	Exemplary Prior Art Disclosures
	resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive

Claim Limitation	Exemplary Prior Art Disclosures
	resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the

Claim Limitation	Exemplary Prior Art Disclosures
	impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.  *FIG. 2* Singh-167, Fig. 2.

Claim Limitation	Exemplary Prior Art Disclosures

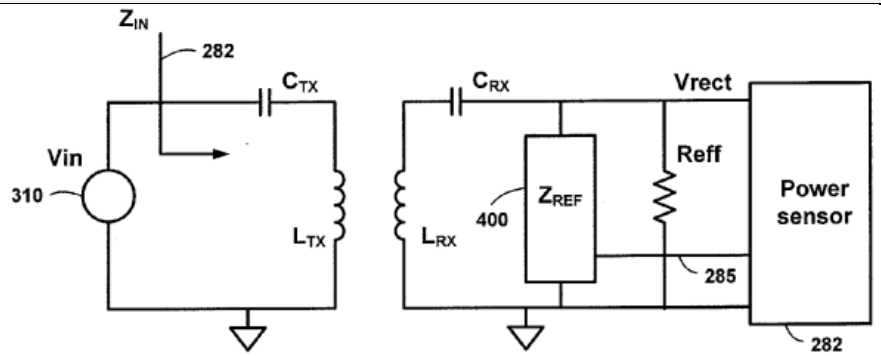


FIG. 3

Singh-167, Fig. 3.

> Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN.
>
> Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above.

Singh-167, ¶¶ 48-49.

> FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance

Claim Limitation	Exemplary Prior Art Disclosures
	adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line

Claim Limitation	Exemplary Prior Art Disclosures
	520. This larger impedance will result in less power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7. **Schuessler** Schuessler discloses circuits such as a resonant circuit, a switched power amplification circuit, and/or circuits that may include the capability for tuning the energy deliver or receipt frequency. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	Coil 205 generally is coupled to circuitry, not shown in FIG. 2, for the transfer of energy through coil 205. For example, ***coil 205 may be included in a resonant circuit for energy transfer through resonance. As another example, coil 205 may be included in a switched power amplification circuit. Coil 205 may be included in a wide variety of other circuits for delivering or receiving power. Circuits including coil 205 may include the capability for tuning the energy delivery or receipt frequency***. Schuessler, 4:19-27. ***Control mechanism 225 may provide adjustment to coil 205, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Schuessler, 5:57-62.

Claim Limitation	Exemplary Prior Art Disclosures

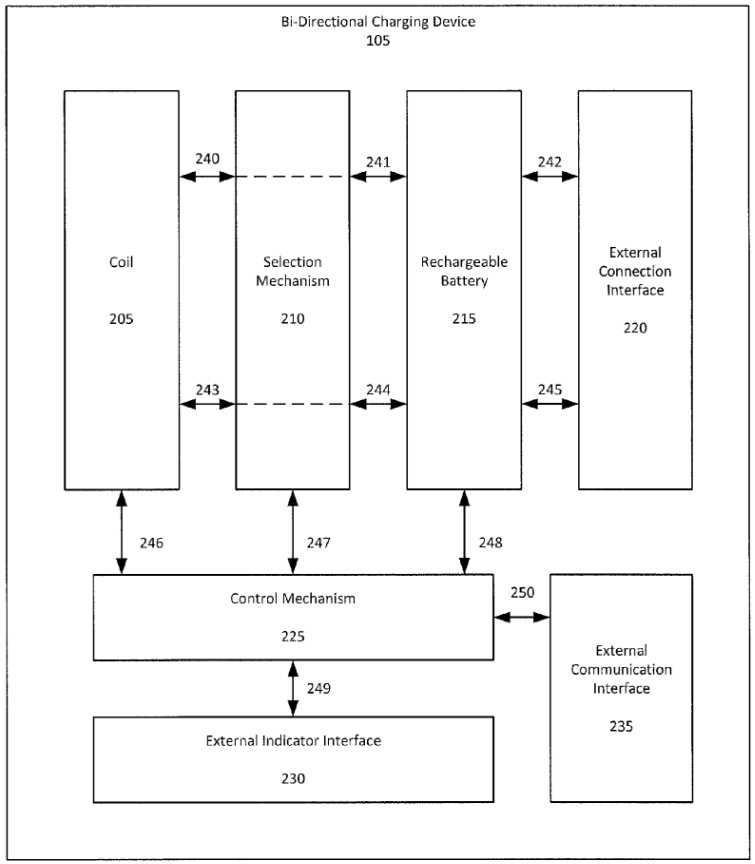


Fig. 2

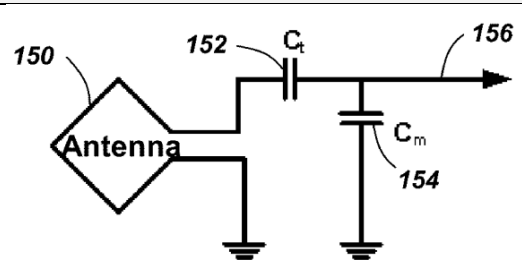
Schuessler, Fig. 2.

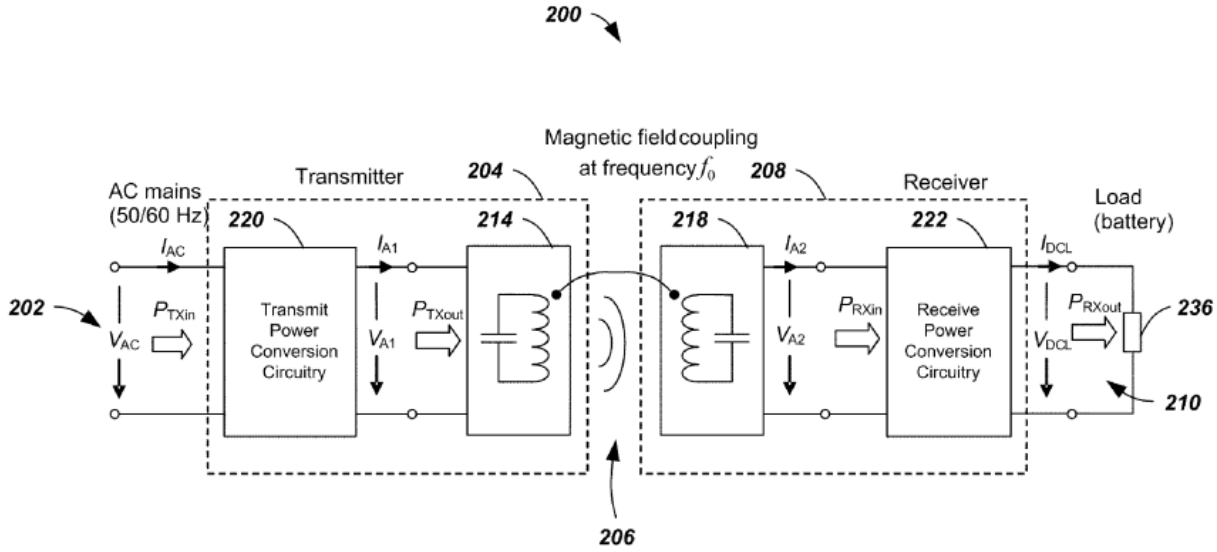
Cook

Cook discloses and/or renders obvious a capacitor connected to the coil and has adjustable capacitance.

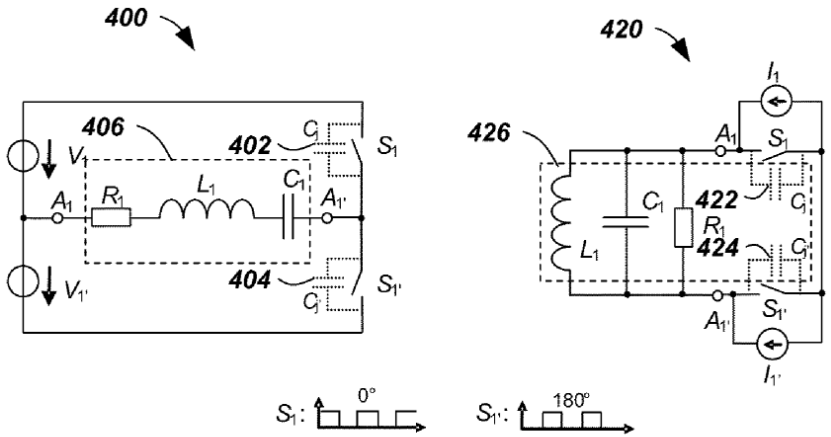
For example:

Claim Limitation	Exemplary Prior Art Disclosures
	An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to charge a battery 136 as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. ***The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118***. Cook, ¶31. As stated, ***efficient transfer of energy between the transmitter 104 and receiver 108 occurs during matched or nearly matched resonance between the transmitter 104 and the receiver 108***. However, even when resonance between the transmitter 104 and receiver 108 are not matched, energy may be transferred at a lower efficiency. Transfer of energy occurs by coupling energy from the near-field of the transmitting antenna to the receiving antenna residing in the neighborhood where this near-field is established rather than propagating the energy from the transmitting antenna into free space. ***The resonant frequency of the loop antennas is based on the inductance and capacitance. Inductance in a loop antenna is generally the inductance created by the loop, whereas, capacitance is generally added to the loop antenna's inductance to create a resonant structure at a desired resonant frequency***. As a non-limiting example, ***capacitor 152 and capacitor 154 may be added to the antenna to create a resonant circuit that generates a sinusoidal or quasi-sinusoidal signal 156***. Accordingly, for larger diameter loop antennas, the size of capacitance needed to induce resonance decreases as the diameter or inductance of the loop increases. Furthermore, as the diameter of the loop antenna increases, the efficient energy transfer area of the near-field increases for “vicinity” coupled devices. Of course, other resonant circuits are possible. As another non-limiting example, a capacitor may be placed in parallel between the two terminals of the loop antenna. In addition, those of ordinary skill in the art will recognize that for transmit antennas the resonant signal 156 may be an input to the loop antenna 150. Cook, ¶¶ 34-35.

Claim Limitation	Exemplary Prior Art Disclosures
	 ***FIG. 3*** *see also* Cook, Figs. 2, 3. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter.

Claim Limitation	Exemplary Prior Art Disclosures
	Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if ***both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0***. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41.  ***FIG. 4*** Cook, Fig. 4

Claim Limitation	Exemplary Prior Art Disclosures
	As described herein, wireless power transfer uses ***coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency***. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of a half bridge rectifier topology 400 including ***a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna*** where ‘dual’ refers to the dualism of electrical circuits that is well known in electrical engineering. A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration. The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. ***The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency***.

Claim Limitation	Exemplary Prior Art Disclosures
	The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.  ***FIG. 8*** Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration) with a half bridge active rectifier configured with the ***switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1 and a receiver 454***. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs)

Claim Limitation	Exemplary Prior Art Disclosures
	with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). ***Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency***. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures

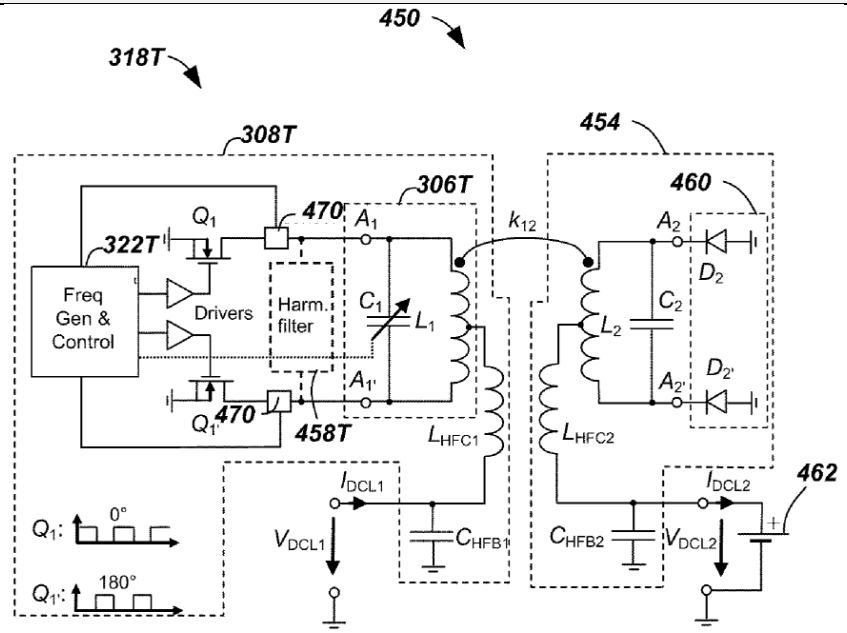
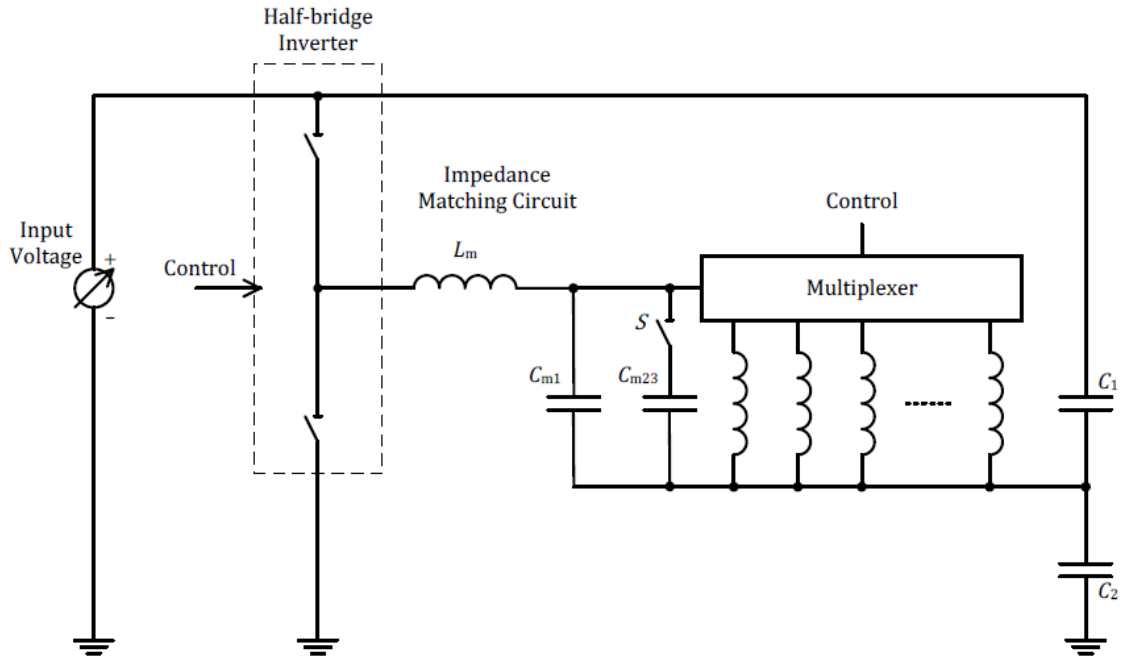


FIG. 9

Cook, Fig. 9.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, l***ow loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T,***

Claim Limitation	Exemplary Prior Art Disclosures
	L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶61. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all.*** Cook, ¶61.

Claim Limitation	Exemplary Prior Art Disclosures
	See also Cook, Figs 7-10. **WPT** For example, WPT discloses an impedance matching circuit. As shown in Figure 3-12, Power Transmitter design B1 uses a half-bridge inverter to drive the Primary Coil array. In addition, Power Transmitter design B1 uses a multiplexer to select the position of the Active Area. The multiplexer shall configure the Primary Coil array in such a way that one, two, or three Primary Coils are connected—in parallel—to the driving circuit. The connected Primary Coils together constitute a Primary Cell. As an additional constraint, the multiplexer shall select the Primary Coils such that each selected Primary Coil has an overlap with every other selected Primary Coil; see Figure 3-10(c) for an example.  **Figure 3-12: Electrical diagram (outline) of Power Transmitter design B1**

Claim Limitation	Exemplary Prior Art Disclosures

> Within the Operating Frequency range $f_{op} = 105 \ldots 113$ kHz, the assembly of Primary Coil array and Shielding has an inductance of $8.1^{\pm 1}$ µH for each individual Primary Coil in layer 1 (closest to the Interface Surface), $8.7^{\pm 1}$ µH for each individual Primary Coil in layer 2, and $9.6^{\pm 1}$ µH for each individual Primary Coil in layer 3. The capacitances and inductance in the impedance matching circuit are, respectively, $C_{m1} = 300^{\pm 5\%}$ nF, $C_{m23} = 200^{\pm 5\%}$ nF,and $L_m = 3.8^{\pm 5\%}$ µH. The capacitances C_1 and C_2 in the half-bridge inverter both are 68 µF. The switch S is open if the Primary Cell consists of a single Primary Coil; otherwise, the swich S is closed. (Informative) *The voltage across the capacitance C_m can reach levels exceeding 36 V pk-pk.*

WPT, 23.

Second, Sagoo discloses and/or renders “a first circuitry comprising: . . . a switch network”. Sagoo discloses a rectifier and an inverter, and that the power control/conversion unit is selectively coupled to one of the rectifier and the inverter.

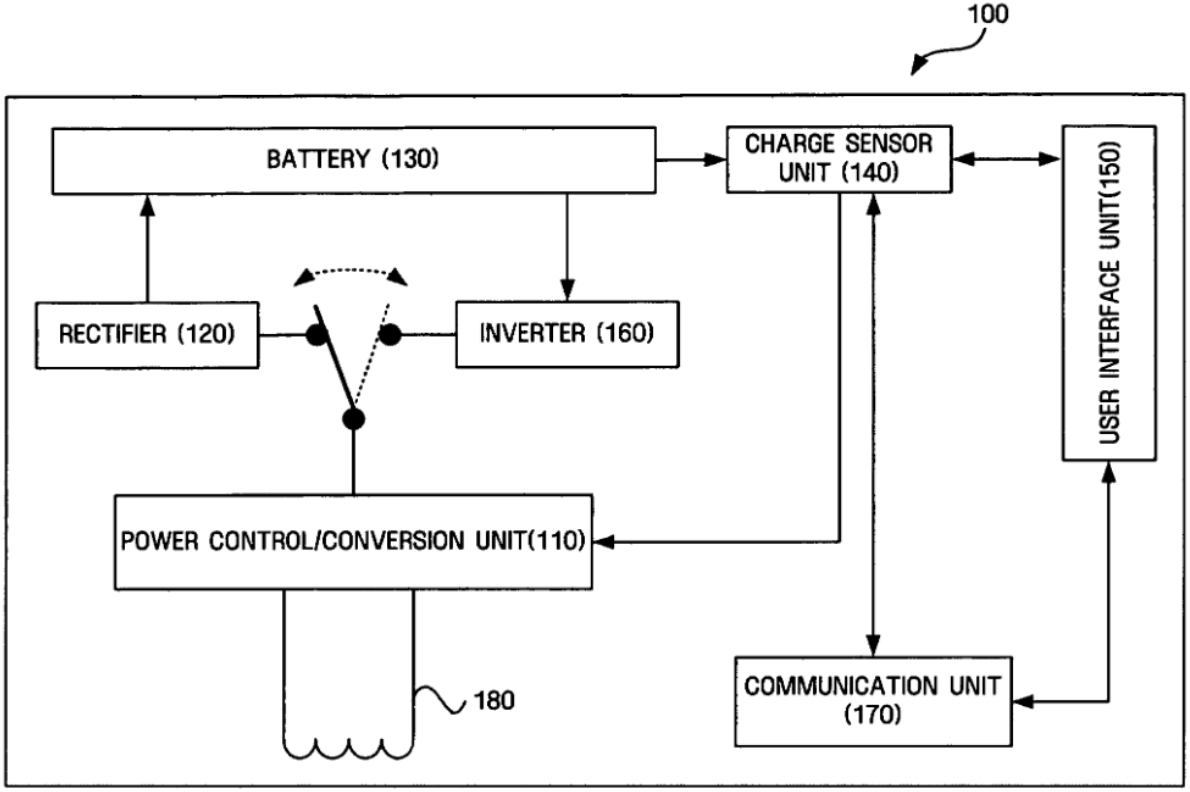
For example:

> An apparatus and method of wirelessly sharing power by an inductive method are provided. The apparatus includes a first battery supplying power; a ***rectifier*** supplied with an AC voltage, converts the AC voltage into a DC voltage, and outputs the DC voltage; an ***inverter*** supplied with the DC voltage, converts the DC voltage into the AC voltage, and outputs the AC voltage; ***a power control/conversion unit connected to the rectifier or the inverter*** and supplying power to charge the first battery or a second battery that is provided in an external device as a power supply for the first battery; and a communication unit communicating with the external device.

Sagoo, Abstract.

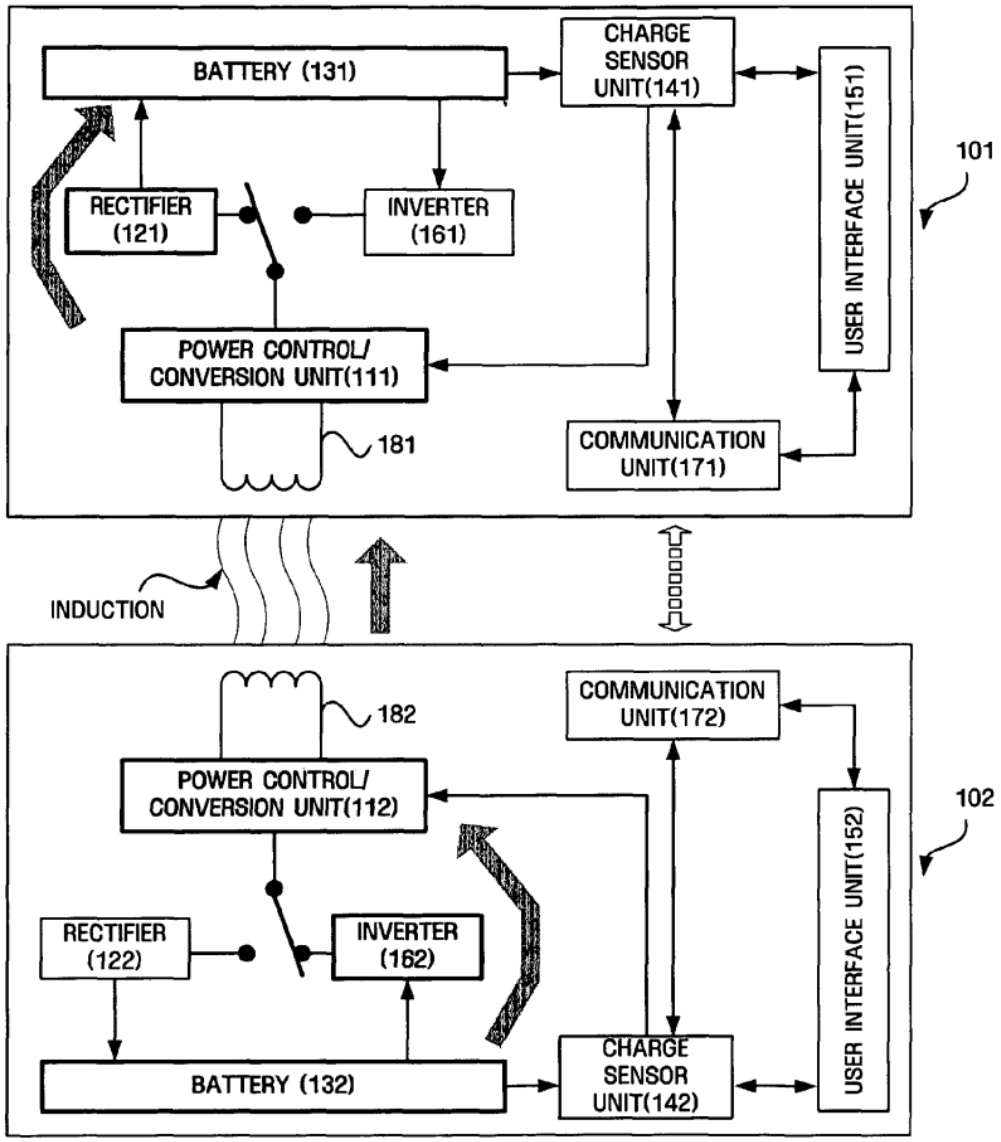
> ***The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage***. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted.
>
> ***The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage***. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to

Claim Limitation	Exemplary Prior Art Disclosures
	charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160*** so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. Sagoo, 4:40-64.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 3  Sagoo, Fig. 3. A power control/conversion unit 111 of the first device 101 is connected to a rectifier 121, and the rectifier 121 converts an AC voltage into a DC voltage and provides the DC voltage to a battery 131 to charge the battery 131. A power control/conversion unit 112 of the second device 102 is connected to an inverter 162. When the inverter 162 converts a DC voltage charged in a battery 132 into an AC voltage and

Claim Limitation	Exemplary Prior Art Disclosures
	supplies the AC voltage to the power control/conversion unit 112, the power control/conversion unit 112 provides energy to the first device 101. Sagoo, 5:45-55.

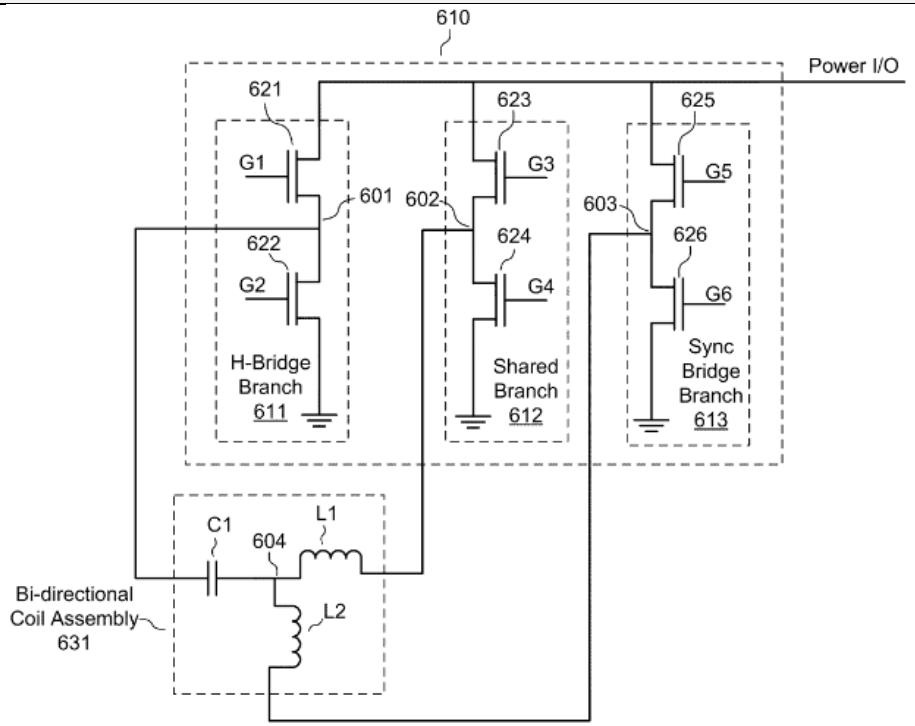
FIG. 4


BATTERY (131)
CHARGE SENSOR UNIT(141)
USER INTERFACE UNIT(151)
101
RECTIFIER (121)
INVERTER (161)
POWER CONTROL/ CONVERSION UNIT(111)
181
COMMUNICATION UNIT(171)
INDUCTION
182
COMMUNICATION UNIT(172)
POWER CONTROL/ CONVERSION UNIT(112)
102
RECTIFIER (122)
INVERTER (162)
BATTERY (132)
CHARGE SENSOR UNIT(142)
USER INTERFACE UNIT(152)

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Fig. 4; *see also* Figs. 5-7. In order to charge the battery 131 by receiving energy from the selected second device 102, the ***power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131***. An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode. The second device 102 is in the source mode and the ***power control/conversion unit 112 is connected to the inverter 162***. DC energy of the battery 132 is converted into an alternating current by the inverter 162, and the alternating current is supplied to the first device 101 through the inductive coil 182 serving as a primary coil of a transformer. The charge sensor unit 142 checks the amount of charge in the battery 132 and provides information on the charge of the battery to the power control/conversion unit 112 to prevent excessive charging of the battery. Sagoo, 6:26-42. To the extent it is argued that Sagoo does not teach "a first circuitry comprising: . . . a switch network," Sagoo in view of the any of the following references would have rendered this limitation obvious. It would have been obvious to apply the circuitry designs disclosed in the following references provide a switch network with changeable topology in implementing Sagoo's mobile device because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have found it obvious to choose the circuitry design disclosed in the following references from a finite number of predictable solutions to implement Sagoo's mobile device with a selectively coupled inverter/rectifier and would have had a reasonable expectation of success because the disclosed circuitry is well known in the art and operates in well-known and predictable ways. **Chatterjee** For example, Chatterjee discloses a power bridge circuit that form different circuits depending on the mode of operation: According to embodiments described herein, the power bridge circuit **311** corresponds to a circuit element that is used by the inductive signal interface **310** when in both power transmit and power

Claim Limitation	Exemplary Prior Art Disclosures
	receive modes. ***More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode***. FIG. 6A illustrates a circuit level embodiment of the power bridge circuit **311**, **411**, **511** and the bi-directional coil assembly **312**, **412**, **512** of FIGS. 3, **4**, and **5**, respectively. An embodiment depicted shows the ***power bridge circuit 610 as being “3-legged”, meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for use with either the H-bridge or the synchronous bridge rectifier branch***. Chatterjee, ¶¶ 38, 61. In the power transmit mode of the inductive signal interface, the power I/O transmits an input DC current to the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the input DC current can be a regulated current transmitted by the power circuit **314** or **414**. ***In the power transmit mode, G5 and G6 are de-asserted by the control logic so that the switches 625 and 626 in the sync bridge branch 613 are in an off (i.e. open) state. Thus, the sync bridge branch 613 is off while the H-bridge branch 611 and the shared branch 612 are active***. Accordingly, current flow through the inductor L**2** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of capacitor C**1** and inductive coil L**1**. In the power receive mode of the inductive signal interface, the power I/O transmits an output DC current from the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the output DC current may be transmitted via the power bus to the power circuit **314** or **414** which performs voltage and current regulation on the output DC current in order to output a regulated current. ***In this mode of operation of the inductive signal interface, the signals G1 and G2 de-asserted such that the switches 621 and 622 of the H-bridge branch 611 are in the off state. Thus, the H-bridge branch 611 is off while the sync bridge branch 613 and the shared branch 612 are active***. By turning off the H-bridge branch **611**, current flow through capacitor C**1** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of inductive coils L**1** and L**2**. Chatterjee, ¶¶ 64–65.

Claim Limitation	Exemplary Prior Art Disclosures

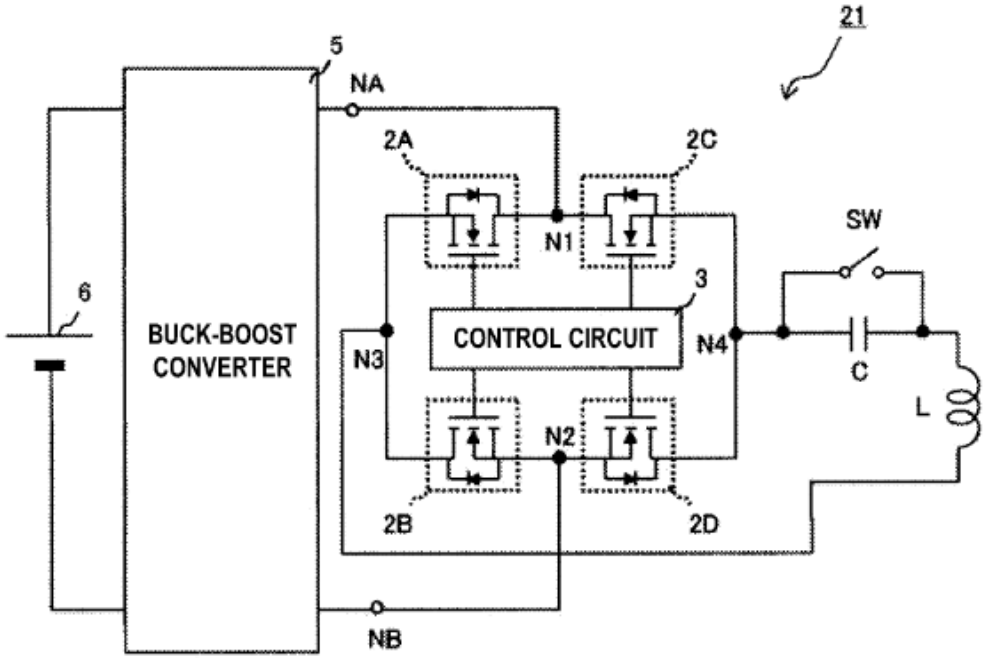


Chatterjee, Fig. 6A; *see also id.* Fig. 6B–6D, ¶¶ 61-73.

> ***FIG. 1 illustrates an H-bridge inverter circuit 110 for transferring power from a DC supply 120 to an AC load 115***. The H-bridge inverter circuit **110** includes four switches **111**-**114** each controlled by a respective one of control signals H**1**-H**4**. During the operation of the H-bridge inverter **110**, the switches **111**-**114** turn on and off in pairs to deliver an AC current to the AC load **115**. For example, at one instance, the signals H**1** and H**4** are asserted to turn on switches **111** and **114**, while the signals H**2** and H**3** are de-asserted to turn off the switches **112** and **113**. Current flows from DC power supply **120** through switch **111**, to the AC load **115**, through the switch **114**, and to a ground voltage or a negative supply voltage. At another instance, the signals H**1** and H**4** are de-asserted to turn off switches **111** and **114**, while the signals H**2** and H**3** are asserted to turn on the switches **112** and **113**. During this instance, the current flows from the DC supply **120**

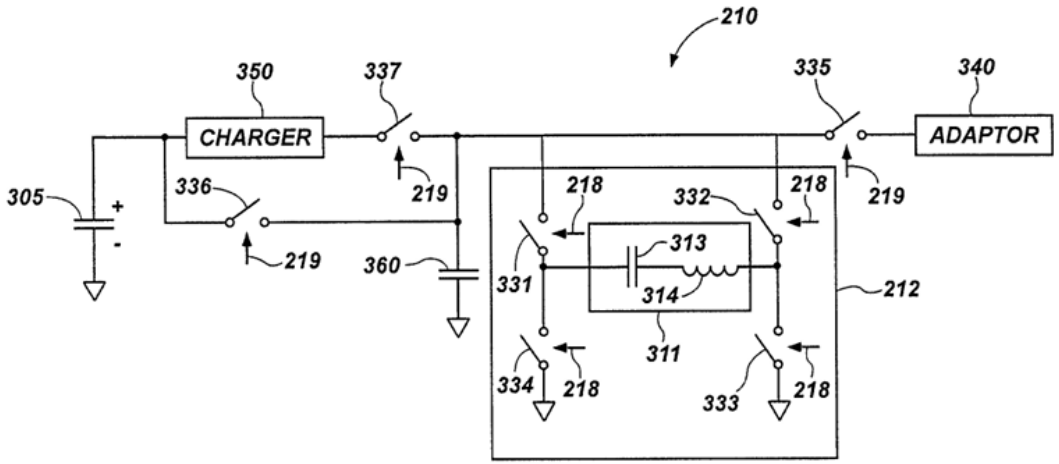
Claim Limitation	Exemplary Prior Art Disclosures
	through the switch **113**, to the AC load **115**, through the switch **112**, and to the ground voltage or the negative supply voltage. By altering the direction of the current flow, the H-bridge inverter is configured to deliver an AC current from the DC supply **120** to the AC load **115**. ***FIG. 2 illustrates a sync bridge circuit 210 for transferring power from an AC supply 215 to a DC load 220***. The sync bridge circuit **210** includes four switches **211**-**214** each controlled by a respective one of control signals S**1**-S**4**. The sync bridge circuit **210** receives an AC current from the AC supply **215**, and the switches **211**-**214** of the sync bridge circuit **210** turn on and off in pairs to deliver a DC current to the DC load. Chatterjee, ¶¶ 3–4; *see also id.* Figs. 1–2. 3. The inductive signal interface of claim 2, wherein two of the three branches operate to form an H-bridge circuit while the inductive signal interface operates in the power transmit mode. 4. The inductive signal interface of claim 2, wherein two of the three branches operate to form a synchronous bridge rectifier circuit while the inductive signal interface operates in the power receive mode. Chatterjee, cls. 3, 4. *See generally* Chatterjee, Figs. 7-11. **Shinoda** For example, Shinoda discloses switching elements (FETs 2A to 2D) that operate as different circuits depending on the mode of operation: FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via ***a respective power transmission circuit 103 and a power reception circuit 104***. ***The power transmission circuit 103 includes an inverter*** for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit*** for

Claim Limitation	Exemplary Prior Art Disclosures
	converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 1:31-46. ***For a power transmission mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the ***FETs 2A to 2D function as a full-bridge inverter circuit***. Shinoda, 3:52-62. ***For a power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the ***FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. The above described parallel circuit including ***first to fourth semiconductor switching elements (i.e., FETs 2A to 2D) operating as a full-bridge inverter circuit*** can apply an alternating-current output to the coil, thus enabling the wireless power transfer terminal to transmit power. Also, the parallel circuit including the ***first to fourth semiconductor switching elements operating as a rectifier circuit*** can rectify an alternating-current input applied from the coil, thus enabling the wireless power transfer terminal to receive power. In this way, the use of the parallel circuit including the first to fourth semiconductor switching elements as a full-bridge inverter circuit or a full-wave rectifier circuit can reduce the total number of the semiconductor switching elements, increase space savings of the circuit configuration of the wireless power transfer terminal 1, and reduce cost of manufacturing.

Claim Limitation	Exemplary Prior Art Disclosures
	For the present embodiment, an FET element is used as a semiconductor switching element. With this, the parallel circuit can operate as a full-wave rectifier circuit using a parasitic diode between the drain and the source of the FET element. However, embodiments consistent with the disclosure can also be suitably carried out using other semiconductor switching elements. For example, a combination of a bipolar transistor and a diode can also be used as substantially the same circuit configuration as that of the present embodiment, and with other embodiments consistent with this disclosure. Shinoda, 5:17-43.  FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203 Singh discloses switches 331, 332, 333, 334 that form a switch network that can operates an inverter or a rectifier under different modes. The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. The plurality of switches 331, 332, 333, 334 may be configured as a full-bridge circuit, such that the resonant tank 311 is coupled on one end at a node between the first switch 331 and the fourth switch 334, and at a node between the second switch 332 and the third switch 333 on the other end. In other words, the first switch 331 and the fourth switch 334 may be serially coupled having a first node therebetween, and the second switch 332 and the third switch 333 may be serially coupled having a second node therebetween. The resonant tank 311 may be coupled between the first node and the second node.

Claim Limitation	Exemplary Prior Art Disclosures
	Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. Singh-203, 7:10-8:12. Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for

Claim Limitation	Exemplary Prior Art Disclosures
	charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof. Singh-203, 8:51-9:5. The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25.  FIG. 3A

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, Fig. 3A; *see also* FIGS. 3A-3D. If the receive mode is determined to be the desired mode of operation, the wireless power enabled operates in the receive mode at operation 430. While in receive mode, control logic may transmit control signals to the wireless charging transceiver. The control signals may control operation of the full-bridge circuit coupled with the resonant tank of the wireless charging transceiver to operate as a full-bridge rectifier. The wireless charging transceiver may receive an incoming wireless power signal and generate an AC current through the resonant tank through inductive coupling. The incoming wireless power signal may be generated by a wireless power transmitting apparatus, such as a wireless power charger. In some embodiments, the wireless power transmitting apparatus may likewise be a wireless power enabled device having multiple modes of operation. The wireless charging transceiver operating as a full-bridge rectifier receives the AC current generated by the resonant tank generates a DC current to be output to a load. Therefore, at operation 435, power may be generated from the energy transfer to provide power to a load. For example, the load may include an energy storage device (e.g., battery), system components of the wireless power enabled device, or other power consuming devices. Singh-203, 10:13-36. **Yeh** Yeh discloses a step up/step down unit, a first reverse current protector, a second reverse current protector, and/or a third reverse current protector, that comprise switches that operate differently under different modes. For example: The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, ***the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-***

Claim Limitation	Exemplary Prior Art Disclosures
	Oxide-Semiconductor Field-Effect Transistor) synchronous rectification. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. Yeh, 3:58-4:30. The second reverse current protector 4 a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1. Yeh, 4:40-47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4 b. The third reverse current protector 4 b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth

Claim Limitation	Exemplary Prior Art Disclosures
	control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4 b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. Referring to FIGS. 1 and 2, ***each reverse current protector (4, 4 a, 4 b) comprises a first resistor 46 and serially-connected oppositely-directed first and second MOSFETs 44, 45***. Two ends of the two serially-connected MOSFETs are respectively the input terminal 41 and the output terminal 42 of the reverse current protector. The first and second MOSFETs 44, 45 each have a control terminal (not labeled), and the two control terminals are electrically connected to the control terminal 43 of the reverse current protector. The first resistor 46 has an end electrically connected between the first and second MOSFETs 44, 45 and an opposite end also electrically connected to the control terminal 43 of the reverse current protector. Further, each reverse current protector (4, 4 a, 4 b) further comprises a transistor 47 and a second resistor 48. The transistor 47 has a first terminal electrically connected to the control terminals (not labeled) of the first and second MOSFETs 44, 45, and a second terminal of the transistor 47 is grounded. The second resistor 48 is electrically connected between a third terminal of the transistor 47 and the control terminal 43 of the reverse current protector. Yeh, 5:17-36. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. ***When the control switch 5 is set conducting, the first***

Claim Limitation	Exemplary Prior Art Disclosures
	reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4 a blocks the electrical power of the battery 93 from charging back. Yeh, 5:44-63. if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. ***With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:12-29. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 6:38-44. When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power

Claim Limitation	Exemplary Prior Art Disclosures
	flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4 a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4 a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4 b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4 a in an ON condition***. Yeh, 6:51-7:18.

Claim Limitation	Exemplary Prior Art Disclosures

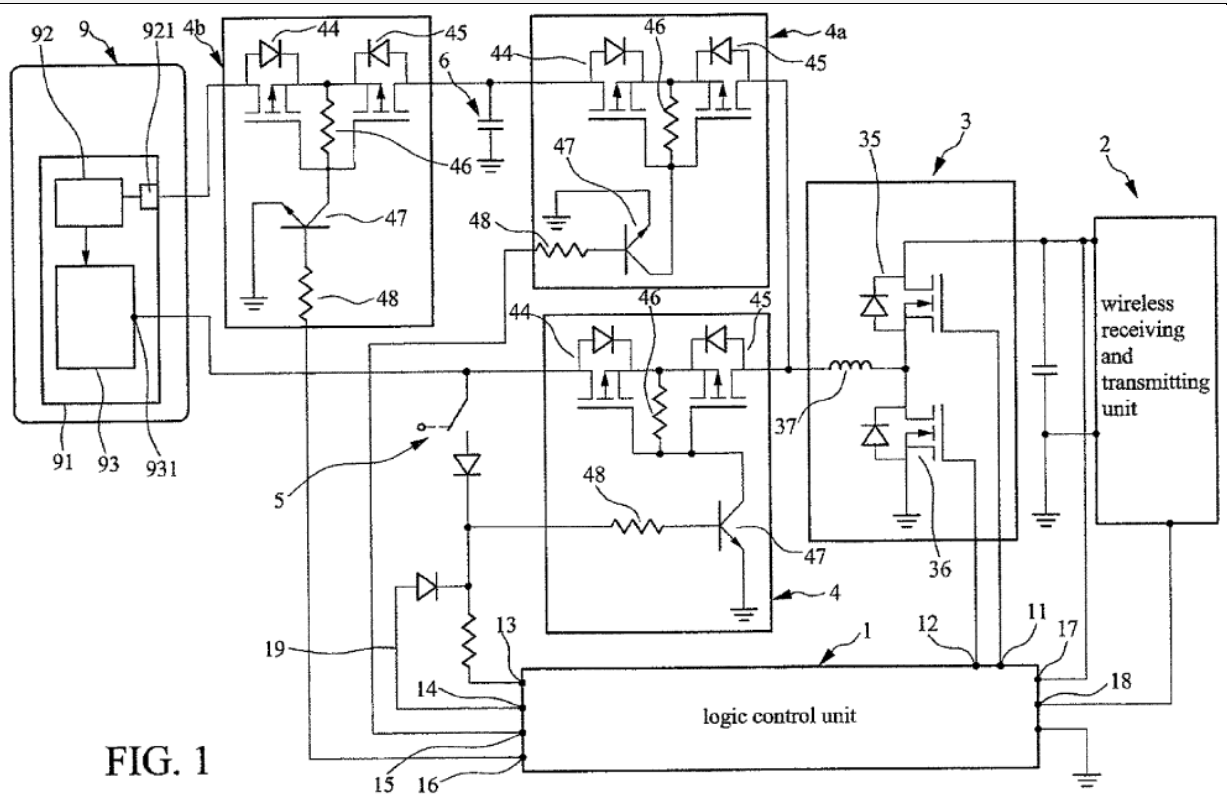


FIG. 1

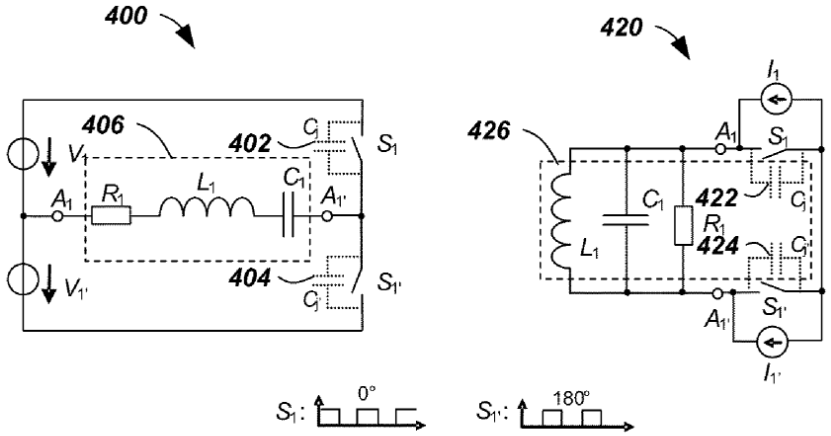
Yeh, Fig. 1; *see also id.* Figs. 2-3.

In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery. ***The first and second reverse current protectors 4, 4 a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized***. ***The step-up/step-down unit 2 is arranged as a step-up/step-down unit with***

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	synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. ***The first to third reverse current protectors 4, 4 a, 4 b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency***. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. **Cook** Cook discloses a power conversion circuit that comprise synchronous switches that operate differently under different modes. For example: FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204.

Claim Limitation	Exemplary Prior Art Disclosures
	Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes ***a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter***. Receiver 208 further includes ***a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter***. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). ***Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable***. Accordingly, the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device. Cook, ¶42. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a

Claim Limitation	Exemplary Prior Art Disclosures
	common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and ***a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow)***. The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. ***The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein***. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, ***a bidirectional power conversion circuit 308*** and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324. ***Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane***. Cook, ¶50. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of ***a half bridge rectifier topology 400*** including a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. ***A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration.*** The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its

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	dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.  FIG. 8 Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration) with a ***half***

Claim Limitation	Exemplary Prior Art Disclosures
	bridge active rectifier configured with the switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, ***a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , ***a half bridge passive diode rectifier*** 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶¶54-57.

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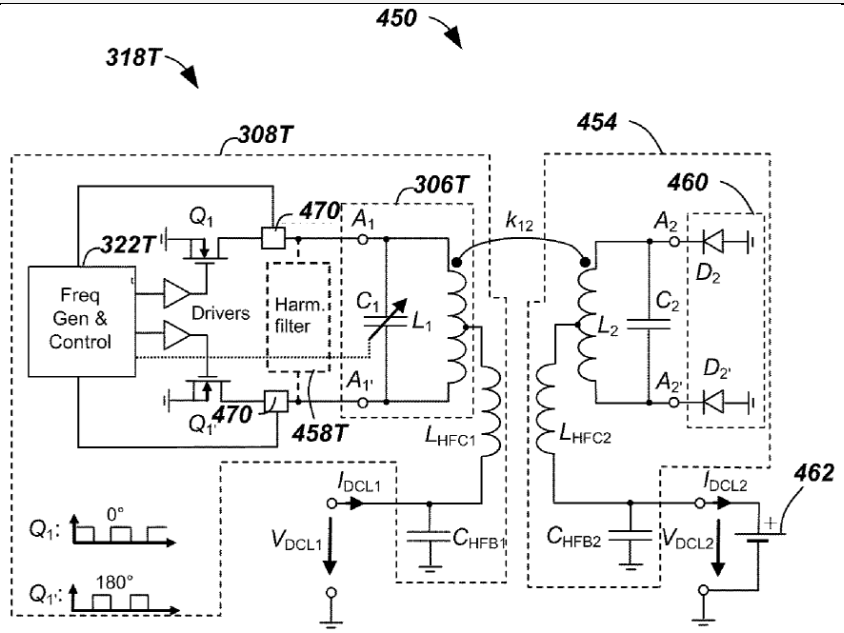


FIG. 9

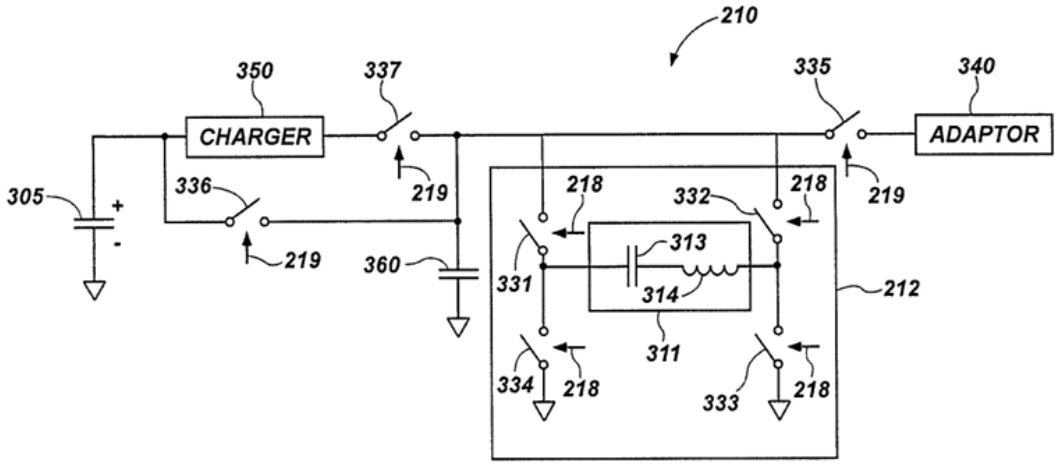
Cook, Fig. 9.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional ***power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna

Claim Limitation	Exemplary Prior Art Disclosures
	306T, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, ***a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratin***gs. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. ***In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier*** and switches are controlled based on sensed voltage. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶63. Third, Sagoo, in view of the teachings of the following references, renders obvious “a first circuitry comprising . . . a filter capacitor.” A POSA would have found it obvious to add the filter capacitor taught in one or more of the following references in implementing Sagoo’s mobile device because it involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA

Claim Limitation	Exemplary Prior Art Disclosures
	would have appreciated the benefit of adding a filter capacitor for filtering out the unwanted frequencies. A POSA would have had a reasonable expectation of success because filter capacitors are well known in the art. **Chatterjee** For example, Chatterjee discloses: > The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. ***The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode)***. The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. Chatterjee, ¶ 37. > The power circuit 414 operates in a similar fashion as the power circuit 314 of FIG. 3 to handle current received in either the power transfer mode or the power receive mode. The power bridge circuit 411 operates in a similar fashion as the power bridge circuit 311 of FIG. 3. Chatterjee, ¶ 44. > FIG. 10 illustrates a power bridge circuit and a bi-directional coil assembly, together **1010**, coupled to current conditioning circuitry, under an embodiment. The power bridge circuit and bi-directional coil assembly combination **1010**, which may be any of the above described embodiments, is coupled via a signal line Power I/O to a decoupling circuit 1020. ***The decoupling circuit 1020 operates to act as a filter for certain signal frequencies and prevents those signals from passing through.*** Chatterjee, ¶¶ 89; *see also id.* Fig. 10. **Van Der Lee** For example, Van Der Lee discloses:

Claim Limitation	Exemplary Prior Art Disclosures
	The primary device and/or the peripheral device may include an integrated circuit (IC) to support the above-described functions. For example, an IC may include at least a portion of the wireless power transceiver circuit (for example, one or more of the coil, capacitor, and diodes of the rectifying circuit may be off-chip), ***at least a portion of the battery charger (for example***, one or more of the switching transistors, ***the output filter capacitor***, the inductor may be off-chip), the transceiver, and the processing module. Van Der Lee, ¶ 36. **Singh-203** The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25; *see also* FIGS. 3A-3D.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3A **Yeh** For example, Yeh discloses a supercapacitor. > An objective of the present invention is to provide a bidirectional wireless charging and discharging device, which makes use of the arrangement of supercapacitors in specific locations and ***the supercapacitors having resistances lower than a battery to allow, in a charging operation, the supercapacitors to be charged first for blocking surges occurring in the charging operation*** and thus realizing protection against accumulated damage caused by charging of the battery; makes use of the function of preventing reverse current by first and second reverse current protectors to eliminate electrical leakage to thereby save power. Yeh, 2:52-62. > To realize the above objectives, the present invention provides a bidirectional wireless charging and discharging device, which is applicable to a portable electronic device having a circuit device. The circuit device is electrically connected to a power receiving terminal and a battery. The bidirectional wireless charging and discharging device comprises a logic control unit, a wireless receiving and transmitting unit, a step-up/step-down unit, a first reverse current protector, a second

Claim Limitation	Exemplary Prior Art Disclosures
	reverse current protector, a control switch, and a first supercapacitor, wherein the logic control unit comprises a plurality of pins; the wireless receiving and transmitting unit has a transmission terminal and a test terminal, the test terminal being electrically connected to a detection pin of the logic control unit; the step-up/step-down unit has a first voltage regulation terminal, a second voltage regulation terminal, and two control terminals, the second voltage regulation terminal being electrically connected to the transmission terminal of the wireless receiving and transmitting unit, the two control terminals being respectively and electrically connected to first and second control pins of the logic control unit; a power pin of the logic control unit being electrically connected to the second voltage regulation terminal and the transmission terminal that are connected to each other; the first reverse current protector has an input terminal, an output terminal, and a control terminal, the input terminal and the output terminal being respectively and electrically connected to a discharging terminal of the battery and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a third control pin of the logic control unit; the control switch has an end electrically connected to the discharging terminal of the battery and an opposite end electrically connected to the control terminal of the first reverse current protector and the third control pin of the logic control unit; the second reverse current protector has an input terminal, an output terminal, and a control terminal, the output terminal and the input terminal being respectively and electrically connected to the power receiving terminal of the circuit device and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a fifth control pin of the logic control unit; and the ***first supercapacitor has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded***. As such, ***the supercapacitor may be used block surges occurring in each charging operation in order to protect a battery from accumulated damaged caused by charging***. Further, the first and second the reverse current protectors provide a function of preventing reverse current so as to eliminate electrical leakage and thus save power. Yeh, 2:20-3:3. ***The first supercapacitor 6 has an end electrically connected to connection between the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the output***

Claim Limitation	Exemplary Prior Art Disclosures
	terminal 42 of the second reverse current protector 4 a and forms a first node 61 there. Another end of the first supercapacitor 6 is grounded. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4 b. The third reverse current protector 4 b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4 b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). ***The second supercapacitor is connected in parallel to the battery 93***. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. ***Since resistances of the first supercapacitor 6 and the second supercapacitor are lower than that of the battery 93, each time a charging operation is performed, the supercapacitors are charged first, whereby the supercapacitors may function to resist the surge occurring in the charging operation. Further, the supercapacitors can be easily charged in full and then immediately charge the battery 93***. Yeh, 4:48-5:15. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4 a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4 a and ***the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4 b)*** to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the

Claim Limitation	Exemplary Prior Art Disclosures
	protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) Yeh, 6:59-7:10. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: ***Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery***. The first and second reverse current protectors 4, 4 a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4 a, 4 b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. a first supercapacitor, which has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded. Yeh, cl. 1.

Claim Limitation	Exemplary Prior Art Disclosures
	2. The bidirectional wireless charging and discharging device as claimed in claim 1 further comprising a second supercapacitor, the second supercapacitor being connected in parallel with the battery. Yeh, cl. 2; *see also* Yeh, Figs. 1-3. **Cook** For example, Cook discloses: FIG. 2 shows a simplified schematic diagram of a wireless power transmission system. The transmitter 104, driven by input power 102, includes an oscillator 122, a power amplifier or power stage 124 and a ***filter*** and matching circuit 126. The oscillator is configured to generate a desired frequency, which may be adjusted in response to adjustment signal 123. The oscillator signal may be amplified by the power amplifier 124 with a power output responsive to control signal 125. The filter and matching circuit 126 may be included to ***filter out harmonics or other unwanted frequencies*** and match the impedance of the transmitter 104 to the transmit antenna 114. Cook, ¶ 30. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd ***harmonics filtering in form of a series resonant L-C circuits*** e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶56. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), ***odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T***, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶60; *see also id.* ¶62.

Claim Limitation	Exemplary Prior Art Disclosures
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	Sagoo discloses and/or renders obvious this limitation. First, Sagoo discloses and/or renders obvious “a second circuitry comprising: a control logic circuit.” Sagoo discloses a power control/conversion unit and/or a communication unit that controls, e.g. which mode the mobile device operates in and the input/output levels of AC and DC voltages. For example: > According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside***; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. > According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device***; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:35-55. > The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. > The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the

Claim Limitation	Exemplary Prior Art Disclosures
	battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:34-5:4. ***The communication unit 170*** performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and ***controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied.

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, 5:5-21. To the extent it is argued that Sagoo's power control/conversion unit does not teach "a second circuitry comprising: a control logic circuit," it would have been obvious in view of the teachings of one or more of the following references. A POSA would have found it obvious to implement the control logic circuit that controls the operation of the first circuitry, as taught in one or more of the following references in implementing Sagoo's power control/conversion unit or in addition to Sagoo's power conversions unit because it involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA would have found that Sagoo's disclosed mobile device is ready for improvement by implementing or adding a control logic circuit to control the operation of the first circuitry. A POSA would have had a reasonable expectation of success because control circuitry is well known in the art. **Chatterjee** For example, Chatterjee discloses: > The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 51. > The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH).

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 55. The power bridge circuit 610 is operable in both the power receive and transmit modes of an inductive signal interface, such as the inductive signal interface 410 of FIG. 4. ***The operation of the power bridge circuit 610 is controlled by the signals G1-G6, which are transmitted by control logic coupled the switches 621-626***. Referring back to FIGS. 3 and 4, for example, ***the control logic may be the control element 313 or processor 413***. Chatterjee, ¶ 63. In the power transmit mode, the sync bridge branch 613 is turned off and the current path through the bi-directional coil assembly 632 is the series combination of the capacitor C2 and the inductive coil L3. In the power receive mode, the H-bridge branch 611 is turned off and the current path through the bi-directional coil assembly 632 is the inductive coil L3. Chatterjee, ¶ 69. As shown by an embodiment of FIG. 11, the MCD 1110 has a housing shell 1112 having a thickness (t). The housing shell 1112 may be used to retain internal components of the MCD 1110, such as ***a circuit board, processor***, memory, or components of a display assembly. The MCD 1110 may be structured so that a primary facade 1115 (e.g. the back panel) of the housing shell 1112 rests on a receiving surface 1125 of the dock 1120. Chatterjee, ¶ 94. **Van Der Lee** For example, Van Der Lee discloses: ***The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode based upon power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44.

Claim Limitation	Exemplary Prior Art Disclosures
	The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit or a wireless power receive mode of operation. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 56. Moreover, the processing module **142 [sic]** provides a power selection signal **223** to the MUX **222** between the regulated power **164** and the supply voltage Vout **162** for wireless power transmission via the wireless power transceiver circuit **144**. Moreover, ***the processing module 132 implements a battery charge control 149, a regulate control 209, an impedance matching circuit control 207, 227, and 235, a DC-to-AC control 225***, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures

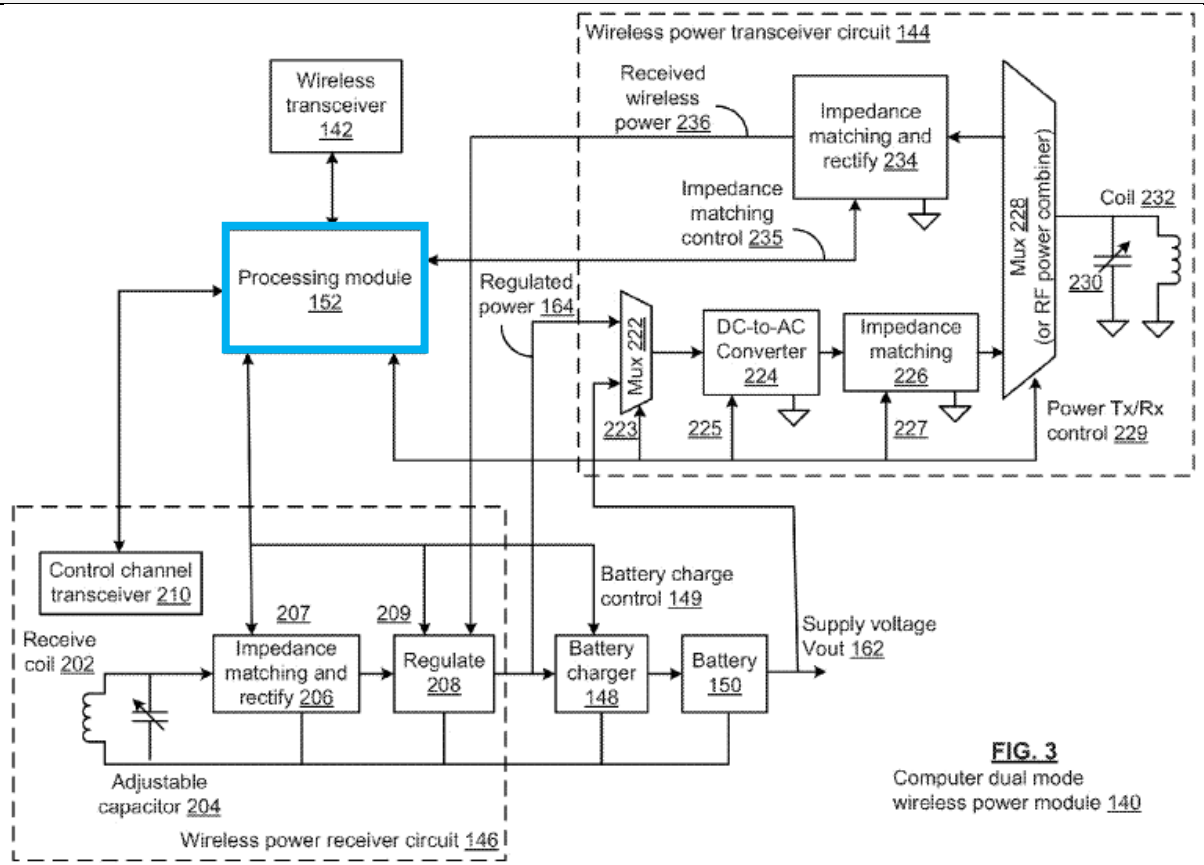


FIG. 3
Computer dual mode wireless power module 140

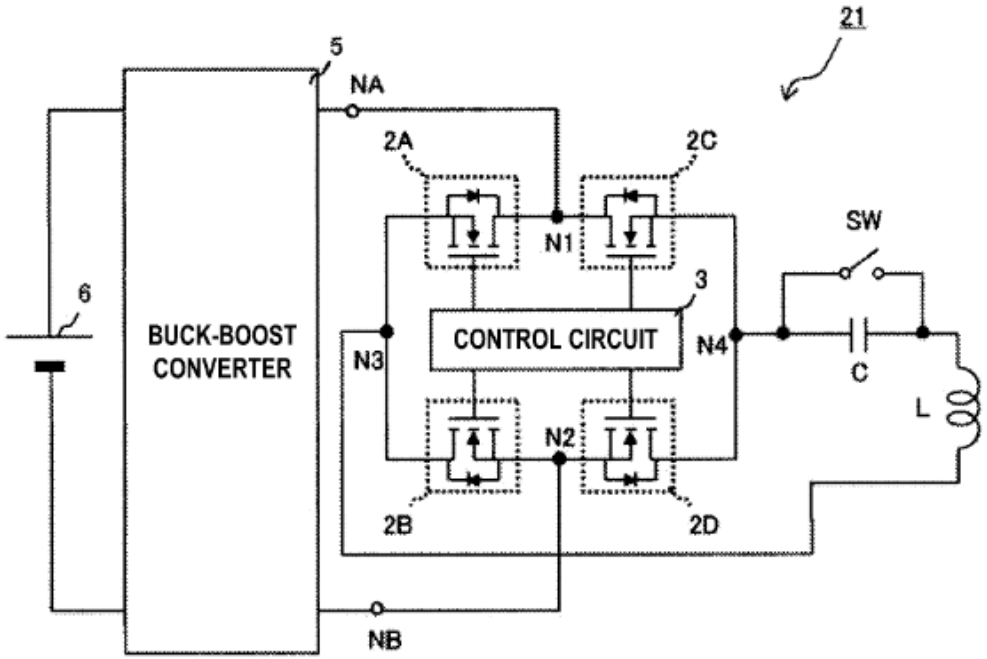
Van Der Lee, Fig. 3; *see also id.* ¶¶ 53, 55, 65, Fig. 4.

Shinoda

For example, Shinoda discloses:

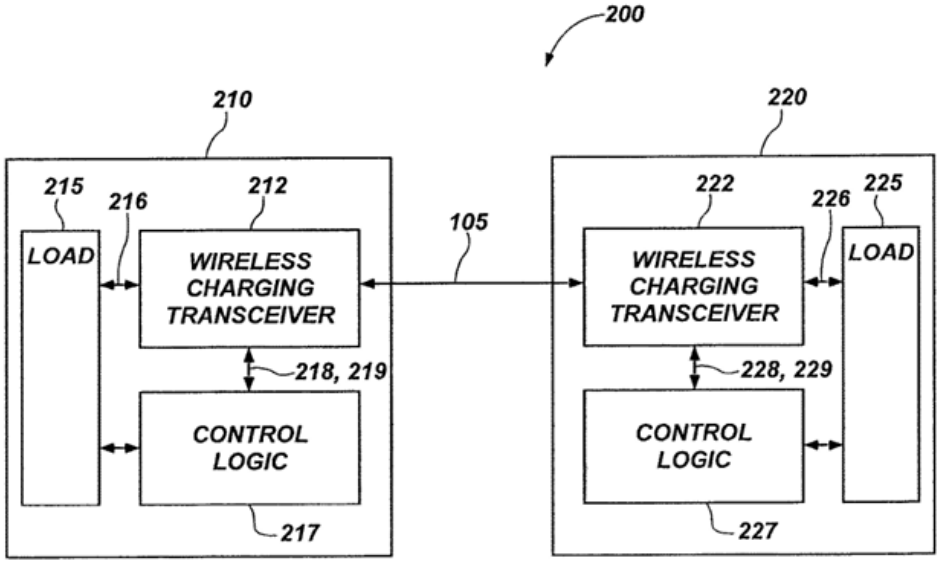
> In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit

Claim Limitation	Exemplary Prior Art Disclosures
	includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power transmission mode of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, ***the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods***. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the FETs 2A to 2D function as a full-bridge inverter circuit. Shinoda, 3:52-62. For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, ***the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the ***control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can

Claim Limitation	Exemplary Prior Art Disclosures
	increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.  FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** Sing-203 describes control logic 217 which is a control logic circuit. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 2 is a schematic block diagram of an inductive wireless power transfer system 200 according to an embodiment of the present disclosure. The inductive wireless power transfer system 200 includes a first wireless power enabled device 210 and a second wireless power enabled device 220. The first wireless power enabled device 210 may include a wireless charging transceiver 212, a load 215, and control logic 217. Similarly, the second wireless power enabled device 220 may include a wireless charging transceiver 222, a load 225, and control logic 227. Singh-203, 5:3-12. The control logic 217, 227 may be configured to determine which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. The control signals 218, 219, 228, 229 may be transmitted to the wireless charging transceivers 212, 222 to drive the desired operations. As an example, the control logic 217, 227 may include a processor (e.g., microcontroller) that is configured (e.g., programmed) to determine whether the respective wireless charging transceiver 212, 222 is to operate in transmit mode or receive mode. The control logic 217, 227 may further include computer-readable media (e.g., memory) storing computing instructions for execution by the processor related to performing processes of the embodiments of the present disclosure. Memory may include volatile and non-volatile memory. The loads 215, 225 may include energy storage devices (e.g., batteries), system components of the wireless power enabled devices 210, 220, or both. Thus, the output power signals 216, 226 may be a charging signal for an energy storage device, or a system power signal for the various system components. Singh-203, 5:31-51. In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless

Claim Limitation	Exemplary Prior Art Disclosures
	power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. Singh-203, 6:5-24; *see also id.*, 7:7-9 (“The plurality of switches 335, 336, 337 may be controlled by control signals 219 from the control logic 217 (FIG. 2).”). The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Singh-203, 7:23-31.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 2 **Schuessler** Schuessler discloses control mechanism that determines the mode for the bi-directional charging device and provides adjustment. For example: ***Control mechanism 225 represents the control hardware, firmware, and/or software that determines the mode for the bi-directional charging device 105, for example, a power receiving mode or a power delivering mode***. As discussed above, there may be multiple concurrent modes. ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown) to receive information or to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and ***control mechanism 225 may use the information received to determine***

Claim Limitation	Exemplary Prior Art Disclosures
	whether conditions are appropriate to begin or continue energy transfer. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215***. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26.

Claim Limitation	Exemplary Prior Art Disclosures
	External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. Bi-directional charging device 105 may include combinations of discrete and integrated components. For example, ***control mechanism 225 may include a processor implemented on a semiconductor device, and discrete input/output circuitry for the processor***. Further, multiple functions or portions of functions may be integrated within one or more semiconductor devices. For example, portions of selection mechanism 210, external connection interface 220, control mechanism 225, external indicator interface 230, and external communication interface 235 may all be integrated within one semiconductor device. Schuessler, 7:20-30. **Yeh** Yeh discloses a logic control unit that controls the operation of a bi-directional wireless charging and discharging device. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	The logic control unit 1 comprises first to sixth control pins 11-16, a power pin 17, and a detection pin 18. The remaining pin that is not labeled is a grounding pin. The wireless receiving and transmitting unit 2 comprises a transmission terminal 21 and a test terminal 22. ***The test terminal 22 is electrically connected to the detection pin 18 of the logic control unit 1***. The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. ***The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1***. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. ***The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3***. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1***. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings.

Claim Limitation	Exemplary Prior Art Disclosures
	The control switch 5 has an end electrically connected to the discharging terminal 931 of the battery 93 and an opposite end electrically connected to the control terminal 43 of the first reverse current protector 4 and the third control pin 13 of the logic control unit 1, wherein the connection of said opposite end of the control switch 5 with the control terminal 43 of the first reverse current protector 4 forms a second node 431. Preferably, the control switch 5 is an automatic returning switch. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1***. Yeh, 3:51-4:47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. ***The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not***. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. The transmission mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows:

Claim Limitation	Exemplary Prior Art Disclosures
	The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to the transmission mode, the control switch 5 is actuated to effect switching. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. ***Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode***. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. ***When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition***. ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2***: if there is no load: the transmission is stopped; if there is a load: ***the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3***. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second

Claim Limitation	Exemplary Prior Art Disclosures
	MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 5:37-6:44. The receiving mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the

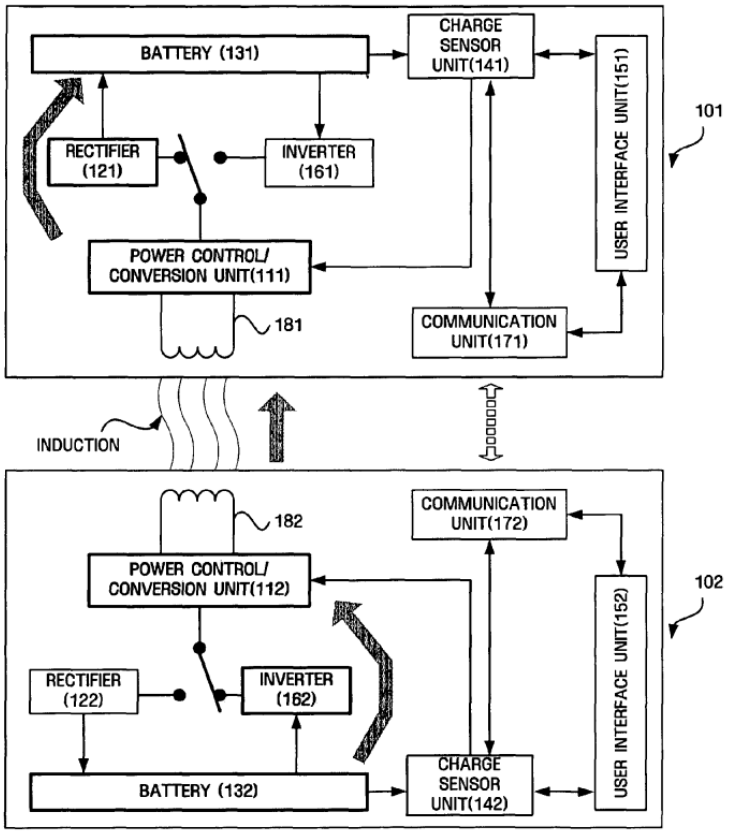
Claim Limitation	Exemplary Prior Art Disclosures
	third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18. In the bidirectional wireless charging and discharging device according to the second embodiment of the present invention, ***the second node 431 of the first reverse current protector 4 is electrically connected to the signal output terminal 911 in order to receive the control signal supplied from the signal output terminal 911 to switch the logic control unit 1 (via the third control pin 13) to the transmission mode***. Yeh, 7:38-44. **Cook** Cook discloses a frequency generation and control circuit that controls the operation of a bidirectional wireless power transceiver. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also***

Claim Limitation	Exemplary Prior Art Disclosures
	performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59.

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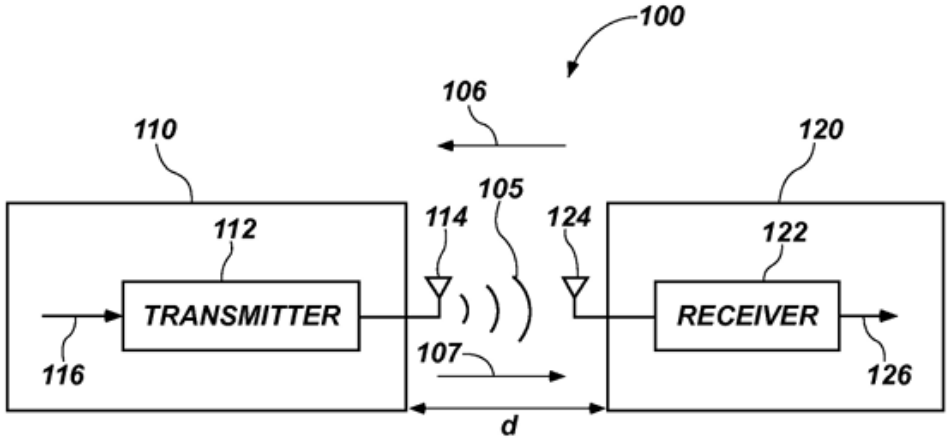
Claim Limitation	Exemplary Prior Art Disclosures
	Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. Second, Sagoo discloses and/or renders obvious “a second circuitry comprising: . . . a modulator/demodulator circuit.” For example: ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication

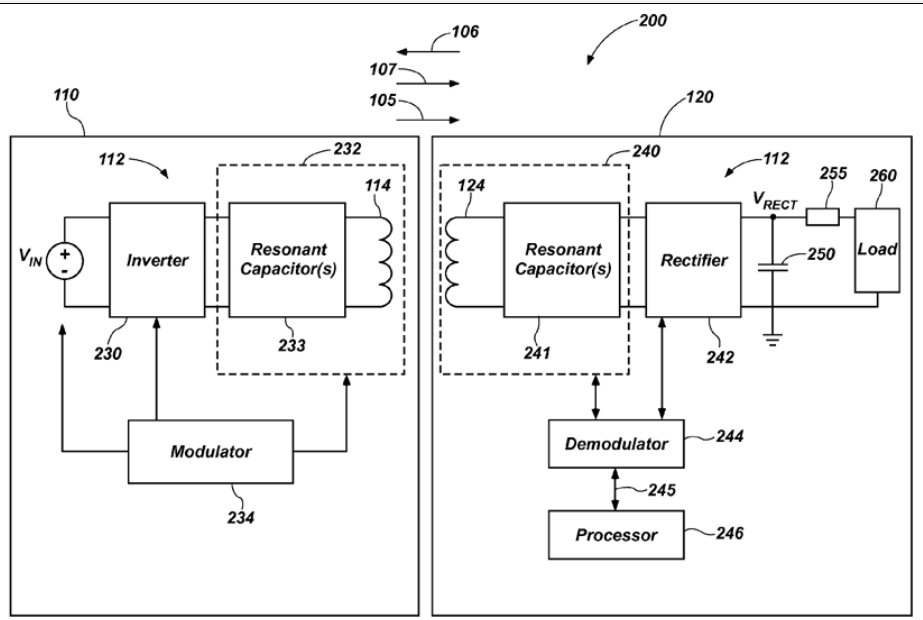
Claim Limitation	Exemplary Prior Art Disclosures
	unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. An example of a process in which the two mobile devices share energy in a non-contact manner will now be described. A user having the first device 101 is informed through a user interface unit 151 that the battery does not have enough charge. The charge sensor unit 141 measures the charge state of the battery and communicates with the communication unit about the charge state of the battery. Rechargeable batteries such as the battery 131 of the first device 101 can be installed in devices, such as a notebook computer, a PDA, an MP3 player, and a game console, and have different voltages, currents, and capacities. The battery can be formed of, for example, a nickel metal hydride (NiMH) battery or a lithium-ion battery. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device and outputs the received information to the user interface unit 151***. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:4-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, the communication units can perform authentication with respect to each other such that charging is performed between authenticated devices. Sagoo, 6:43-48.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 4  Sagoo, Fig. 4; *see also id.* Figs. 3-7. To the extent it is argued that Sagoo does not teach “a second circuitry comprising: . . . a modulator/demodulator circuit,” Sagoo in view of the any of the following references would have rendered this limitation obvious. It would have been obvious to use a modulator/demodulator circuit disclosed in the following references in implementing Sagoo’s communication unit because it involves nothing more than

Claim Limitation	Exemplary Prior Art Disclosures
	combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of using a modulator to provide communication for wireless power transfer to provide improved functionality and efficiency. A POSA would have had a reasonable expectation of success because modulator/demodulator circuits are well known in the art for providing communication data over a power signal. **Chatterjee** For example, Chatterjee discloses a modulator and demodulator: > The communication circuit **415** is coupled to the bi-directional coil assembly **412** in order to transmit and receive data over the inductive link **430**. ***The communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. > According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). > The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. > Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. Chatterjee, ¶¶ 51-54.

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda For example, Shinoda discloses: > For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. > > Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5. > ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20. **Singh-203** Singh-203 discloses a modulator / demodulator. For example: > The embodiments shown in FIG. 2, as well as in FIGS. 3A through 3D, are shown to demonstrate a wireless power enabled device being configured to operate in either a transmit mode or a receive mode, such as for wireless OTG charging. It should be recognized that the wireless power enabled device may include additional components to perform other features not specifically described herein. For example, the wireless power enabled device may include a modulator and/or a

Claim Limitation	Exemplary Prior Art Disclosures
	demodulator for communicating with other devices, foreign object detection modules, I/O modules for interfacing with a user, memory for storing instructions and data, various sensors, among other components. Singh-203, 9:26-37. **Singh-624** Singh-624 describes a modulator/demodulator. For example:  FIG. 1

Claim Limitation	Exemplary Prior Art Disclosures
	 *FIG. 2* Singh-624, FIGS. 1-2; *see also id.*, FIG. 7. An inductive wireless power transfer device comprises a transmitter that comprises a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. An inductive wireless power receiving device comprises a receiver that comprises a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Related inductive wireless power transfer systems and methods for back-channel communication from the transmitter to the receiver of an inductive wireless power transfer system are disclosed.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, Abstract. During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Embodiments of the present disclosure include an inductive wireless power transfer device. The inductive wireless power transfer device comprises a transmitter that includes a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power receiving device. The inductive wireless power receiving device comprises a receiver having a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power transfer system. The inductive wireless power transfer system comprises a transmitter having a transmit coil configured to generate a modulated wireless power signal in a coupling region for wireless power transfer, and a receiver having a receive coil configured to couple with the transmit coil by receiving the modulated wireless power signal and to generate an output signal in response thereto to provide power to a load, wherein the modulated wireless power signal includes characters. Another embodiment of the present disclosure includes a method for communicating between a transmitter to a receiver in an inductive wireless power transfer system. The method comprises

Claim Limitation	Exemplary Prior Art Disclosures
	generating a wireless power signal through a transmit coil of a transmitter to a receive coil of a receiver, and modulating the wireless power signal on the transmitter side for communicating data over the wireless power signal from the transmitter to the receiver. Singh-624, 1:56-2:25. Embodiments of the present disclosure include a back-channel communication link 107 to transmit data from the transmitter 112 to the receiver 122. The transmitter 112 may be configured to establish the back-channel communication link 107 by modulating the wireless power signal 105. In particular, the conversion gain of the wireless power signal 105 may be modulated, which may be detected responsive to the wireless power signal 105 being received and demodulated by the receiver 122. While the back-channel communication link 107 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105, it should be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils (through transmit coil 114 and receive coil 124). Thus, the wireless power signal 105 carries the communication data of the back-channel communication link 107 when the wireless power signal 105 is modulated as described herein. The arrow for the back-channel communication link 107 is merely shown separately for the purpose of indicating a direction of communication data flow. Similar to conventional wireless power transfer systems, embodiments of the present disclosure may further include a forward-channel communication link 106 for transmitting data from the receiver 122 to the transmitter 112, such as via backscatter modulation. As discussed above, conventional wireless power transfer systems may be limited to one-way communication from the receiver 122 to the transmitter 112, or else require separate RF coils for transmitting data separately from the transmit coil 114 and receive coil 124. Like the back-channel communication link 107, the forward-channel communication link 106 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105; however, it should also be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils. Thus, the wireless power signal 105 carries the communication data of the forward-channel communication link 106 when the wireless power signal 105 is modulated according to the conventional principles of back scatter modulation. The arrow for the forward-channel communication link 106 is also shown separately for the purpose of indicating a direction of communication data flow.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, 5:38-6:11. The transmitter 112 may further include an inverter 230, a resonant tank 232, and a modulator 234. The resonant tank 232 may include one or more capacitors (e.g., resonant capacitor(s) 233) coupled with an inductor (e.g., the transmit coil 114). The capacitors and inductors may be configured in an LC network, such as being coupled in series or parallel. The inverter 230 is coupled between the input voltage (VIN) and the resonant tank 232. The modulator 234 may be coupled with one or more of the inverter 230, the resonant tank 232, and the input voltage (VIN) in order to modulate the wireless power signal 105 such that communication may be achieved from the transmitter 112 to the receiver 122, as will be described in more detail below. The transmitter 112 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions such as power monitoring, foreign object detection, etc. It will also be appreciated that the transmitter 112 may include a demodulator for receiving and demodulating communication received from the receiver 122. The receiver 122 may further include a resonant tank 240, a rectifier 242, a demodulator 244, and a processor 246. The resonant tank 240 may include an inductor (e.g., receive coil 124) coupled with one or more capacitor (e.g., resonant capacitor(s) 241). The resonant tank 240 is coupled with the rectifier 242, which may further be coupled to the load 260. The demodulator 244 may be coupled with one or more of the resonant tank 240, the rectifier 242, and the processor 246 in order to demodulate the received wireless power signal 105 and transmit a demodulated signal 245 to the processor 246 for analysis or other processing. The receiver 122 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions, such as power monitoring, foreign object detection, etc. It will also be appreciated that the receiver 122 may include a modulator for modulating communication to the receiver 122. Singh-624, 6:55-7:22. **Schuessler** For example: The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile

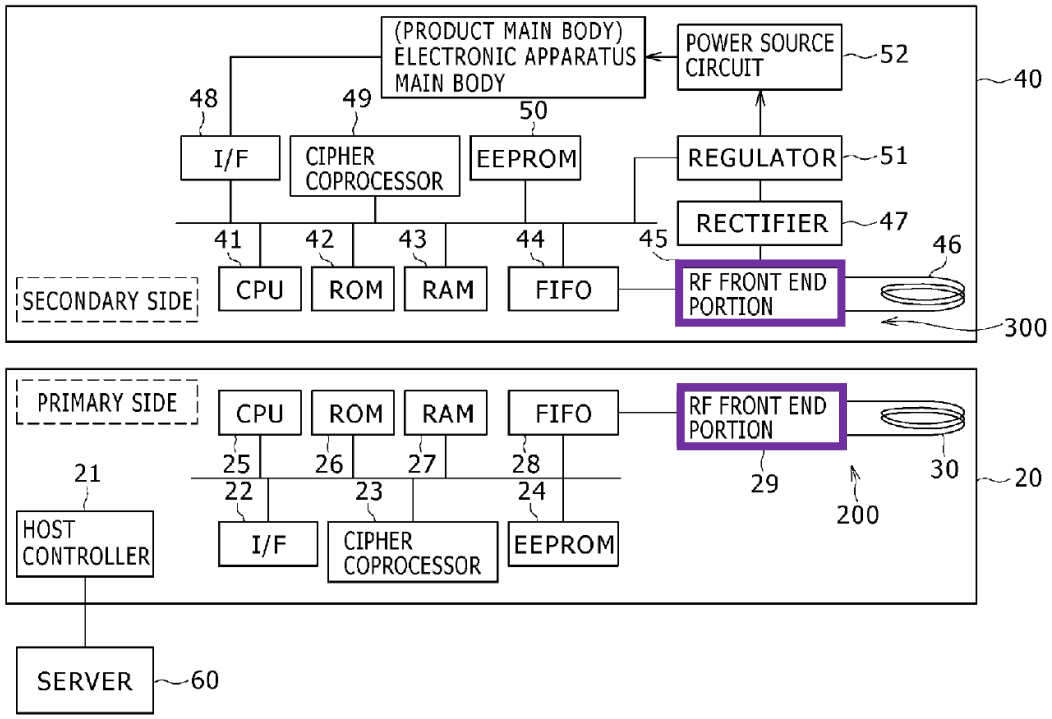
Claim Limitation	Exemplary Prior Art Disclosures
	devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Schuessler, 5:5-21. One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. wherein the wireless communication mechanism is selected from Bluetooth, WiFi, other public or proprietary wireless protocols, ***modulation on the energy transfer itself, modulating a low frequency protocol on a high frequency energy transfer, by modulating a high frequency protocol on a low frequency energy transfer or an infrared interface***; Schuessler, cl. 1. **Corbridge** For example: On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422

Claim Limitation	Exemplary Prior Art Disclosures
	includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. Corbridge, ¶55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.***

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶57. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0”

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	values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95. **Teramoto** For example, Teramoto discloses: Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like.

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	Teramoto, ¶ 52.



Teramoto, Fig. 1; *see also id.* ¶ 55.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

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	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17. **WPT** The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, ***the communications modulator typically consists of a capacitor in series with a switch*** (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power

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	Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme").
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Sagoo discloses and/or renders obvious this limitation. Sagoo discloses that the mobile device receives power wirelessly in a load mode. For example: The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that ***the mobile device 100 can be supplied with energy from another device (the load mode)*** or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. Sagoo, 4:56-64. The ***inductive coil 180 performs the function of the secondary coil when the mobile device is in the load mode***, and performs the function of the primary coil when the mobile device is in the source mode. Sagoo, 5:27-30. In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. ***An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode***. Sagoo, 6:26-32; *see also* Sagoo, Figs. 2-5. When the selected mobile device (hereinafter, referred to as a source device) can operate in the source mode, the mobile device to be charged is switched to the load mode (S270). ***When the mobile device to be charged is switched to the load mode, the rectifier is connected to the battery and the power control/conversion unit such that energy can be received from the outside.***

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	Further, the inductive coil is set as the secondary coil (S280). Energy is received from the secondary coil and the primary coil of the source device (S290). The charge state of the battery can be checked while the energy is being received such that the battery is prevented from being excessively charged. Sagoo, 7:34-45; *see also id.* Figs. 6, 8. *See generally* Limitation [1.p].
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device;	Sagoo, in view of the references cited above in Limitation [1b], discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network," as explained above in claim limitation [1b]. Sagoo, alone or in view of the reference cited in Limitation [1c], discloses and/or renders obvious that changing "impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device" is "based on an input from said control logic circuit." Sagoo discloses a power control/conversion unit that is selectively coupled to a rectifier and controls the input/output levels of the AC and DC voltages. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside***; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. Sagoo, 2:35-45. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging.

Claim Limitation	Exemplary Prior Art Disclosures
	The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:40-5:4. *See also* Limitations [1b], [1c].
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch network and said impedance of	Sagoo, in view of the references cited above in Limitation [1b], discloses and/or renders obvious “said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network,” as explained above in claim limitation [1b]. Sagoo, alone or in view of the references cited above in Limitation [1c], also discloses and/or renders obvious that changing “said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver” is “based on an input from said control logic circuit.” Sagoo discloses a power

Claim Limitation	Exemplary Prior Art Disclosures
said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	control/conversion unit that is selectively coupled to an inverter and controls the input/output levels of the AC and DC voltages. For example: According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device***; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:46-55. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion

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	unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:34-5:4. *See also* Limitations [1b], [1c].
[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	Sagoo discloses and/or renders obvious this limitation. Sagoo teaches that the communication unit receives information on the states of other mobile devices, authentication information, information on whether charging can be performed on a neighboring device, For example: ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices***, and controls whether the mobile device can be charged by any one of the other mobile devices. When ***the communication unit is made to further perform an authentication process***, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device*** and outputs the received information to the user interface unit 151. Alternatively, it is possible to automatically select a specific device to be used for charging.

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	The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:17-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, ***the communication units can perform authentication with respect to each other*** such that charging is performed between authenticated devices. Sagoo, 6:43-48. To the extent it is argued that Sagoo does not teach this limitation, this limitation would have been obvious in view of the teachings of the following references. A POSA would have found it obvious to apply communication techniques taught in one or more of the following references in implementing Sagoo's electronic device because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Chatterjee** For example, Chatterjee discloses a processor in the inductive signal interface that receives and process data from a second electronic device via a modulator/demodulator, including data about type identification, status, authentication, enumeration, presence of the other device, protocol, and wireless power needs: The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power

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	transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power

Claim Limitation	Exemplary Prior Art Disclosures
	signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information

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	of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The communication circuit includes a modulator 416 and a demodulator 417.*** The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH).

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶¶ 51-55. **Corbridge** For example, Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410.

ACTIVE 690717230

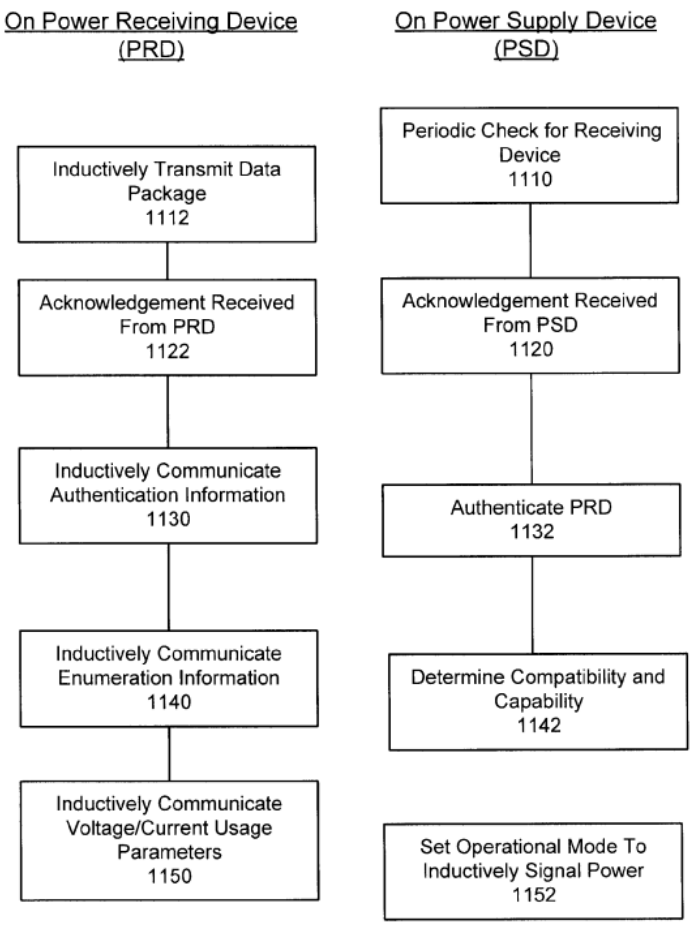
WIPQTUS Exhibit 2007
Samsung Electronics Co., Ltd. v. WIPQTUS, INC. IPR2024-00023
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Claim Limitation	Exemplary Prior Art Disclosures
	Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path). Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be***

Claim Limitation	Exemplary Prior Art Disclosures
	used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0” values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled

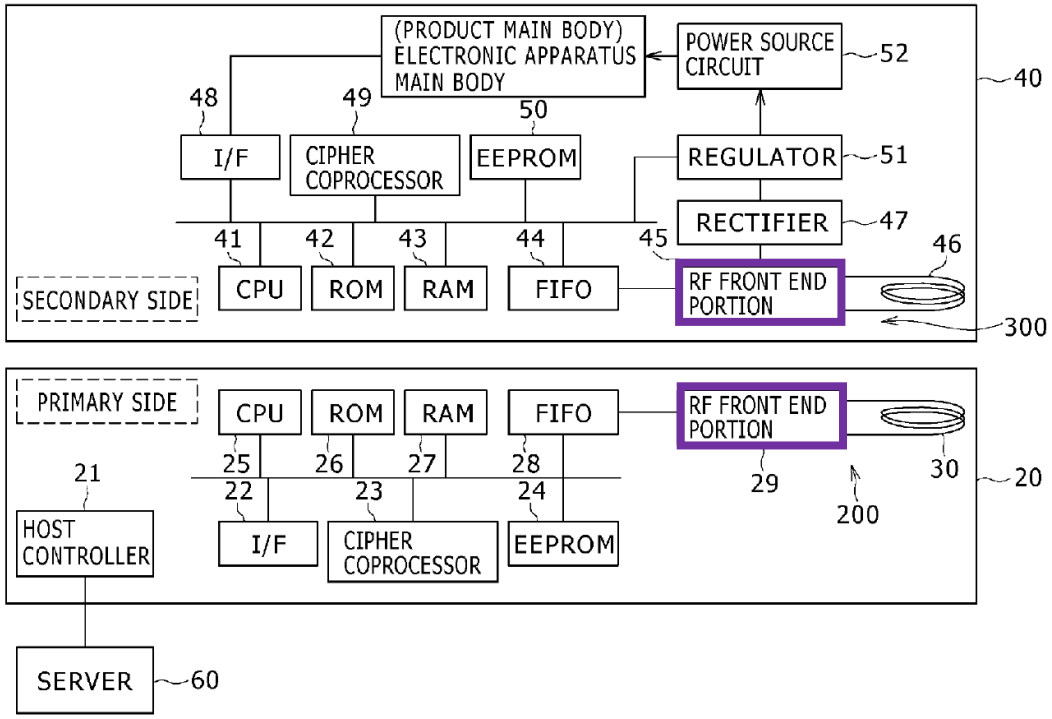
Claim Limitation	Exemplary Prior Art Disclosures
	to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the***

Claim Limitation	Exemplary Prior Art Disclosures
	inductive communication link (e.g. three packets) until acknowledgement is received (step 1120). Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium.

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶¶ 109-113.  **FIG. 11** Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

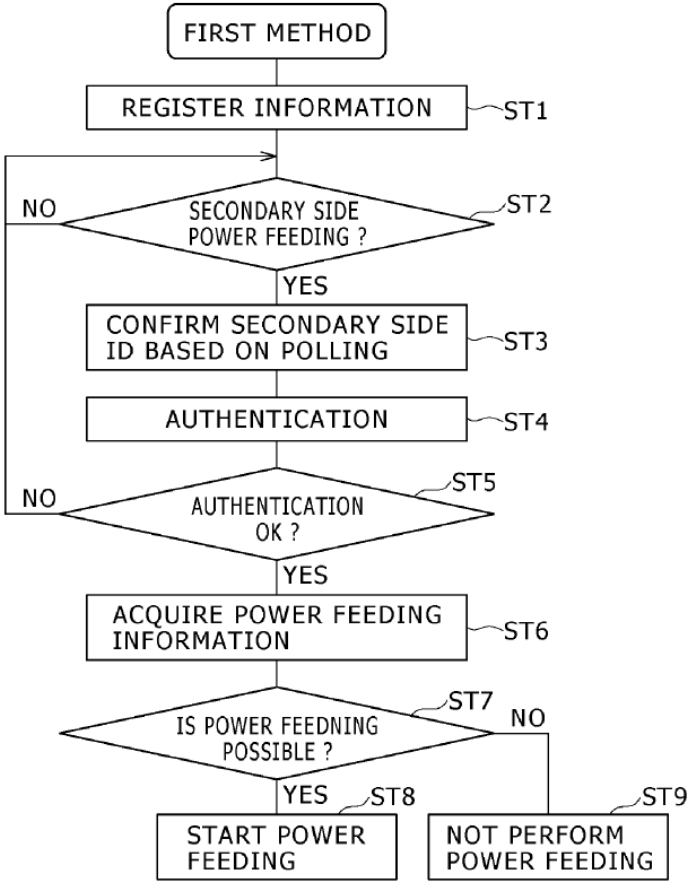
Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto For example, Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** For example, the WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of

Claim Limitation	Exemplary Prior Art Disclosures
	data defined in the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator

Claim Limitation	Exemplary Prior Art Disclosures
	The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme") From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 Signal Strength Value **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 End Power Transfer Code

Claim Limitation	Exemplary Prior Art Disclosures

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two’s complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

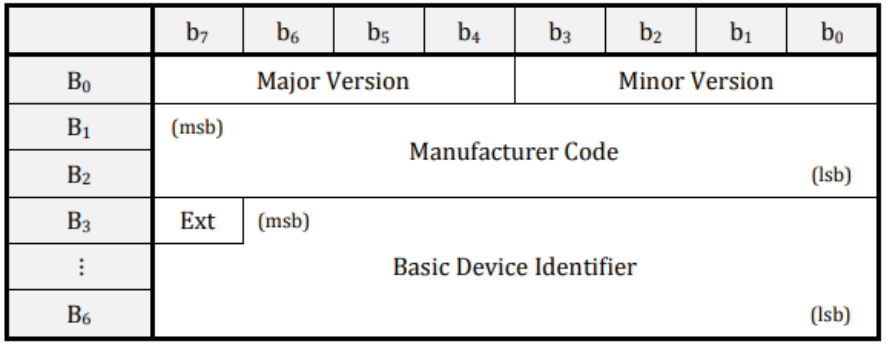
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Sagoo, along or in combination with one or more of the references cited above for claim limitations [1c] and [1g], discloses and/or renders obvious this limitation. Sagoo discloses that the power control/conversion unit and/or the communication unit controls, e.g., which mode the mobile device operates in and the input/output levels of AC and DC voltages, based on, *inter alia*, data received from other mobile devices. For example, Sagoo discloses: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside***; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying***

Claim Limitation	Exemplary Prior Art Disclosures
	energy to the first device; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:35-55. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***.

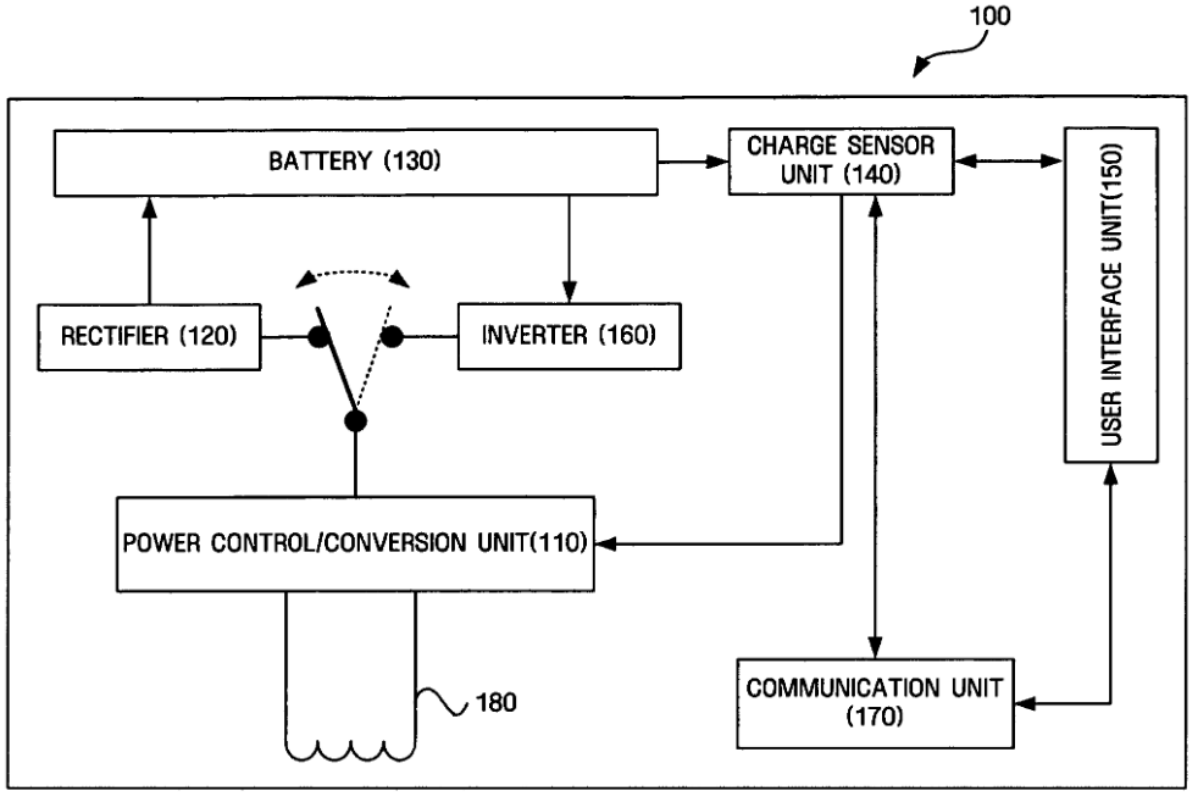
Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, 4:34-5:4. ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices***, and ***controls whether the mobile device can be charged by any one of the other mobile devices***. When ***the communication unit is made to further perform an authentication process***, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device*** and outputs the received information to the user interface unit 151. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:17-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, ***the communication units can perform authentication with respect to each other*** such that charging is performed between authenticated devices. Sagoo, 6:43-48. This limitation would also have been obvious in view of one or more references cited above for claim limitations [1c] and [1g]. A POSA would have found it obvious to apply the communication techniques taught in one or more of those references in implementing Sagoo’s mobile device to provide a second circuitry that is configured to receive and interpret data from said secondary wireless power receiver in said identified wireless

Claim Limitation	Exemplary Prior Art Disclosures
	power protocol because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improve functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See also supra* Limitations [1c], [1g].
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Sagoo, alone or in combination with one or more of the references cited above for claim limitations [1c] and [1g], discloses and/or renders obvious this limitation. Sagood discloses that the power control/conversion unit and/or the communication unit controls, e.g., which mode the mobile device operates in and the input/output levels of AC and DC voltages, based on, *inter alia*, data received from other mobile devices. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. Sagoo, 4:56-64. ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices***, and ***controls whether the mobile device can be charged by any one of the other mobile devices***. When ***the communication unit is made to further perform an authentication process***, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied.

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, 5:4-21. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, ***the communication units can perform authentication with respect to each other*** such that charging is performed between authenticated devices. Sagoo, 6:43-48. It would also have been obvious to apply the teachings of one or more references discussed in Limitations [1c] and [1g] in implementing Sagoo’s mobile device because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer, such as to perform a function associated with said transmitted power in conjunction with said first circuitry based on interpretation of data received from the receiver. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See also supra* Limitations [1g], [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured as one of an inverter and a rectifier.	Sagoo discloses and/or renders obvious this limitation. For example:

Claim Limitation	Exemplary Prior Art Disclosures

FIG. 3



Sagoo, Fig. 3.

A power control/conversion unit 111 of the first device 101 is connected to a rectifier 121, and the rectifier 121 converts an AC voltage into a DC voltage and provides the DC voltage to a battery 131 to charge the battery 131.

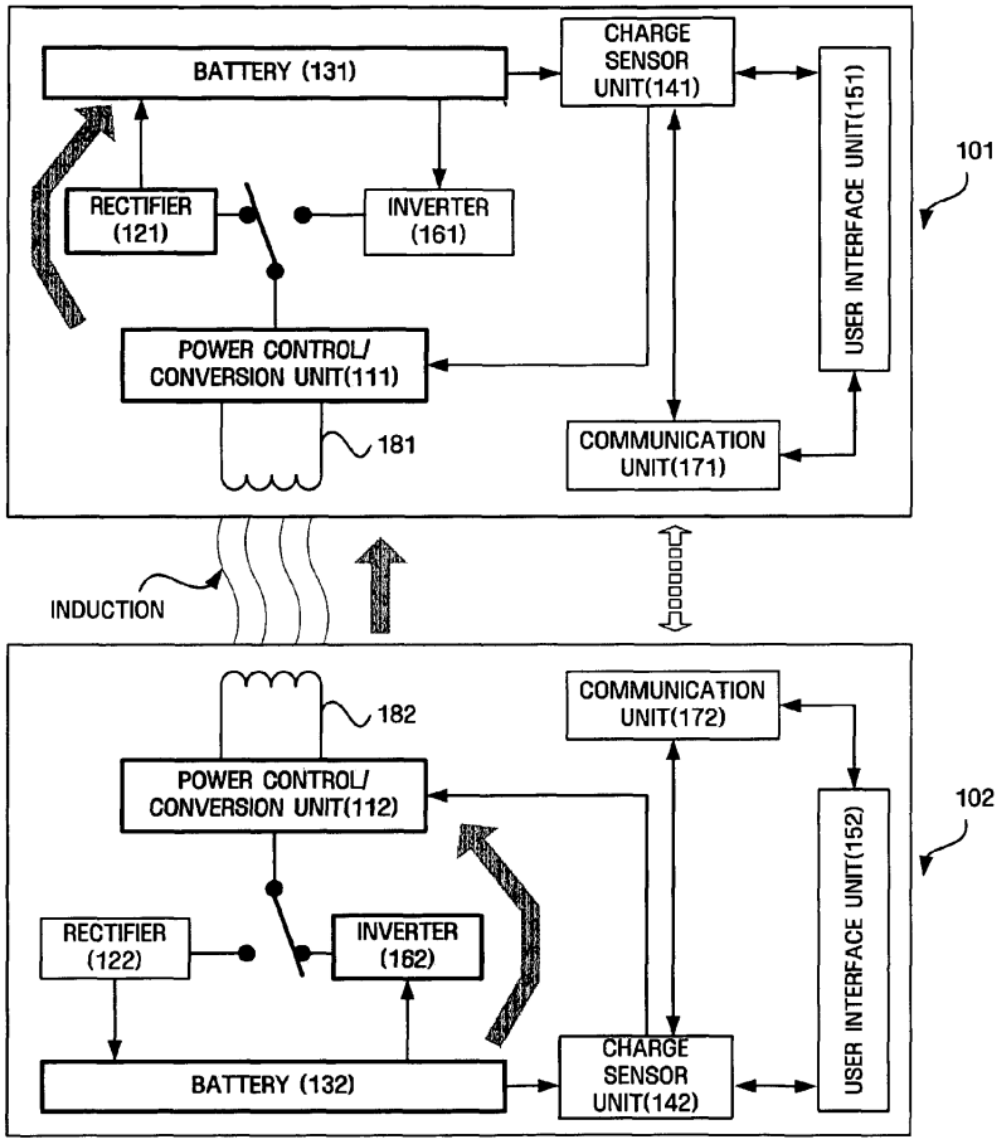
A power control/conversion unit 112 of the second device 102 is connected to an inverter 162. When the inverter 162 converts a DC voltage charged in a battery 132 into an AC voltage and

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Claim Limitation	Exemplary Prior Art Disclosures
	supplies the AC voltage to the power control/conversion unit 112, the power control/conversion unit 112 provides energy to the first device 101. Sagoo, 5:45-55.

FIG. 4


BATTERY (131)
CHARGE SENSOR UNIT(141)
USER INTERFACE UNIT(151)
101
RECTIFIER (121)
INVERTER (161)
POWER CONTROL/ CONVERSION UNIT(111)
181
COMMUNICATION UNIT(171)
INDUCTION
182
COMMUNICATION UNIT(172)
POWER CONTROL/ CONVERSION UNIT(112)
102
RECTIFIER (122)
INVERTER (162)
BATTERY (132)
CHARGE SENSOR UNIT(142)
USER INTERFACE UNIT(152)

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Fig. 4; *see also* Figs. 5-7. In order to charge the battery 131 by receiving energy from the selected second device 102, the ***power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131***. An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode. The second device 102 is in the source mode and the ***power control/conversion unit 112 is connected to the inverter 16***2. DC energy of the battery 132 is converted into an alternating current by the inverter 162, and the alternating current is supplied to the first device 101 through the inductive coil 182 serving as a primary coil of a transformer. The charge sensor unit 142 checks the amount of charge in the battery 132 and provides information on the charge of the battery to the power control/conversion unit 112 to prevent excessive charging of the battery. Sagoo, 6:26-42. *See also supra* claim limitation [1b].

U.S. Pat. No. 8,901,875 (“Schuessler”)

The asserted claims of U.S. No. 10,038,339 (the “’339 patent”) are anticipated and/or rendered obvious by U.S. Pat. No. 8,901,875 (“Schuessler”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. 2011/0018356 (“Chatterjee”), U.S. Patent Application Publication No. 2013/0026981 (“Van Der Lee”), U.S. 8,400,801 (“Shinoda”), U.S. Pat. No. 9,837,203 (“Singh-203”), U.S. Patent Pub. No. 2013/0257167 (“Singh-167”), U.S. Pat. No. 8,698,450 (“Yeh”), U.S. Patent Application Publication No. 2010/0148723 (“Cook”), U.S. 2010/0083012 (“Corbridge”), U.S. 2012/0049646 (“Teramoto”), and/or WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 (“WPT Standard” or “WPT”).

Schuessler was filed on March 3, 2011 and published on September 13, 2012. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Chatterjee was filed on December 1, 2009 and published on January 27, 2011. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(2).

Van Der Lee was filed on July 28, 2011 and published on January 31, 2013. It qualifies as prior art under either pre-AIA 102(e), or post-AIA 102(a)(2).

Shinoda was filed on October 25, 2011, published on February 16, 2012, and issued on March 19, 2013. It qualifies as prior art under pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Singh-203 was filed on March 29, 2012, published on October 3, 2013, and issued on December 5, 2017. It qualifies as prior art under pre-AIA 102(e), or post AIA 102(a)(2).

Singh-167 was filed on March 29, 2012 and published on October 3, 2013. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Yeh was filed on December 27, 2011 and published on June 27, 2013. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(2).

Cook was filed on September 1, 2009 and published on June 17, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Corbridge was filed on June 4, 2009 and published on April 1, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Teramoto was filed on August 23, 2011 and published on March 1, 2012. It qualifies as prior art under either pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1).

Claim Limitation	**Exemplary Prior Art Disclosures**
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	To the extent the preamble is limiting, Schuessler teaches and renders obvious a "dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver." Schuessler discloses a bi-directional wireless charger that includes a coil for wireless power transfer and a rechargeable battery, and can selectively cause power to be delivered from its battery to the coil to recharge another device, or from the coil to its battery. For example: ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively causes power to be delivered from the coil to the battery and selectively causes power to be delivered from the battery to the coil, and a control mechanism***. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the coil to the battery***, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the battery to the coi***l. Schuessler, Abstract. ***A bi-directional charging device may wirelessly receive power and wirelessly deliver power***. When the bi-directional charging device is in the vicinity of a charging bay it may receive power from the charging bay to recharge an internal battery. When the bi-directional charging device is in the vicinity of a rechargeable electronic device it may deliver power to the electronic device for recharging an internal battery of the electronic device. Thus, the bi-directional charging device may be kept near rechargeable electronic devices to recharge batteries in the electronic devices, for example throughout the day. The bi-directional charging device may itself be recharged when it is placed in the vicinity of a charging bay, for example overnight. Schuessler, 1:41-53.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 1A illustrates a bi-directional charging device 105 and a rechargeable electronic device 115 placed in the vicinity of a charging bay 110. In the configuration illustrated in FIG. 1A, ***bi-directional charging device 105 and electronic device 115 receive power from charging bay 110 wirelessly, for example, through a near field or far field coil-to-coil energy transfe***r. The distance d between bi-directional charging device 105 and charging bay 110 or between electronic device 115 and charging bay 110 depends on the charging mechanism used. In some implementations, distance d may be small, in terms of a few centimeters. In other implementations, distance d may be several centimeters or meters. ***Bi-directional charging device 105 is a portable unit that may be selectively configured to receive power from a charging bay 110 or selectively configured to deliver power***, as described below. In some implementations, bi-directional charging device 105 may be configured only for the receiving or delivering of power. In many other implementations, bi-directional charging device 105 may be configured for the receiving and delivering of power as only one of many functions with device 105. For example, ***bi-directional charging device 105 may be a portable device such as a notebook computer, laptop computer, tablet computer, or a cellular phone, to name just a few examples. In such a device 105, the device 105 may both use the power received from charging bay 110 and share the power with a rechargeable electronic device 115***. In this manner, a portable device may provide power for other portable devices in the vicinity, including providing power for other rechargeable electronic devices 115. Schuessler, 1:56-2:19. While being charged by charging bay 110, bi-directional charging device 105 may provide power to charge electronic devices 115. For example, power may be received by bi-directional charging device 105 at one coil and power may be delivered to an electronic device 115 from another coil substantially concurrently. For another example, power may be received by bi-directional charging device 105 at a coil at one frequency and power may be delivered to an electronic device 115 from the same coil at a different frequency substantially concurrently. ***The capability to both receive power and deliver power substantially concurrently*** may be used to stack devices oh a charging bay 110 for maximum utilization of available surface space of charging bay 110. Schuessler, 3:23-35.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 1B illustrates an exemplary system 100 in which a bi-directional charging device 105 is placed in the vicinity of a rechargeable electronic device 115 away from charging bay 110, in an exemplary configuration for charging the electronic device 115. The distance d between bi-directional charging device 105 and electronic device 115 depends on the charging mechanism used, as described above. The same mechanism used to charge devices 105 and 115 from charging bay 110 may be used to ***charge rechargeable electronic device 115 from bi-directional charging device 105***. For example, rechargeable electronic device 115 may use the same coil for receiving power from bi-directional charging device 105 as used for receiving power from charging bay 110, and ***bi-directional charging device 105 may use the same coil to provide power to rechargeable electronic device 115 as used for receiving power from charging bay 110***. However, in some implementations, ***bi-directional charging device 105 may use one coil to receive power from charging bay 110 and a separate coil to provide power to rechargeable electronic device 115***. Schuessler, 3:36-55. Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in ***a power receiving mode*** or directing power from rechargeable battery 215 ***in a power delivering mode***. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. ***Rechargeable battery 215 represents a device capable of storing charge, accepting charge for storage, and delivering charge from the stored charge***. Some examples of rechargeable battery technology include the use of lead-acid; alkaline; combinations with nickel such as nickel-iron, nickel-cadmium, and nickel-zinc; lithium forms or combinations with lithium such as lithium ion,

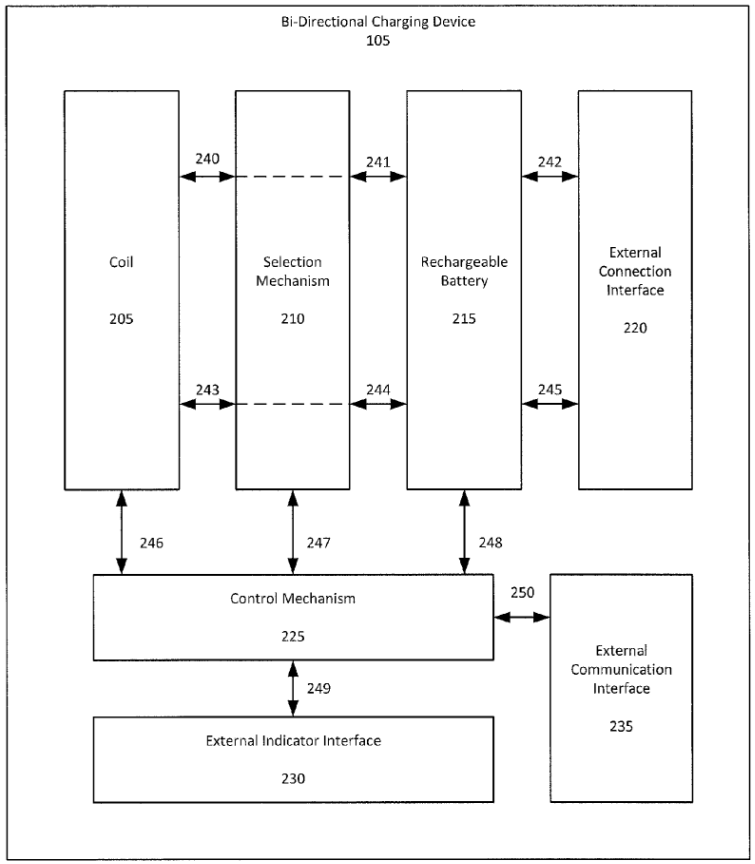
Claim Limitation	Exemplary Prior Art Disclosures
	lithium polymer, lithium-sulfur, lithium titanate, and thin film lithium; and other elemental combinations such as zinc-bromium; sodium-sulfur; and silver-zinc. ***Rechargeable battery 215 may represent multiple rechargeable batteries*** 215, as discussed above. In a bi-directional charging device 105 with multiple rechargeable batteries 215, the batteries 215 may be of different technologies. Schuessler, 4:61-5:7. Control mechanism 225 represents the control hardware, firmware, and/or software that determines ***the mode for the bi-directional charging device 105, for example, a power receiving mode or a power delivering mode***. As discussed above, there may be multiple concurrent modes. Schuessler, 5:39-43. FIG. 3A illustrates an exemplary charging bay 305 that may be plugged into a wall receptacle for connection to a building main power supply. A charging bay such as bay 305 may be placed in an entryway or a corner or the like so that as occupants of the building enter, they may place a bag on charging bay 305. Inside the bag is a ***bi-directional charging device 105 to be charged from charging bay 305. Exemplary bags illustrated in FIG. 3A are a handbag 310, briefcase 315, and backpack 320 each containing one bi-directional charging device 105***. Of course, more than one bi-directional charging device 105 may be carried in a bag. As a bag is placed on charging bay 305, a bi-directional charging device 105 inside the bag may recognize the presence of charging bay 305 and begin receiving power from charging bay 305. Bi-directional charging device 105 may recognize the presence of charging bay 305 by, for example, recognizing that a large power source at an appropriate frequency is nearby, or by communicating with charging bay 105 through external communication interface 235. In some implementations, charging bay 305 may be able to charge a bi-directional device 105 from a distance. For example, as illustrated in FIG. 3A, backpack 320 is placed a distance from charging bay 305, but may still be able to receive energy transfer from charging bay 305 if the energy transfer mechanism is able to span the distance. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. ***If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as***

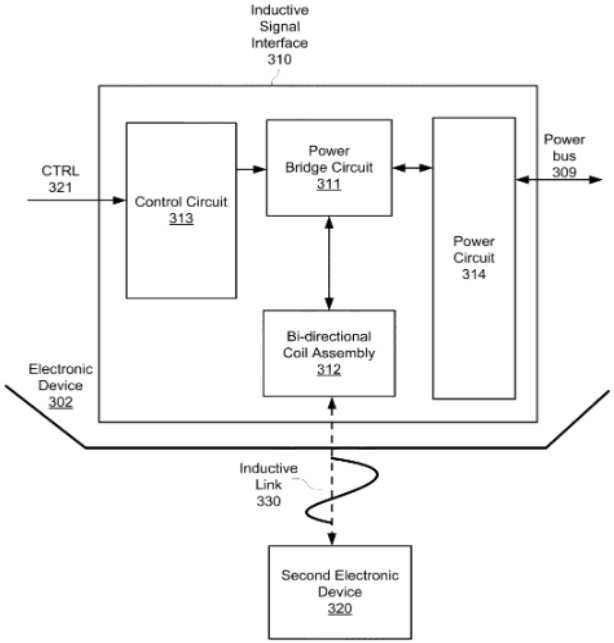
Claim Limitation	Exemplary Prior Art Disclosures
	charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge. Schuessler, 7:49-8:21; *see also* Schuessler, Figs. 1-5. Schuessler discloses or renders obvious the "dual mode wireless power receiver configured to . . . communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device." Schuessler discloses communication between two electronic devices that results in charging the second electronic device. For example: ***One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status***. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. If communication capability is included in both bi-directional charging device 105 and rechargeable electronic device 115 as described above, then the devices may communicate with each other to coordinate energy transfer. Coordination of energy transfer may include beginning and ending energy transfer and status communication during energy transfer. Schuessler, 3:56-61. External communication interface 235 optionally provides the capability for communication with external devices such as charging bay 110 or rechargeable electronic device 115, as discussed above. External communication interface 235 includes the hardware, firmware and/or software

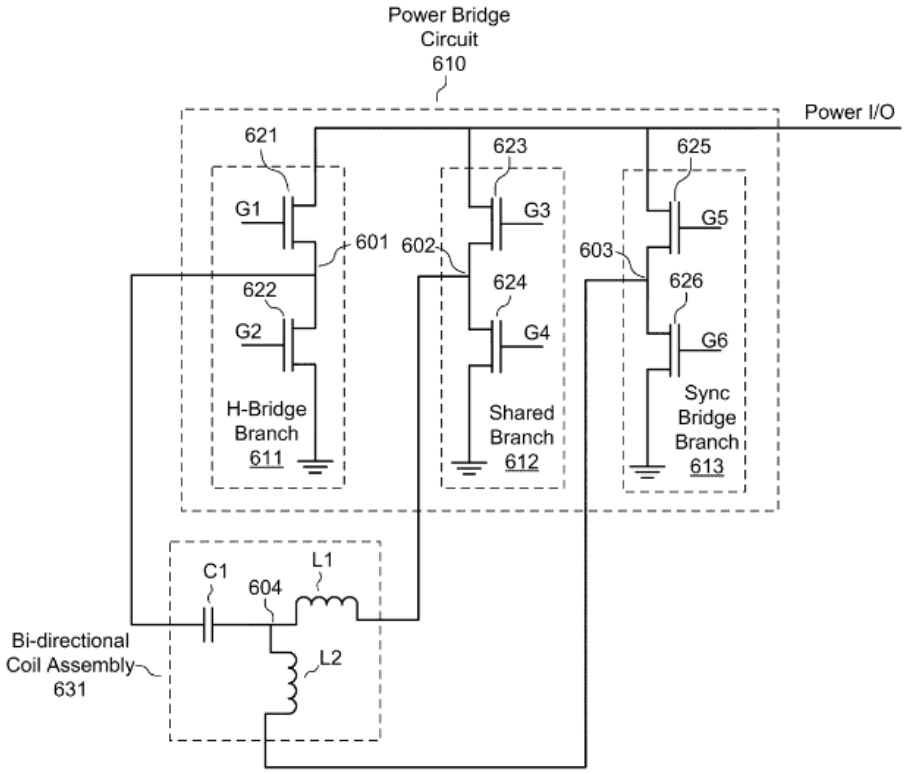
Claim Limitation	Exemplary Prior Art Disclosures
	necessary for communication through the implemented protocol. For example, interface 235 may include integrated circuit transceiver chips with associated circuitry and multiple levels of software to enable communications using Bluetooth protocol. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, ***external communication interface 235 may perform handshaking with an external device, and then inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. ***External communication interface 235 may be used by bi-directional charging device 105 to make requests to external devices for charging***. For example, upon recognizing that a charging bay 110 is in the vicinity, bi-directional charging device 105 may request the charging bay 110 to begin delivering power. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215. Schuessler, 6:52-7:6. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. ***A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge***.

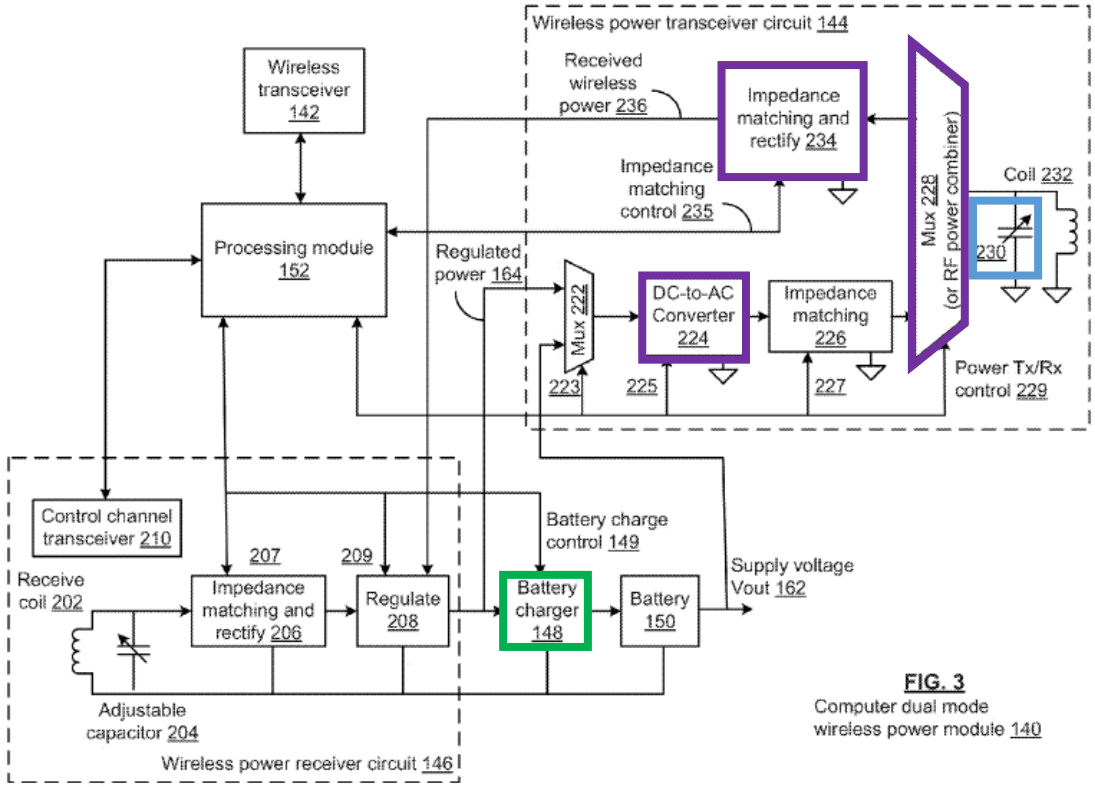
Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 8:7-21.
[1a] one of coil and capacitor electrodes;	Schuessler discloses or renders obvious this limitation. Schuessler discloses coils. For example: Bi-directional charging device 105 includes ***a coil for receiving or delivering power***, a rechargeable battery for storing energy, and electronics to control the receiving and delivering of power. Bi-directional charging device 105 is discussed in detail below with respect to FIG. 2. Schuessler, 2:27-31. FIG. 2 illustrates a block diagram of components of an exemplary bi-directional charging device 200 including ***a coil 205***, a selection mechanism 210, a rechargeable battery 215, an external connection interface 220, a control mechanism 225, an external indicator interface 230, an external communication interface 235, and connections 240-250. Bi-directional charging device 200 may include more or fewer components than those shown. In one implementation, for example, the external connection interface 220, the external indicator interface 230, or the external communication interface 235 may not be included. In another implementation, there may be multiple coils 205 or multiple batteries 215. Other implementations are also possible. In each implementation of a bi-directional charging device 105 ***at least one coil 205 is selectively used to provide power to at least one rechargeable battery 215 and to receive power from at least one rechargeable battery 215***. ***Coil 205 is configured to receive or deliver power. Coil 205 may be metal, ceramic, semiconductor material, or other material suitable for forming coils, and may be one or more layers. Thus, coil 205 may be, for example, a ring, multiple layers of rings, a trace around a circuit board, or multiple layers of a MEMS (microelectromechanical systems) device, to name just a few***. Coil 205 generally is coupled to circuitry, not shown in FIG. 2, for the ***transfer of energy through coil 205***. For example, coil 205 may be included in a resonant circuit for energy transfer through resonance. As another example, coil 205 may be included in a switched power amplification circuit. Coil 205 may be included in a wide variety of other circuits for delivering or receiving

Claim Limitation	Exemplary Prior Art Disclosures
	power. Circuits including coil 205 may include the capability for tuning the energy delivery or receipt frequency. ***Coil 205 may represent multiple coils 205***. In a first exemplary implementation with multiple coils 205, separate coils are used to receive and to deliver power. In a second exemplary implementation, different coils are used to receive or to deliver power at different frequencies, for example, to power multiple devices in parallel, or to receive power at one frequency and deliver power at another frequency. Schuessler, 3:62-4:27; *see also id.* Figs. 1-2.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	Schuessler, in view of one or more of the references cited below, renders obvious this limitation. First, Schuessler discloses and/or renders obvious "a first circuitry comprising: an impedance network." Schuessler discloses circuits such as a resonant circuit, a switched power amplification circuit, and/or circuits that may include the capability for tuning the energy deliver or receipt frequency. For example: Coil 205 generally is coupled to circuitry, not shown in FIG. 2, for the transfer of energy through coil 205. For example, ***coil 205 may be included in a resonant circuit for energy transfer through resonance. As another example, coil 205 may be included in a switched power amplification circuit. Coil 205 may be included in a wide variety of other circuits for delivering or receiving power. Circuits including coil 205 may include the capability for tuning the energy delivery or receipt frequency***. Schuessler, 4:19-27. ***Control mechanism 225 may provide adjustment to coil 205, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Schuessler, 5:57-62.

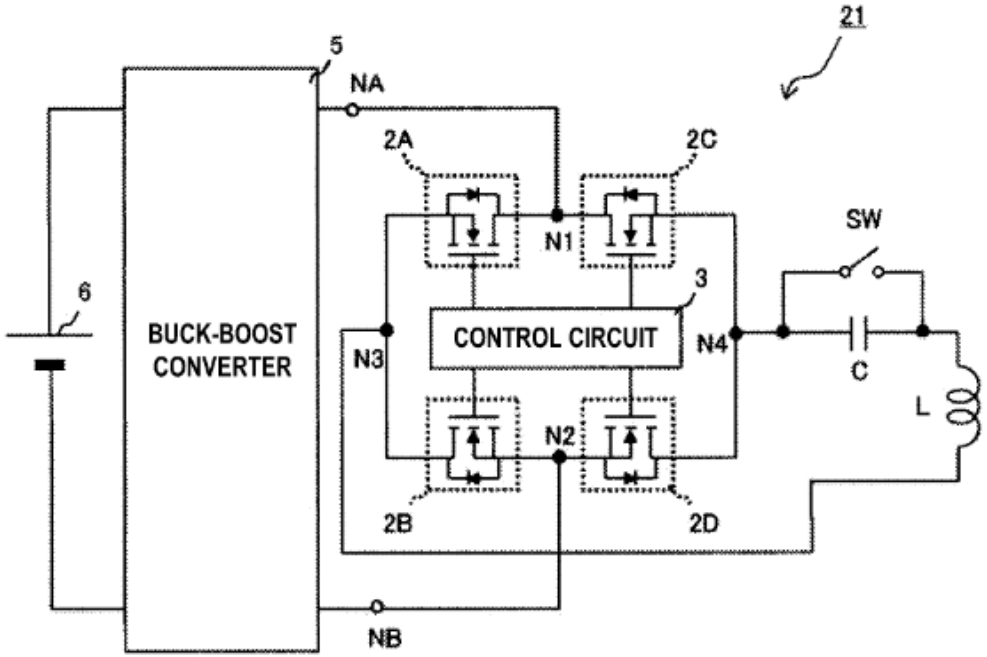
Claim Limitation	Exemplary Prior Art Disclosures
	 *Fig. 2* Schuessler, Fig. 2. To the extent it is argued that Schuessler does not teach this limitation, a POSA would have found it obvious in view of one or more of the following references, because it involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA would have appreciated the benefit of providing an impedance network to provide changeable impedance to improve the power charging

Claim Limitation	Exemplary Prior Art Disclosures
	efficiency. A POSA would have had a reasonable expectation of success because adjusting impedance for wireless power charging is well known in the art. **Chatterjee** Chatterjee discloses a bi-directional coil assembly whose impedance is changeable. For example:  **FIG. 3** Chatterjee, Fig. 3; *see also id.* Fig. 4. By selectively turning off the H-bridge branch 611 or the sync bridge branch 613, the power bridge circuit 610 is configurable to ***selectively turn off current paths in the bi-directional coil assembly 631 to change the impedance of the bi-directional coil assembly 631 based on the***

Claim Limitation	Exemplary Prior Art Disclosures
	mode of operation of the inductive signal interface. For example, in the power receive mode of the inductive signal interface, the current paths through the bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the capacitor C1 and the inductive coil L1. In the power transmit mode, the current path through bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the inductive coils L1 and L2. Chatterjee, ¶ 66.  Chatterjee, Figs. 6A; *see also id*. Figs. 6B-6D, ¶¶ 61-73. *See generally* Chatterjee, Figs. 7, 9, 10.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee Van Der Lee discloses and/or renders obvious a capacitor and/or a coil whose impedance is adjustable. For example:  FIG. 3 Computer dual mode wireless power module 140 Van Der Lee, Fig. 3. The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a

Claim Limitation	Exemplary Prior Art Disclosures
	multiplexer 228, a DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, ***an adjustable capacitor 230***, and a coil 232. Van Der Lee, ¶ 51. In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. ***As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit***. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54, Fig. 3; *see also id.* ¶¶ 62, 73, Fig. 4. **Shinoda** Shinoda discloses a resonant capacitor that can be connected or bypassed in different modes. For example: The wireless power transfer terminal 11 includes the FETs 2A to 2D, coil L, control circuit 3, a switch SW, and a resonant capacitor C. The resonant capacitor C is provided between the node N4 and the coil L, and the switch SW is provided in parallel with the resonant capacitor C. ***The capacitance of the resonant capacitor C is set such that it is connected to the coil L and resonates in series therewith***. ***For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power

Claim Limitation	Exemplary Prior Art Disclosures
	transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:52-6:2.  FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 4, 7. **Singh-167** Singh-167 teaches an impedance adjuster 400 that provides variable impedance.

Claim Limitation	Exemplary Prior Art Disclosures

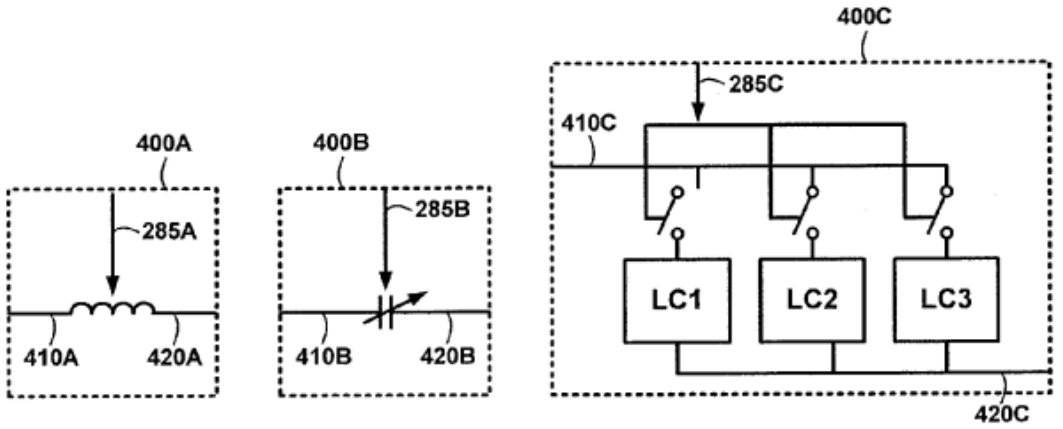


FIG. 4A FIG. 4B FIG. 4C

Singh-167 at Figs. 4A-4C; *see also* Singh-167, Figs. 2-3.

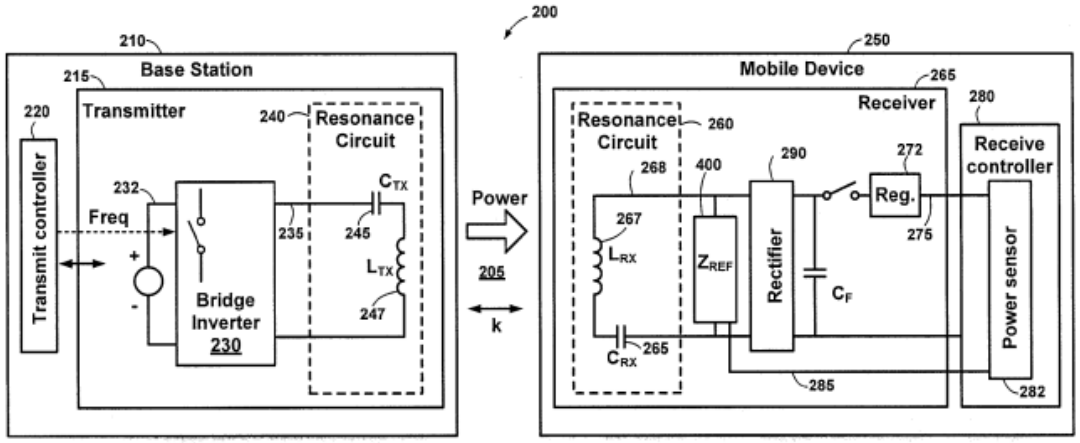
> The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster.

Singh-167, Abstract.

> Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive

Claim Limitation	Exemplary Prior Art Disclosures
	resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive

Claim Limitation	Exemplary Prior Art Disclosures
	resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the

Claim Limitation	Exemplary Prior Art Disclosures
	impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.  *FIG. 2* Singh-167, Fig. 2.

Claim Limitation	Exemplary Prior Art Disclosures

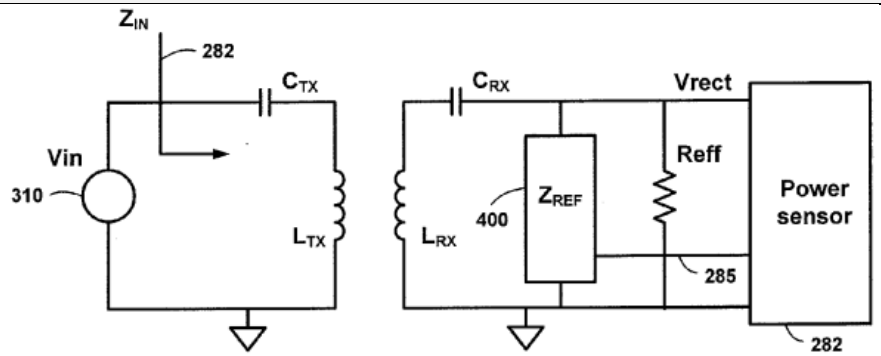


FIG. 3

Singh-167, Fig. 3.

> Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN.
>
> Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above.

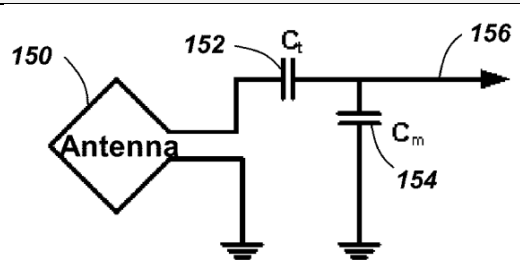
Singh-167, ¶¶ 48-49.

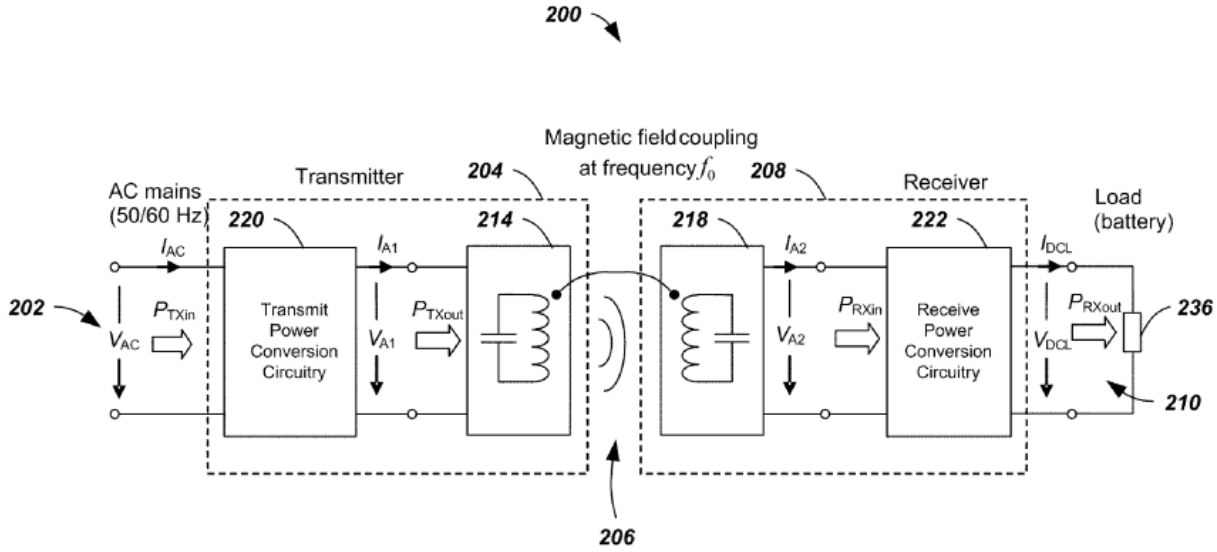
> FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance

Claim Limitation	Exemplary Prior Art Disclosures
	adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line

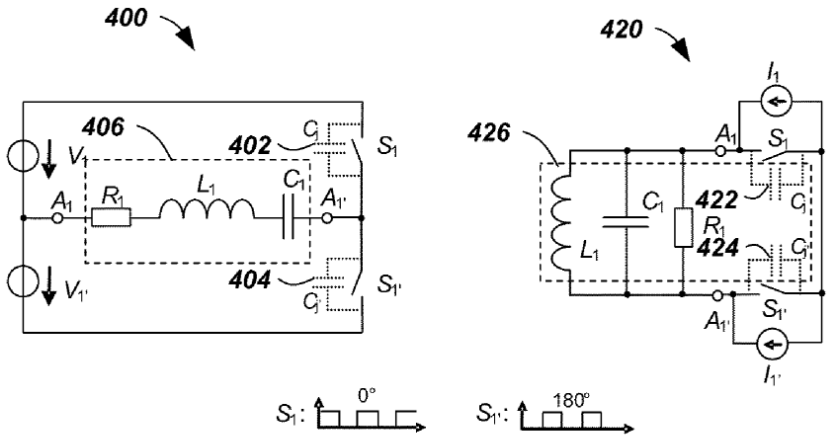
Claim Limitation	Exemplary Prior Art Disclosures
	520. This larger impedance will result in less power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7. **Cook** Cook discloses and/or renders obvious a capacitor connected to the coil and has adjustable capacitance. For example: An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to

Claim Limitation	Exemplary Prior Art Disclosures
	charge a battery 136 as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. ***The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118***. Cook, ¶31. As stated, ***efficient transfer of energy between the transmitter 104 and receiver 108 occurs during matched or nearly matched resonance between the transmitter 104 and the receiver 108***. However, even when resonance between the transmitter 104 and receiver 108 are not matched, energy may be transferred at a lower efficiency. Transfer of energy occurs by coupling energy from the near-field of the transmitting antenna to the receiving antenna residing in the neighborhood where this near-field is established rather than propagating the energy from the transmitting antenna into free space. ***The resonant frequency of the loop antennas is based on the inductance and capacitance. Inductance in a loop antenna is generally the inductance created by the loop, whereas, capacitance is generally added to the loop antenna's inductance to create a resonant structure at a desired resonant frequency***. As a non-limiting example, ***capacitor 152 and capacitor 154 may be added to the antenna to create a resonant circuit that generates a sinusoidal or quasi-sinusoidal signal 156***. Accordingly, for larger diameter loop antennas, the size of capacitance needed to induce resonance decreases as the diameter or inductance of the loop increases. Furthermore, as the diameter of the loop antenna increases, the efficient energy transfer area of the near-field increases for "vicinity" coupled devices. Of course, other resonant circuits are possible. As another non-limiting example, a capacitor may be placed in parallel between the two terminals of the loop antenna. In addition, those of ordinary skill in the art will recognize that for transmit antennas the resonant signal 156 may be an input to the loop antenna 150. Cook, ¶¶ 34-35.

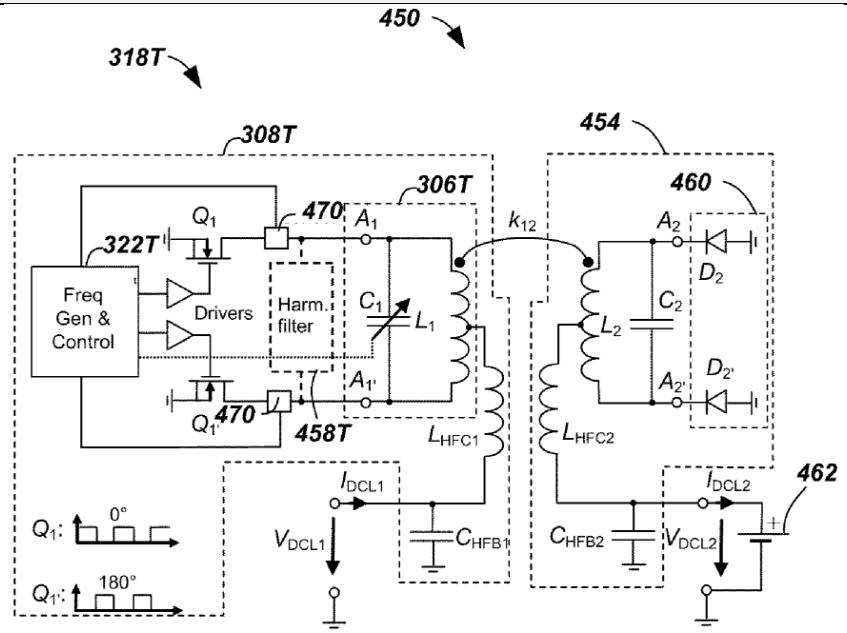
Claim Limitation	Exemplary Prior Art Disclosures
	 ***FIG. 3*** *see also* Cook, Figs. 2, 3. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter.

Claim Limitation	Exemplary Prior Art Disclosures
	Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if ***both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0***. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41.  FIG. 4 Cook, Fig. 4

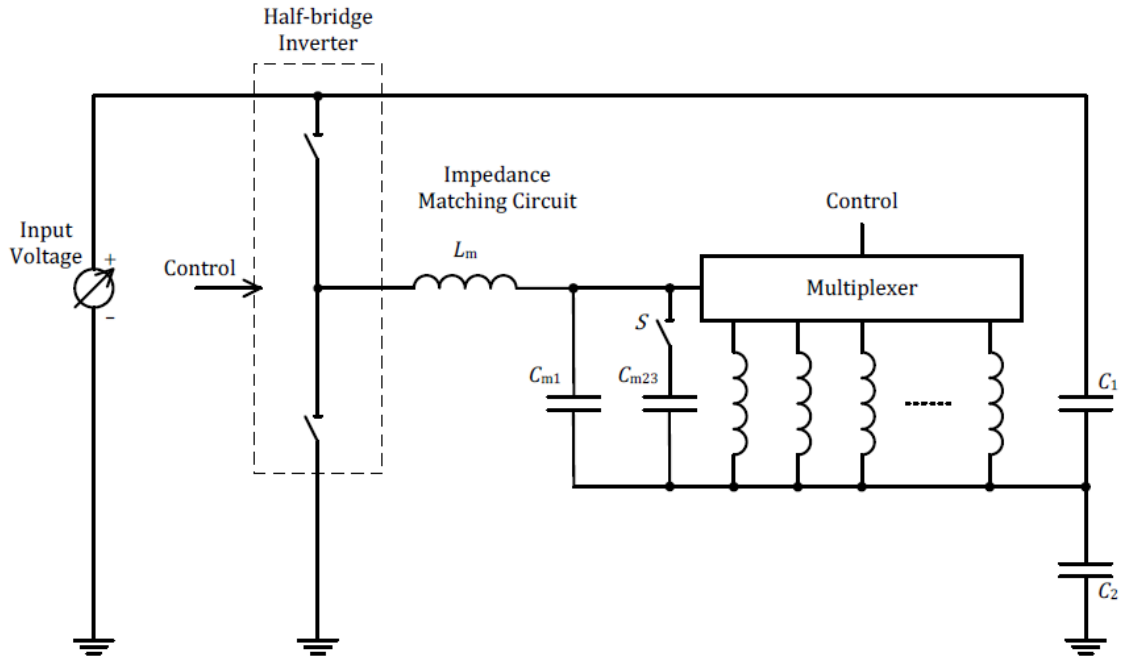
Claim Limitation	Exemplary Prior Art Disclosures
	As described herein, wireless power transfer uses ***coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency***. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of a half bridge rectifier topology 400 including ***a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna*** where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration. The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. ***The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency***.

Claim Limitation	Exemplary Prior Art Disclosures
	The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.  ***FIG. 8*** Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration) with a half bridge active rectifier configured with the ***switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454***. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs)

Claim Limitation	Exemplary Prior Art Disclosures
	with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454, a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). ***Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency***. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 9 Cook, Fig. 9. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, ***low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T,***

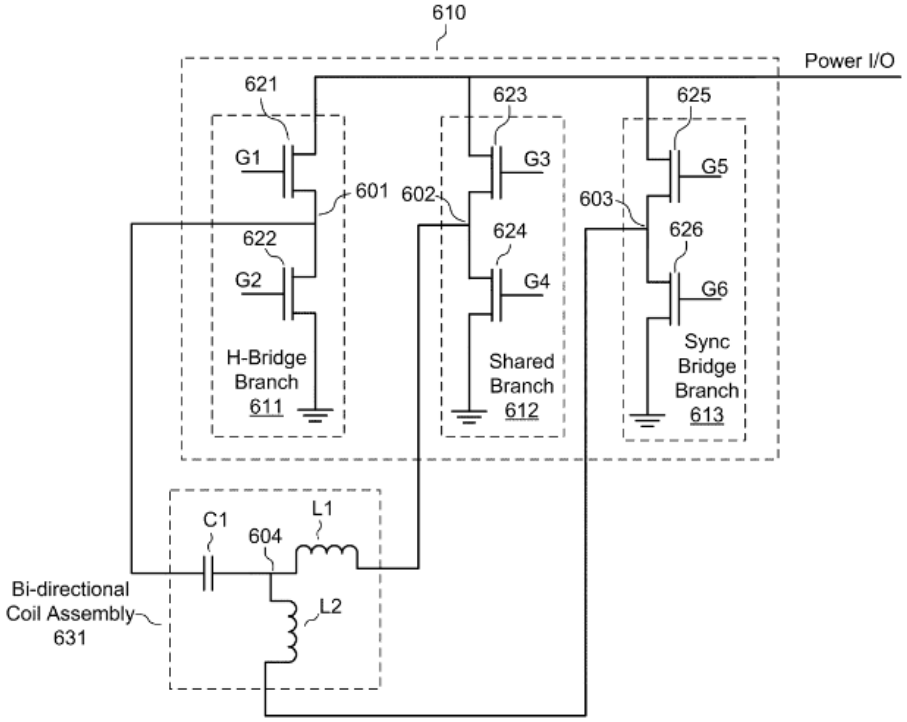
Claim Limitation	Exemplary Prior Art Disclosures
	L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶61. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all.*** Cook, ¶61.

Claim Limitation	Exemplary Prior Art Disclosures
	See also Cook, Figs 7-10. **WPT** For example, WPT discloses an impedance matching circuit. As shown in Figure 3-12, Power Transmitter design B1 uses a half-bridge inverter to drive the Primary Coil array. In addition, Power Transmitter design B1 uses a multiplexer to select the position of the Active Area. The multiplexer shall configure the Primary Coil array in such a way that one, two, or three Primary Coils are connected—in parallel—to the driving circuit. The connected Primary Coils together constitute a Primary Cell. As an additional constraint, the multiplexer shall select the Primary Coils such that each selected Primary Coil has an overlap with every other selected Primary Coil; see Figure 3-10(c) for an example.  **Figure 3-12: Electrical diagram (outline) of Power Transmitter design B1**

Claim Limitation	Exemplary Prior Art Disclosures
	Within the Operating Frequency range $f_{op} = 105 \ldots 113$ kHz, the assembly of Primary Coil array and Shielding has an inductance of $8.1^{\pm 1}$ µH for each individual Primary Coil in layer 1 (closest to the Interface Surface), $8.7^{\pm 1}$ µH for each individual Primary Coil in layer 2, and $9.6^{\pm 1}$ µH for each individual Primary Coil in layer 3. The capacitances and inductance in the impedance matching circuit are, respectively, $C_{m1} = 300^{\pm 5\%}$ nF, $C_{m23} = 200^{\pm 5\%}$ nF,and $L_m = 3.8^{\pm 5\%}$ µH. The capacitances C_1 and C_2 in the half-bridge inverter both are 68 µF. The switch S is open if the Primary Cell consists of a single Primary Coil; otherwise, the swich S is closed. (Informative) *The voltage across the capacitance C_m can reach levels exceeding 36 V pk-pk.* WPT, 23. Second, Schuessler discloses and/or renders "a first circuitry comprising: . . . a switch network". Schuessler discloses a selection mechanism that includes switching circuitry including power FETs. For example: Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Selection mechanism 210 may include electrical and/or mechanical selection. For example, a ***selection mechanism 210 may be a mechanical switch*** on the outside of a housing containing bi-directional charging device 105. As another example, ***selection mechanism 210 may be circuitry internal to bi-directional charging device 105, such as switching circuitry including power FETs (field effect transistors) or other electronic switches***. Selection mechanism 210 may be controlled by control mechanism 225, discussed below. Schuessler, 4:35-60.

Claim Limitation	Exemplary Prior Art Disclosures
	Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the ***FETs may be turned on and off by electrical signals from control mechanism 225***. Schuessler, 6:11-17. Bi-directional charging device 105 may include combinations of discrete and integrated components. For example, control mechanism 225 may include a processor implemented on a semiconductor device, and discrete input/output circuitry for the processor. Further, multiple functions or portions of functions may be integrated within one or more semiconductor devices. For example, portions of selection mechanism 210, external connection interface 220, control mechanism 225, external indicator interface 230, and external communication interface 235 may all be integrated within one semiconductor device. Schuessler, 7:20-30. Control mechanism 225 may be additional to an ***external selection option such as a switch*** accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 6:18-26. To the extent it is argued that Schuessler does not teach this limitation, Schuessler in view of one or more of the following references would have rendered this limitation obvious. It would have been obvious to apply the circuitry designs disclosed in the following references to provide a switch network with changeable topology in implementing Schuessler's bi-directional wireless charger because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have found it obvious to choose the circuitry design disclosed in the following references from a finite number of predictable solutions to implement Schuessler's bi-directional wireless charger and would have had a

Claim Limitation	Exemplary Prior Art Disclosures
	reasonable expectation of success because the disclosed circuitry is well known in the art and operates in well-known and predictable ways. **Chatterjee** Chatterjee discloses a power bridge circuit that form different circuits depending on the mode of operation. For example: > According to embodiments described herein, the power bridge circuit **311** corresponds to a circuit element that is used by the inductive signal interface **310** when in both power transmit and power receive modes. ***More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode***. > FIG. 6A illustrates a circuit level embodiment of the power bridge circuit **311**, **411**, **511** and the bi-directional coil assembly **312**, **412**, **512** of FIGS. 3, **4**, and **5**, respectively. An embodiment depicted shows the ***power bridge circuit 610 as being "3-legged", meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for use with either the H-bridge or the synchronous bridge rectifier branch***. Chatterjee, ¶¶ 38, 61. > In the power transmit mode of the inductive signal interface, the power I/O transmits an input DC current to the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the input DC current can be a regulated current transmitted by the power circuit **314** or **414**. ***In the power transmit mode, G5 and G6 are de-asserted by the control logic so that the switches 625 and 626 in the sync bridge branch 613 are in an off (i.e. open) state. Thus, the sync bridge branch 613 is off while the H-bridge branch 611 and the shared branch 612 are active***. Accordingly, current flow through the inductor L**2** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of capacitor C**1** and inductive coil L**1**. > In the power receive mode of the inductive signal interface, the power I/O transmits an output DC current from the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the output DC current may be transmitted via the power bus to the power circuit **314** or **414** which performs voltage and current regulation on the output DC current in order to output a regulated

Claim Limitation	Exemplary Prior Art Disclosures
	current. ***In this mode of operation of the inductive signal interface, the signals G1 and G2 de-asserted such that the switches 621 and 622 of the H-bridge branch 611 are in the off state. Thus, the H-bridge branch 611 is off while the sync bridge branch 613 and the shared branch 612 are active***. By turning off the H-bridge branch **611**, current flow through capacitor C**1** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of inductive coils L**1** and L**2**. Chatterjee, ¶¶ 64–65.  Chatterjee, Fig. 6A; *see also id.* Fig. 6B–6D, ¶¶ 61-73. ***FIG. 1 illustrates an H-bridge inverter circuit 110 for transferring power from a DC supply 120 to an AC load 115***. The H-bridge inverter circuit **110** includes four switches **111-114** each controlled by a respective one of control signals H**1**-H**4**. During the operation of the H-bridge

Claim Limitation	Exemplary Prior Art Disclosures
	inverter **110**, the switches **111**-**114** turn on and off in pairs to deliver an AC current to the AC load **115**. For example, at one instance, the signals H**1** and H**4** are asserted to turn on switches **111** and **114**, while the signals H**2** and H**3** are de-asserted to turn off the switches **112** and **113**. Current flows from DC power supply **120** through switch **111**, to the AC load **115**, through the switch **114**, and to a ground voltage or a negative supply voltage. At another instance, the signals H**1** and H**4** are de-asserted to turn off switches **111** and **114**, while the signals H**2** and H**3** are asserted to turn on the switches **112** and **113**. During this instance, the current flows from the DC supply **120** through the switch **113**, to the AC load **115**, through the switch **112**, and to the ground voltage or the negative supply voltage. By altering the direction of the current flow, the H-bridge inverter is configured to deliver an AC current from the DC supply **120** to the AC load **115**. ***FIG. 2 illustrates a sync bridge circuit 210 for transferring power from an AC supply 215 to a DC load 220***. The sync bridge circuit **210** includes four switches **211**-**214** each controlled by a respective one of control signals S**1**-S**4**. The sync bridge circuit **210** receives an AC current from the AC supply **215**, and the switches **211**-**214** of the sync bridge circuit **210** turn on and off in pairs to deliver a DC current to the DC load. Chatterjee, ¶¶ 3–4; *see also id.* Figs. 1–2. 3. The inductive signal interface of claim 2, wherein two of the three branches operate to form an H-bridge circuit while the inductive signal interface operates in the power transmit mode. 4. The inductive signal interface of claim 2, wherein two of the three branches operate to form a synchronous bridge rectifier circuit while the inductive signal interface operates in the power receive mode. Chatterjee, cls. 3, 4. *See generally* Chatterjee, Figs. 7-11. **Shinoda** Shinoda discloses switching elements (FETs 2A to 2D) that operate as different circuits depending on the mode of operation. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via ***a respective power transmission circuit 103 and a power reception circuit 104***. ***The power transmission circuit 103 includes an inverter*** for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit*** for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 1:31-46. ***For a power transmission mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the ***FETs 2A to 2D function as a full-bridge inverter circuit***. Shinoda, 3:52-62. ***For a power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the ***FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33.

Claim Limitation	Exemplary Prior Art Disclosures
	The above described parallel circuit including ***first to fourth semiconductor switching elements (i.e., FETs 2A to 2D) operating as a full-bridge inverter circuit*** can apply an alternating-current output to the coil, thus enabling the wireless power transfer terminal to transmit power. Also, the parallel circuit including the ***first to fourth semiconductor switching elements operating as a rectifier circuit*** can rectify an alternating-current input applied from the coil, thus enabling the wireless power transfer terminal to receive power. In this way, the use of the parallel circuit including the first to fourth semiconductor switching elements as a full-bridge inverter circuit or a full-wave rectifier circuit can reduce the total number of the semiconductor switching elements, increase space savings of the circuit configuration of the wireless power transfer terminal 1, and reduce cost of manufacturing. For the present embodiment, an FET element is used as a semiconductor switching element. With this, the parallel circuit can operate as a full-wave rectifier circuit using a parasitic diode between the drain and the source of the FET element. However, embodiments consistent with the disclosure can also be suitably carried out using other semiconductor switching elements. For example, a combination of a bipolar transistor and a diode can also be used as substantially the same circuit configuration as that of the present embodiment, and with other embodiments consistent with this disclosure. Shinoda, 5:17-43.

Claim Limitation	Exemplary Prior Art Disclosures

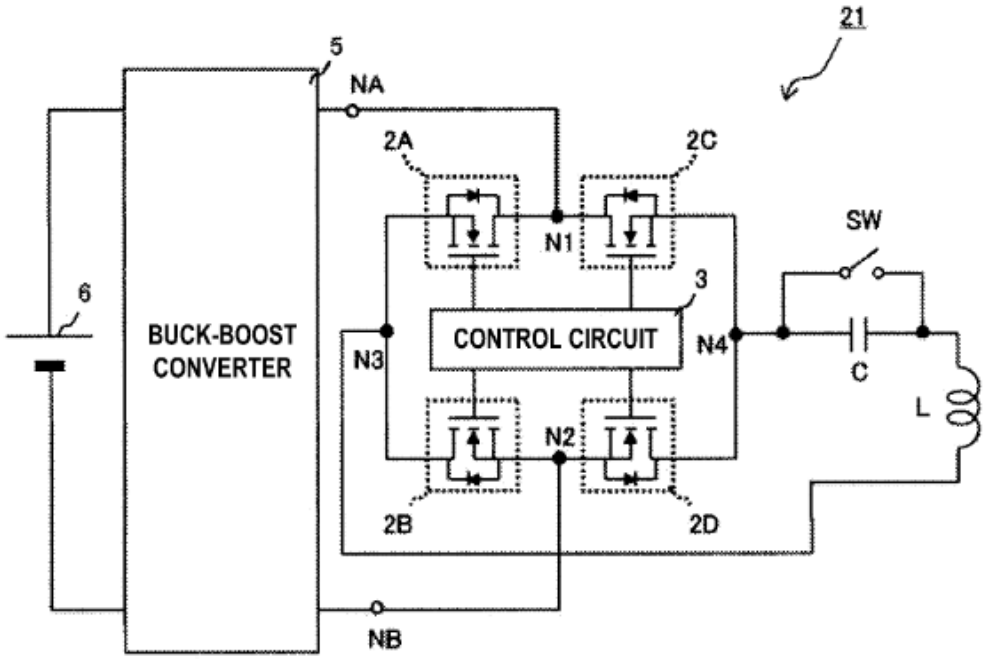


FIG.5

Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7.

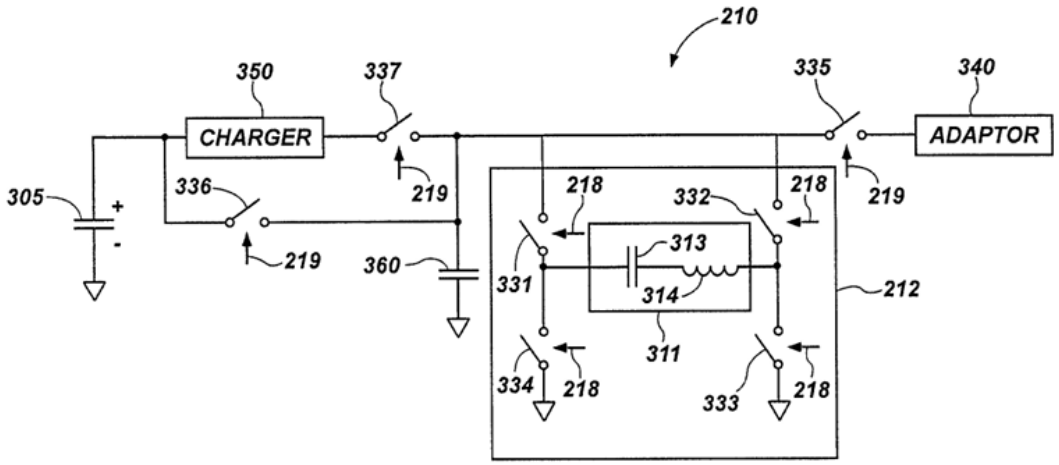
Singh-203

Singh discloses switches 331, 332, 333, 334 that form a switch network that can operates an inverter or a rectifier under different modes.

> The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of

Claim Limitation	Exemplary Prior Art Disclosures
	the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. The plurality of switches 331, 332, 333, 334 may be configured as a full-bridge circuit, such that the resonant tank 311 is coupled on one end at a node between the first switch 331 and the fourth switch 334, and at a node between the second switch 332 and the third switch 333 on the other end. In other words, the first switch 331 and the fourth switch 334 may be serially coupled having a first node therebetween, and the second switch 332 and the third switch 333 may be serially coupled having a second node therebetween. The resonant tank 311 may be coupled between the first node and the second node. Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof.

Claim Limitation	Exemplary Prior Art Disclosures
	As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. Singh-203, 7:10-8:12. Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof. Singh-203, 8:51-9:5. The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy

Claim Limitation	Exemplary Prior Art Disclosures
	storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25.  FIG. 3A Singh-203, Fig. 3A; *see also* FIGS. 3A-3D. If the receive mode is determined to be the desired mode of operation, the wireless power enabled operates in the receive mode at operation 430. While in receive mode, control logic may transmit control signals to the wireless charging transceiver. The control signals may control operation of the full-bridge circuit coupled with the resonant tank of the wireless charging transceiver to operate as a full-bridge rectifier. The wireless charging transceiver may receive an incoming wireless power signal and generate an AC current through the resonant tank through inductive coupling. The incoming wireless power signal may be generated by a wireless power transmitting

Claim Limitation	Exemplary Prior Art Disclosures
	apparatus, such as a wireless power charger. In some embodiments, the wireless power transmitting apparatus may likewise be a wireless power enabled device having multiple modes of operation. The wireless charging transceiver operating as a full-bridge rectifier receives the AC current generated by the resonant tank generates a DC current to be output to a load. Therefore, at operation 435, power may be generated from the energy transfer to provide power to a load. For example, the load may include an energy storage device (e.g., battery), system components of the wireless power enabled device, or other power consuming devices. Singh-203, 10:13-36. **Yeh** Yeh discloses a step up/step down unit, a first reverse current protector, a second reverse current protector, and/or a third reverse current protector, that comprise switches that operate differently under different modes. For example: The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, ***the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification***. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal

Claim Limitation	Exemplary Prior Art Disclosures
	grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. Yeh, 3:58-4:30. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1. Yeh, 4:40-47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first

Claim Limitation	Exemplary Prior Art Disclosures
	supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. Referring to FIGS. 1 and 2, ***each reverse current protector (4, 4a, 4b) comprises a first resistor 46 and serially-connected oppositely-directed first and second MOSFETs 44, 45***. Two ends of the two serially-connected MOSFETs are respectively the input terminal 41 and the output terminal 42 of the reverse current protector. The first and second MOSFETs 44, 45 each have a control terminal (not labeled), and the two control terminals are electrically connected to the control terminal 43 of the reverse current protector. The first resistor 46 has an end electrically connected between the first and second MOSFETs 44, 45 and an opposite end also electrically connected to the control terminal 43 of the reverse current protector. Further, each reverse current protector (4, 4a, 4b) further comprises a transistor 47 and a second resistor 48. The transistor 47 has a first terminal electrically connected to the control terminals (not labeled) of the first and second MOSFETs 44, 45, and a second terminal of the transistor 47 is grounded. The second resistor 48 is electrically connected between a third terminal of the transistor 47 and the control terminal 43 of the reverse current protector. Yeh, 5:17-36. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. ***When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1***. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back.

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh, 5:44-63. if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. ***With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:12-29. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 6:38-44. When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the

Claim Limitation	Exemplary Prior Art Disclosures
	third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:51-7:18.

Claim Limitation	Exemplary Prior Art Disclosures

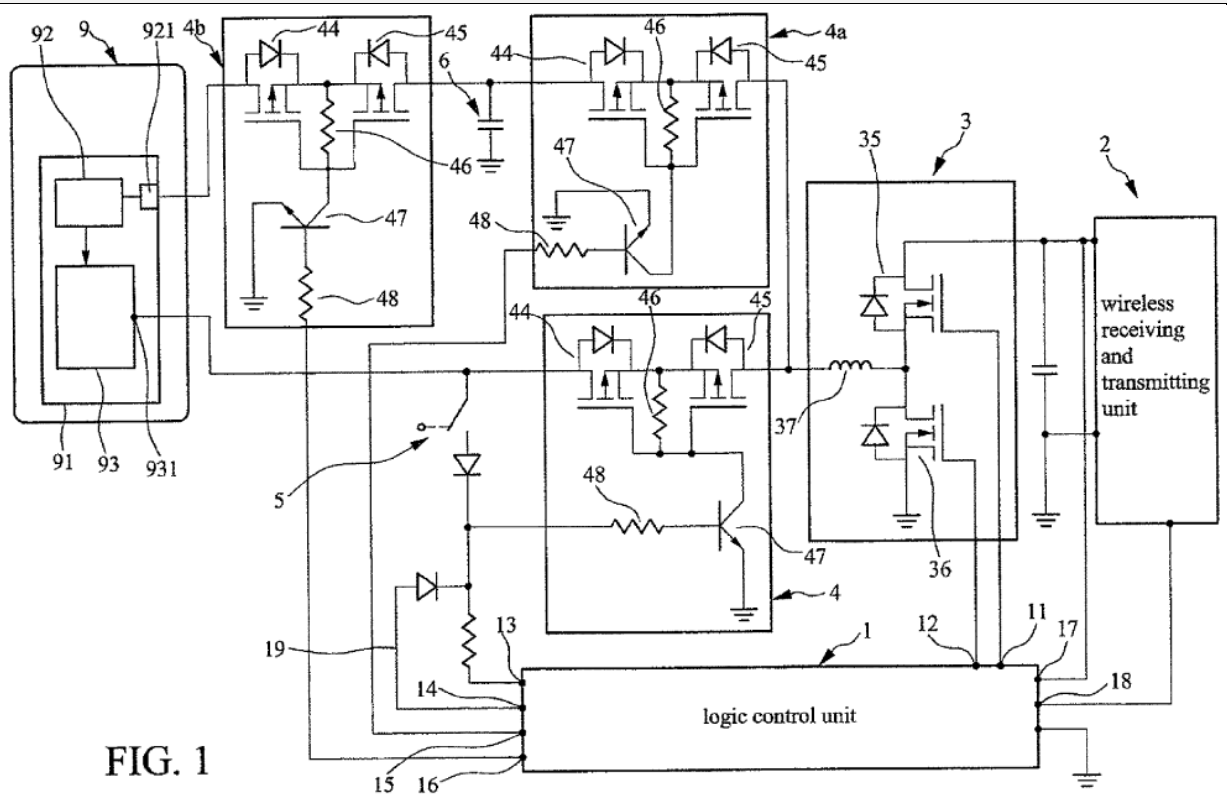


FIG. 1

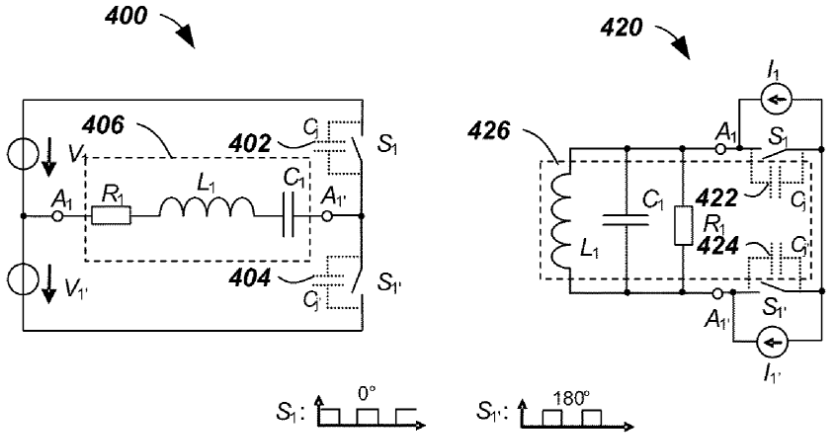
Yeh, Fig. 1; *see also id.* Figs. 2-3.

In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery. ***The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized***. ***The step-up/step-down unit 2 is arranged as a step-up/step-down unit with***

Claim Limitation	Exemplary Prior Art Disclosures
	synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. ***The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency***. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. **Cook** Cook discloses a power conversion circuit that comprise synchronous switches that operate differently under different modes. For example: FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204.

Claim Limitation	Exemplary Prior Art Disclosures
	Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes ***a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter***. Receiver 208 further includes ***a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter***. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). ***Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable***. Accordingly, the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device. Cook, ¶42. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a

Claim Limitation	Exemplary Prior Art Disclosures
	common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and ***a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow)***. The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. ***The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein***. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, ***a bidirectional power conversion circuit 308*** and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324. ***Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane***. Cook, ¶50. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of ***a half bridge rectifier topology 400*** including a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. ***A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration.*** The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its

Claim Limitation	Exemplary Prior Art Disclosures
	dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.  FIG. 8 Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration) with a ***half***

Claim Limitation	Exemplary Prior Art Disclosures
	bridge active rectifier configured with the switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, ***a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454, ***a half bridge passive diode rectifier*** 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures

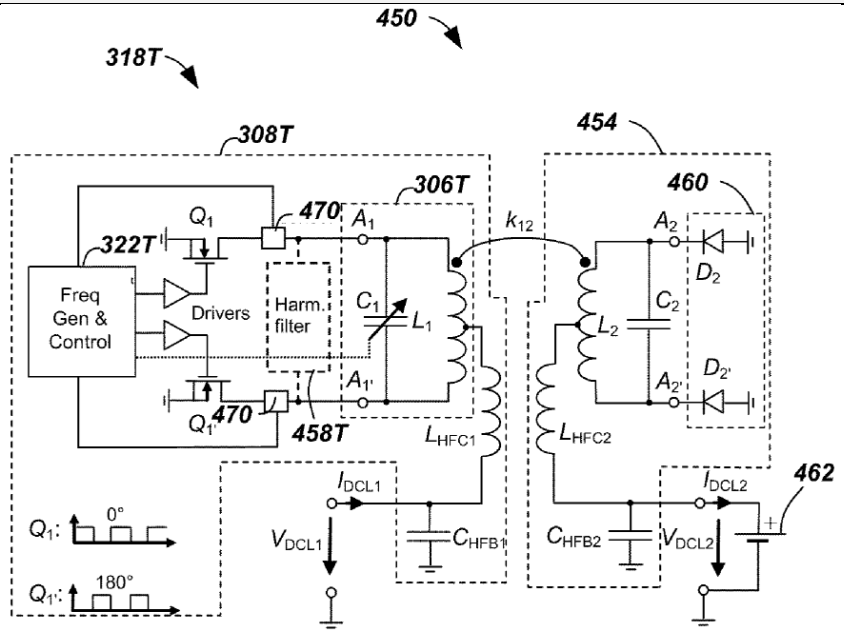


FIG. 9

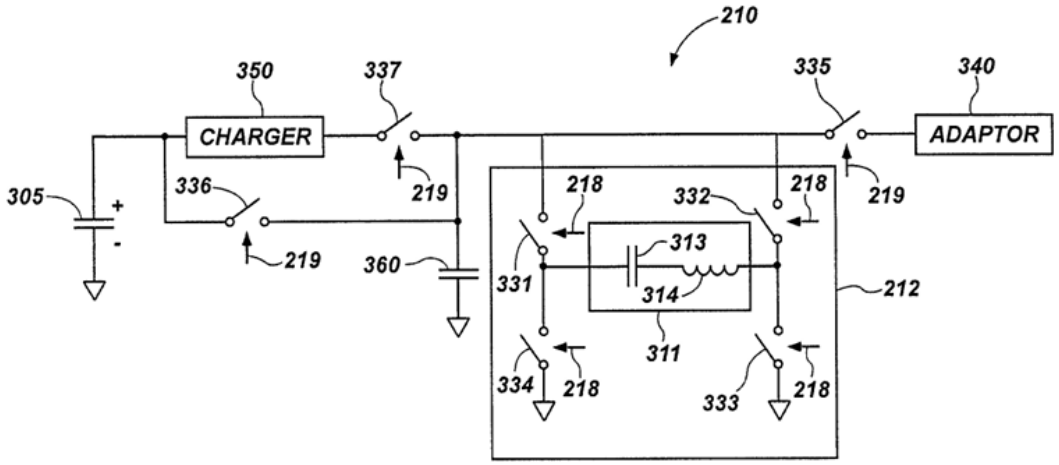
Cook, Fig. 9.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional ***power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna

Claim Limitation	Exemplary Prior Art Disclosures
	306T, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, ***a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratin***gs. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. ***In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier*** and switches are controlled based on sensed voltage. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶63. Third, Schuessler, in view of the teachings of the following references, renders obvious "a first circuitry comprising . . . a filter capacitor." A POSA would have found it obvious to add the filter capacitor taught in one or more of the following references in implementing Schuessler's mobile device because it involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA would have appreciated the benefit of adding a filter capacitor for filtering out the unwanted

Claim Limitation	Exemplary Prior Art Disclosures
	frequencies. A POSA would have had a reasonable expectation of success because filter capacitors are well known in the art. **Chatterjee** For example, Chatterjee discloses: > The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. ***The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode)***. The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. Chatterjee, ¶ 37. > The power circuit 414 operates in a similar fashion as the power circuit 314 of FIG. 3 to handle current received in either the power transfer mode or the power receive mode. The power bridge circuit 411 operates in a similar fashion as the power bridge circuit 311 of FIG. 3. Chatterjee, ¶ 44. > FIG. 10 illustrates a power bridge circuit and a bi-directional coil assembly, together **1010**, coupled to current conditioning circuitry, under an embodiment. The power bridge circuit and bi-directional coil assembly combination **1010**, which may be any of the above described embodiments, is coupled via a signal line Power I/O to a decoupling circuit 1020. ***The decoupling circuit 1020 operates to act as a filter for certain signal frequencies and prevents those signals from passing through.*** Chatterjee, ¶¶ 89; *see also id.* Fig. 10. **Van Der Lee** For example, Van Der Lee discloses:

Claim Limitation	Exemplary Prior Art Disclosures
	The primary device and/or the peripheral device may include an integrated circuit (IC) to support the above-described functions. For example, an IC may include at least a portion of the wireless power transceiver circuit (for example, one or more of the coil, capacitor, and diodes of the rectifying circuit may be off-chip), ***at least a portion of the battery charger (for example***, one or more of the switching transistors, ***the output filter capacitor***, the inductor may be off-chip), the transceiver, and the processing module. Van Der Lee, ¶ 36. **Singh-203** The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25; *see also* FIGS. 3A-3D.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3A **Yeh** Yeh discloses a supercapacitor. For example: > An objective of the present invention is to provide a bidirectional wireless charging and discharging device, which makes use of the arrangement of supercapacitors in specific locations and ***the supercapacitors having resistances lower than a battery to allow, in a charging operation, the supercapacitors to be charged first for blocking surges occurring in the charging operation*** and thus realizing protection against accumulated damage caused by charging of the battery; makes use of the function of preventing reverse current by first and second reverse current protectors to eliminate electrical leakage to thereby save power. Yeh, 2:52-62. > To realize the above objectives, the present invention provides a bidirectional wireless charging and discharging device, which is applicable to a portable electronic device having a circuit device. The circuit device is electrically connected to a power receiving terminal and a battery. The

Claim Limitation	Exemplary Prior Art Disclosures
	bidirectional wireless charging and discharging device comprises a logic control unit, a wireless receiving and transmitting unit, a step-up/step-down unit, a first reverse current protector, a second reverse current protector, a control switch, and a first supercapacitor, wherein the logic control unit comprises a plurality of pins; the wireless receiving and transmitting unit has a transmission terminal and a test terminal, the test terminal being electrically connected to a detection pin of the logic control unit; the step-up/step-down unit has a first voltage regulation terminal, a second voltage regulation terminal, and two control terminals, the second voltage regulation terminal being electrically connected to the transmission terminal of the wireless receiving and transmitting unit, the two control terminals being respectively and electrically connected to first and second control pins of the logic control unit; a power pin of the logic control unit being electrically connected to the second voltage regulation terminal and the transmission terminal that are connected to each other; the first reverse current protector has an input terminal, an output terminal, and a control terminal, the input terminal and the output terminal being respectively and electrically connected to a discharging terminal of the battery and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a third control pin of the logic control unit; the control switch has an end electrically connected to the discharging terminal of the battery and an opposite end electrically connected to the control terminal of the first reverse current protector and the third control pin of the logic control unit; the second reverse current protector has an input terminal, an output terminal, and a control terminal, the output terminal and the input terminal being respectively and electrically connected to the power receiving terminal of the circuit device and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a fifth control pin of the logic control unit; and the ***first supercapacitor has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded***. As such, ***the supercapacitor may be used block surges occurring in each charging operation in order to protect a battery from accumulated damaged caused by charging***. Further, the first and second the reverse current protectors provide a function of preventing reverse current so as to eliminate electrical leakage and thus save power. Yeh, 2:20-3:3.

Claim Limitation	Exemplary Prior Art Disclosures
	The first supercapacitor 6 has an end electrically connected to connection between the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the output terminal 42 of the second reverse current protector 4a and forms a first node 61 there. Another end of the first supercapacitor 6 is grounded. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). ***The second supercapacitor is connected in parallel to the battery 93***. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. ***Since resistances of the first supercapacitor 6 and the second supercapacitor are lower than that of the battery 93, each time a charging operation is performed, the supercapacitors are charged first, whereby the supercapacitors may function to resist the surge occurring in the charging operation. Further, the supercapacitors can be easily charged in full and then immediately charge the battery 93***. Yeh, 4:48-5:15. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and ***the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b)*** to thereby supply to the battery 93 of the portable electronic device 9. It is

Claim Limitation	Exemplary Prior Art Disclosures
	apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) Yeh, 6:59-7:10. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: ***Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a batter***y. The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. a first supercapacitor, which has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded.

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh, cl. 1. 2. The bidirectional wireless charging and discharging device as claimed in claim 1 further comprising a second supercapacitor, the second supercapacitor being connected in parallel with the battery. Yeh, cl. 2; *see also* Yeh, Figs. 1-3. **Cook** For example, Cook discloses: FIG. 2 shows a simplified schematic diagram of a wireless power transmission system. The transmitter 104, driven by input power 102, includes an oscillator 122, a power amplifier or power stage 124 and a ***filter*** and matching circuit 126. The oscillator is configured to generate a desired frequency, which may be adjusted in response to adjustment signal 123. The oscillator signal may be amplified by the power amplifier 124 with a power output responsive to control signal 125. The filter and matching circuit 126 may be included to ***filter out harmonics or other unwanted frequencies*** and match the impedance of the transmitter 104 to the transmit antenna 114. Cook, ¶ 30. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd ***harmonics filtering in form of a series resonant L-C circuits*** e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶56. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), ***odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T***, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶60; *see also id.* ¶62.

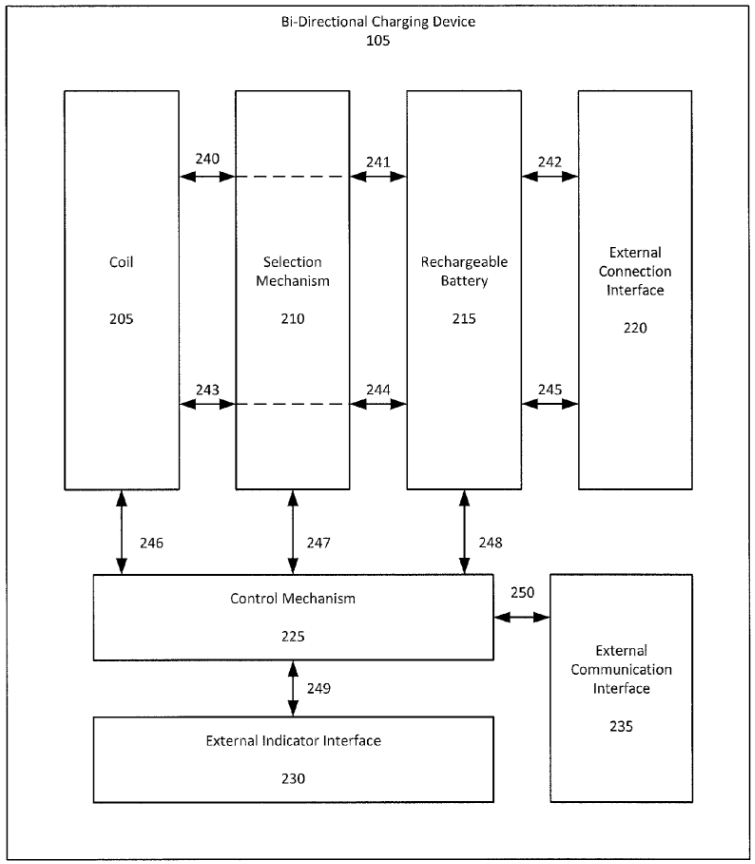
Claim Limitation	Exemplary Prior Art Disclosures
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	Schuessler discloses and/or renders obvious this limitation. First, Schuessler discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Schuessler discloses control mechanism that determines the mode for the bi-directional charging device and provides adjustment. For example: ***Control mechanism 225 represents the control hardware, firmware, and/or software that determines the mode for the bi-directional charging device 105, for example, a power receiving mode or a power delivering mode***. As discussed above, there may be multiple concurrent modes. ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown) to receive information or to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and ***control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer***. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215.

Claim Limitation	Exemplary Prior Art Disclosures
	Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215***. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 7:13-30. Bi-directional charging device 105 may include combinations of discrete and integrated components. For example, ***control mechanism 225 may include a processor implemented on a semiconductor device, and discrete input/output circuitry for the processor***. Further, multiple functions or portions of functions may be integrated within one or more semiconductor devices. For example, portions of selection mechanism 210, external connection interface 220, control mechanism 225, external indicator interface 230, and external communication interface 235 may all be integrated within one semiconductor device. Schuessler, 7:20-30. Second, Schuessler discloses and/or renders obvious “a second circuitry comprising: . . . a modulator/demodulator circuit.” For example: The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Schuessler, 5:5-21. One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high***

Claim Limitation	Exemplary Prior Art Disclosures
	frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. wherein the wireless communication mechanism is selected from Bluetooth, WiFi, other public or proprietary wireless protocols, ***modulation on the energy transfer itself, modulating a low frequency protocol on a high frequency energy transfer, by modulating a high frequency protocol on a low frequency energy transfer or an infrared interface***; Schuessler, cl. 1.
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Schuessler discloses and/or renders obvious this limitation. Schuessler discloses that a bi-directional wireless charger receives power wirelessly in, for example, a power-receiving mode. For example: ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively causes power to be delivered from the coil to the battery*** and selectively causes power to be delivered from the battery to the coil, and a control mechanism. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the coil to the battery***, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the battery to the coil. Schuessler, Abstract. ***A bi-directional charging device may wirelessly receive power*** and wirelessly deliver power. When the bi-directional charging device is in the vicinity of a charging bay it may receive power from the charging bay to recharge an internal battery. When the bi-directional charging device is in the vicinity of a rechargeable electronic device it may deliver power to the electronic device for recharging an internal battery of the electronic device. Thus, the bi-directional charging device may be kept near rechargeable electronic devices to recharge batteries in the electronic devices, for example throughout the day. The bi-directional charging device may itself be recharged when it is placed in the vicinity of a charging bay, for example overnight.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 1:41-53. ***Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode*** or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60.

Claim Limitation	Exemplary Prior Art Disclosures
	 *Fig. 2* Schuessler, Fig. 2 *See generally* Limitations [1p] and [1b].
[1e] said first circuitry, based on an input from said control logic	Schuessler, alone or in view of the references cited above in Limitation [1b], discloses and/or renders obvious “said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network,” as explained above in claim limitation [1b].

Claim Limitation	Exemplary Prior Art Disclosures
circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device;	Schuessler, alone of in view of the reference cited in Limitation [1c], discloses and/or renders obvious that changing "impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device" is "based on an input from said control logic circuit." Schuessler discloses that a control mechanism controls the coil circuitry and selection mechanism to direct power from a coil to a rechargeable battery. For example: ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown)*** to receive information or ***to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then ***tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For***

Claim Limitation	Exemplary Prior Art Disclosures
	example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. ***Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode*** or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection

Claim Limitation	Exemplary Prior Art Disclosures
	mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. *See also* Limitations [1b], [1c].
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	Schuessler, alone or in view of the references cited above in Limitation [1b], discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network," as explained above in claim limitation [1b]. Schuessler, alone or in view of the references cited above in Limitation [1c], also discloses and/or renders obvious that changing "said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver" is "based on an input from said control logic circuit." Schuessler discloses that a control mechanism controls the coil circuitry and selection mechanism to direct power from a coil to a rechargeable battery. For example: ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown)*** to receive information or ***to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic

Claim Limitation	Exemplary Prior Art Disclosures
	device 115, then ***tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225***. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate***

Claim Limitation	Exemplary Prior Art Disclosures
	frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. ***Selection mechanism 210 selects the direction of energy transfer,*** either directing power to rechargeable battery 215 in a power receiving mode or ***directing power from rechargeable battery 215 in a power delivering mode***. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively*** causes power to be delivered from the coil to the battery and selectively ***causes power to be delivered from the battery to the coil, and a control mechanism***. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the coil to the battery, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the battery to the coi***l.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, Abstract. *See also* Limitations [1b], [1c].
[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	Schuessler discloses and/or renders obvious this limitation. Schuessler teaches receiving communication from the second electronic device such as charging needs, status, handshaking, power deliver request, charging completion, and that such communication can be modulated on the energy transfer itself. For example: One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding ***charging needs and status***. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. If communication capability is included in both bi-directional charging device 105 and rechargeable electronic device 115 as described above, then the devices may communicate with each other to coordinate energy transfer. ***Coordination of energy transfer may include beginning and ending energy transfer and status communication during energy transfer***. Schuessler, 3:56-61. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform ***handshaking*** with an external device, and then inform control mechanism 225 of ***an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. External communication interface 235 may be used by bi-directional charging device 105 to make requests to external devices for charging. For example, upon recognizing that a charging bay 110

Claim Limitation	Exemplary Prior Art Disclosures
	is in the vicinity, bi-directional charging device 105 may request the charging bay 110 to begin delivering power. External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies. An external device may notify bi-directional charging device 105 that charging is complete, and control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215. Schuessler, 6:62-7:19. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. ***A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge***. Schuessler, 8:7-21. Multiple bi-directional charging devices 105 may be within charging distance of each other. In such cases, one of the bi-directional charging devices 105 may charge another bi-directional charging device 105. A protocol may be implemented for determining which of multiple devices 105 is to provide charge and which is to receive charge. For example, a protocol may include a determination within one or more bi-directional charging devices 105 as to battery state of charge and expected battery life at the present rate of use and a further determination of whether a device 105 has reached a critical battery state of charge. A protocol may include a heuristic to automatically determine whether a device 105 should be used to charge another device 105. A protocol may include a user notification on a first device 105 that a second device 105 in the vicinity needs to be charged, and that the expected battery life of the first device 105 will be reduced by an amount if the first device 105 is used to charge the second device 105. A user interface on the first devices 105 may allow a user to direct that charge be provided to the second

Claim Limitation	Exemplary Prior Art Disclosures
	device 105, or direct that no charge be provided to the second device 105. Many other protocols may be implemented to address the situation in which multiple bi-directional recharging devices 105 are within charging distance of each other wherein each device 105 may have a different level of battery charge. Schuessler, 8:53-9:10. To the extent it is argued that Schuessler does not teach this limitation, this limitation would have been obvious in view of the teachings of the following references. A POSA would have found it obvious to apply communication techniques taught in one or more of the following references in implementing Schuessler's bi-directional wireless charger because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improved functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Chatterjee** Chatterjee discloses a processor in the inductive signal interface that receives and process data from a second electronic device via a modulator/demodulator, including data about type identification, status, authentication, enumeration, presence of the other device, protocol, and wireless power needs. For example: The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device***

Claim Limitation	Exemplary Prior Art Disclosures
	320. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was

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	treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the

Claim Limitation	Exemplary Prior Art Disclosures
	mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal.

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	Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The communication circuit includes a modulator 416 and a demodulator 417.*** The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH).

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶¶ 51-55. **<u>Corbridge</u>** Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. For example: FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***<u>data may be conveyed by either modulating an inductive power signal</u>*** or using a separate data signal path.

Claim Limitation	Exemplary Prior Art Disclosures
	The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path). Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the***

Claim Limitation	Exemplary Prior Art Disclosures
	signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0" values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a

Claim Limitation	Exemplary Prior Art Disclosures
	small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step 1120)***. Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is

Claim Limitation	Exemplary Prior Art Disclosures
	communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

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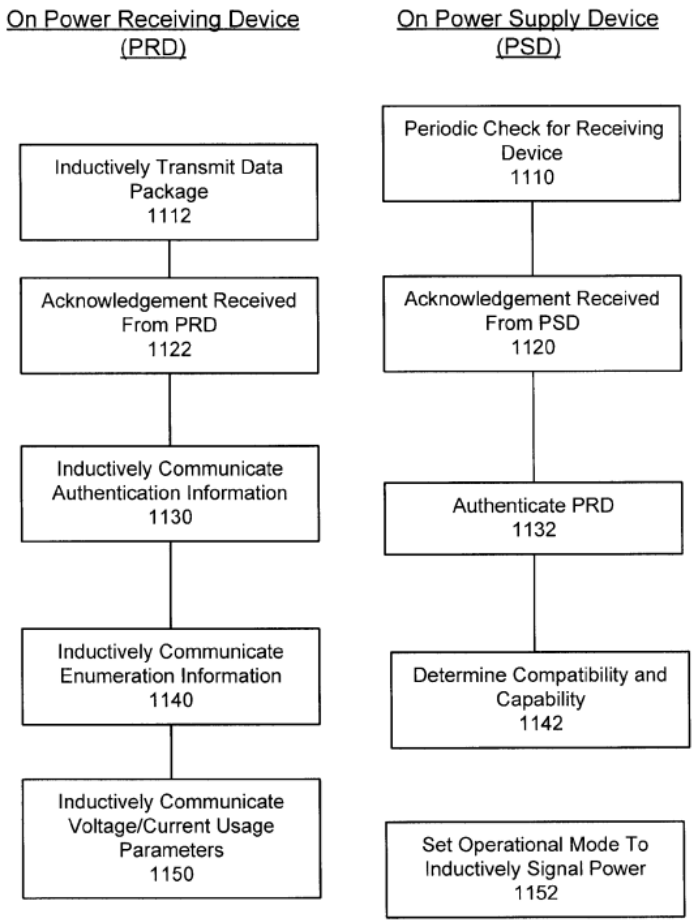


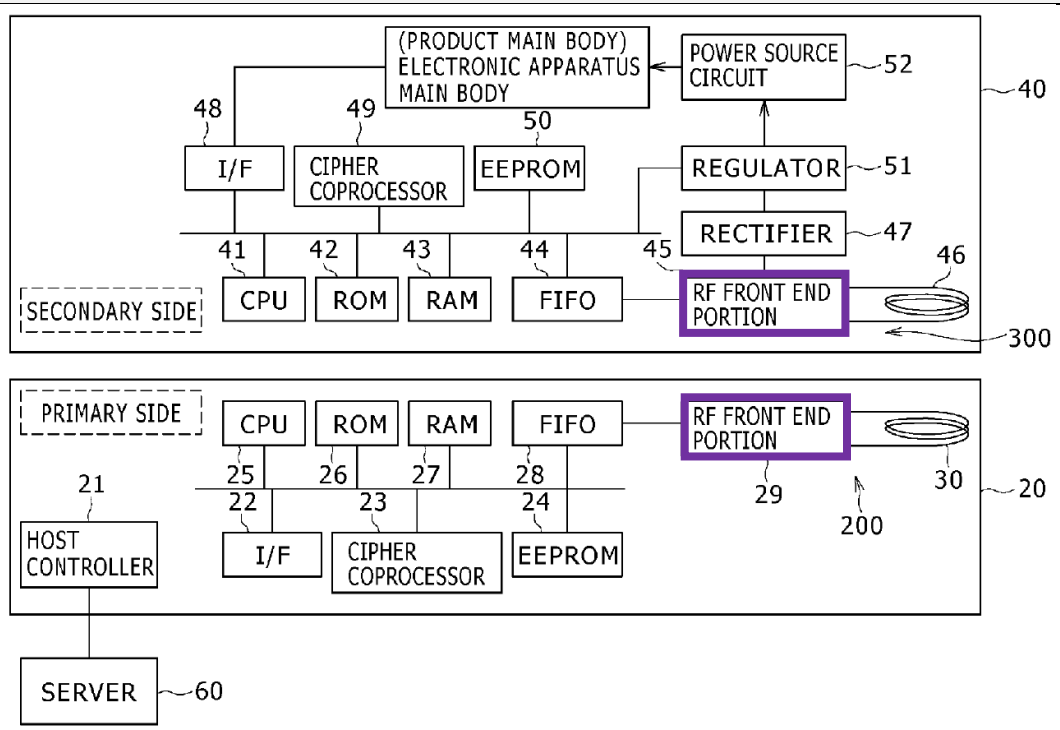
FIG. 11

Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

Teramoto

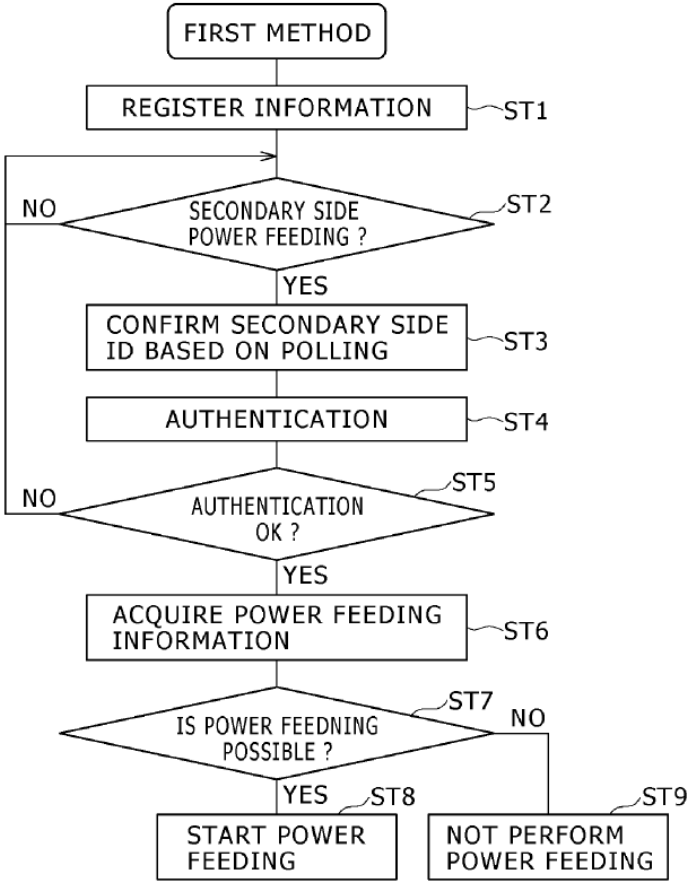
Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. For example: The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** The WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of data defined in

Claim Limitation	Exemplary Prior Art Disclosures
	the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. For example: Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1.

Claim Limitation	Exemplary Prior Art Disclosures
	4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme") From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 Signal Strength Value **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 End Power Transfer Code

Claim Limitation	Exemplary Prior Art Disclosures

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two's complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

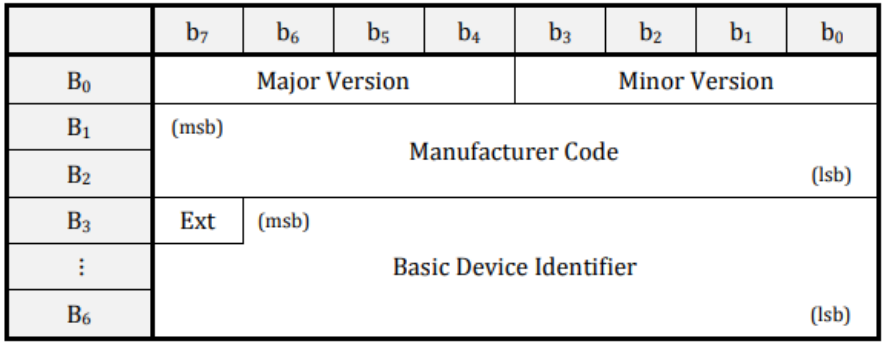
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

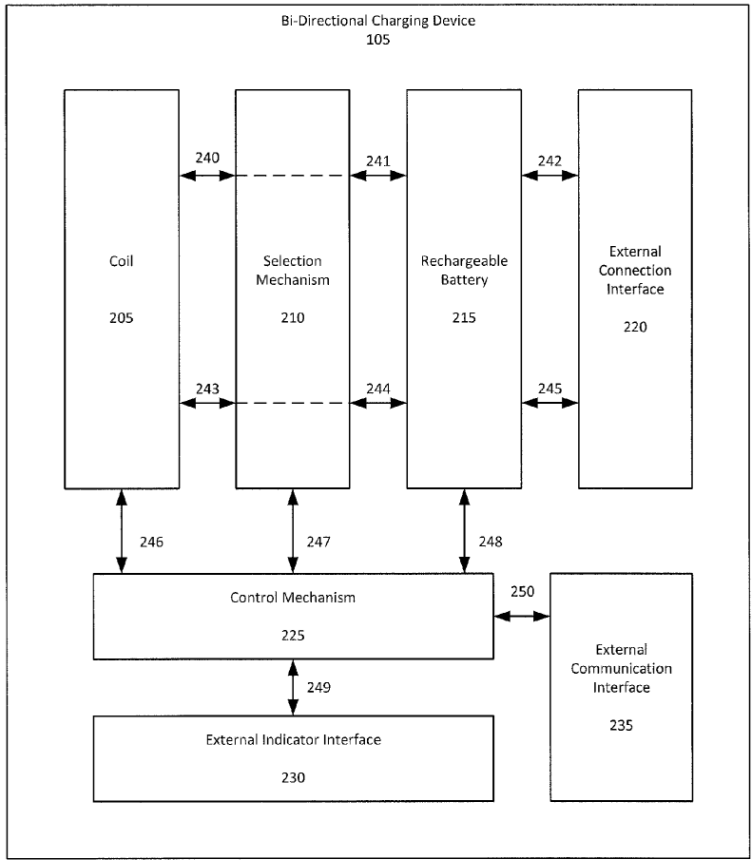
	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Schuessler, alone or in combination with one or more of the references cited above for claim limitation [1g], discloses and/or renders obvious this limitation. Schuessler discloses that a control mechanism receives and process data from a second electronic device for controlling the operation and power transfer of a bi-directional wireless charger. For example: ***External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. ***External communication interface 235 may be used by bi-directional charging device 105 to make requests to external devices for charging***. For example, upon recognizing that a charging

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	bay 110 is in the vicinity, bi-directional charging device 105 may request the charging bay 110 to begin delivering power. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215. Schuessler, 6:52-7:6. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. ***A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge***. Schuessler, 8:7-21. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-19. This limitation would also have been obvious in view of one or more references cited above for claim limitations [1g]. A POSA would have found it obvious to apply the communication techniques taught in one or more of those references in implementing Schuessler's bidirectional wireless charger to provide a second circuitry that is configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol because it involves nothing more than combining prior art elements

Claim Limitation	Exemplary Prior Art Disclosures
	according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improve functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See also supra* Limitations [1c], [1g].
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Schuessler, alone or in combination with one or more of the references cited above for claim [1g], discloses and/or renders obvious this limitation. Schuessler discloses that a control mechanism adjusts the operation and power transfer of a bi-directional wireless charger based on data received from a second electronic device. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215***. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an

Claim Limitation	Exemplary Prior Art Disclosures
	implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26.  *Fig. 2*

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, Fig. 2. ***External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. Schuessler, 6:52-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-19. It would also have been obvious to apply the teachings of one or more references discussed in Limitation [1g] in implementing Schuessler's bi-directional wireless charger because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer, such as to perform a function associated with said transmitted power in conjunction with said first circuitry based on interpretation of data received from the receiver. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See also supra* Limitations [1c], [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch	Schuessler, alone or in view of the references in limitation [1b], discloses and/or renders obvious this limitation. Schuessler discloses that a selection mechanism comprises switching circuitry including FETs that transfer power between an inductive coil and a rechargeable battery.

Claim Limitation	Exemplary Prior Art Disclosures
network of said first circuitry is configured as one of an inverter and a rectifier.	For example: Selection mechanism 210 may include electrical and/or mechanical selection. For example, a ***selection mechanism 210 may be a mechanical switch*** on the outside of a housing containing bi-directional charging device 105. As another example, ***selection mechanism 210 may be circuitry internal to bi-directional charging device 105, such as switching circuitry including power FETs (field effect transistors) or other electronic switches***. Selection mechanism 210 may be controlled by control mechanism 225, discussed below. Schuessler, 4:35-60. Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the ***FETs may be turned on and off by electrical signals from control mechanism 225***. Schuessler, 6:11-17. ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively causes power to be delivered from the coil to the battery and selectively causes power to be delivered from the battery to the coil, and a control mechanism***. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the coil to the battery, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the battery to the coil. Schuessler, Abstract. *See also supra* claim limitation [1b].

U.S. Pat. No. 8,698,450 (“Yeh”)

The asserted claims of U.S. No. 10,038,339 (the “’339 patent”) are anticipated and/or rendered obvious by U.S. Pat. No. 8,698,450 (“Yeh”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. 2011/0018356 (“Chatterjee”), U.S. Patent Application Publication No. 2013/0026981 (“Van Der Lee”), U.S. 8,400,801 (“Shinoda”), U.S. Pat. No. 9,837,203 (“Singh-203”), U.S. Patent No. 8,942,624 (“Singh-624”), U.S. Patent Pub. No. 2013/0257167 (“Singh-167”), U.S. Pat. No. 8,901,875 (“Schuessler”), U.S. Patent Application Publication No. 2010/0148723 (“Cook”), U.S. 2010/0083012 (“Corbridge”), U.S. 2012/0049646 (“Teramoto”), and/or WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 (“WPT Standard” or “WPT”).

Yeh was filed on December 27, 2011 and published on June 27, 2013. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(2).

Chatterjee was filed on December 1, 2009 and published on January 27, 2011. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Van Der Lee was filed on July 28, 2011 and published on January 31, 2013. It qualifies as prior art under either pre-AIA 102(e), or post-AIA 102(a)(2).

Shinoda was filed on October 25, 2011, published on February 16, 2012, and issued on March 19, 2013. It qualifies as prior art under pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Singh-203 was filed on March 29, 2012, published on October 3, 2013, and issued on December 5, 2017. It qualifies as prior art under pre-AIA 102(e), or post AIA 102(a)(2).

Singh-624 was filed on March 30, 2012, published on October 3, 2012, and issued on January 27, 2015. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Singh-167 was filed on March 29, 2012 and published on October 3, 2013. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Schuessler was filed on March 3, 2011 and published on September 13, 2012. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Cook was filed on September 1, 2009 and published on June 17, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Corbridge was filed on June 4, 2009 and published on April 1, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Teramoto was filed on August 23, 2011 and published on March 1, 2012. It qualifies as prior art under either pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1).

Claim Limitation	**Exemplary Prior Art Disclosures**
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	To the extent the preamble is limiting, Yeh teaches and renders obvious a "dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver." Yeh discloses a bidirectional wireless charging and discharging device for an electronic device that selectively operates in a receiving mode and a transmission mode to charge a battery of the electronic device, or to transmit power from the battery to charge a second electronic device. For example: Disclosed is a ***bidirectional wireless charging and discharging device*** for portable electronic device. The bidirectional wireless charging and discharging device includes: a wireless receiving and transmitting unit and a logic control unit, a step-up/step-down unit, first and second reverse current protectors, a control switch, and at least a supercapacitor. The first and second reverse current protectors function to prevent reverse current and to switch. The step-up/step-down unit controls step-up conversion in discharging and step-down conversion in charging. The logic control unit detects if a load exists on an opposite side of the wireless receiving and transmitting unit and controls the operations of the step-up/step-down unit and the first and second reverse current protectors, and can be even combined with a control switch to control selectively charging and discharging operations. The supercapacitor absorbs surge occurring in each charging operation. Yeh, Abstract. The present invention relates to a bidirectional wireless charging and discharging device, and in particular to ***a bidirectional wireless charging and discharging device for portable electronic device that protects a rechargeable battery*** from accumulated damage caused by repeated charging and improves wireless charging/discharging efficiency and step-up/step-down efficiency.

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh, 1:7-14. The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to ***the transmission mode***, the control switch 5 is actuated to effect switching. Presumably, ***a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device***. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition. The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be

Claim Limitation	Exemplary Prior Art Disclosures
	successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so ***that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37***. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, ***the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current***. Yeh, 5:40-6:37. The ***receiving mode*** of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with ***a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93*** of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the

Claim Limitation	Exemplary Prior Art Disclosures
	opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition. Yeh, 6:48-7:18; *see also* Yeh, Figs. 1-3. Yeh discloses or renders obvious the "dual mode wireless power receiver configured to . . . communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device." Yeh discloses communication between the two electronic devices such as whether a load exists on the detection pin, that results in charging of the second electronic device. For example: ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna***. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; ***if there is a load***: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that ***electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical***

Claim Limitation	Exemplary Prior Art Disclosures
	power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. Yeh, 6:4-29; *see also id.* Figs. 3-7.
[1a] one of coil and capacitor electrodes;	Yeh discloses or renders obvious this limitation. Yeh discloses a wireless receiving and transmitting unit that comprises an internal winding for converting between electrical current and magnetic force. For example: In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. ***When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current.*** Yeh, 6:30-37. When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives ***electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2*** thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. Yeh, 6:51-58.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	Yeh, in view of one or more of the references cited below, renders obvious this limitation. First, Yeh, alone or in view of one or more of the references cited below, discloses and/or renders obvious "a first circuitry comprising: an impedance network." Yeh discloses a capacitor connected to a wireless receiving and transmitting unit.

Claim Limitation	Exemplary Prior Art Disclosures

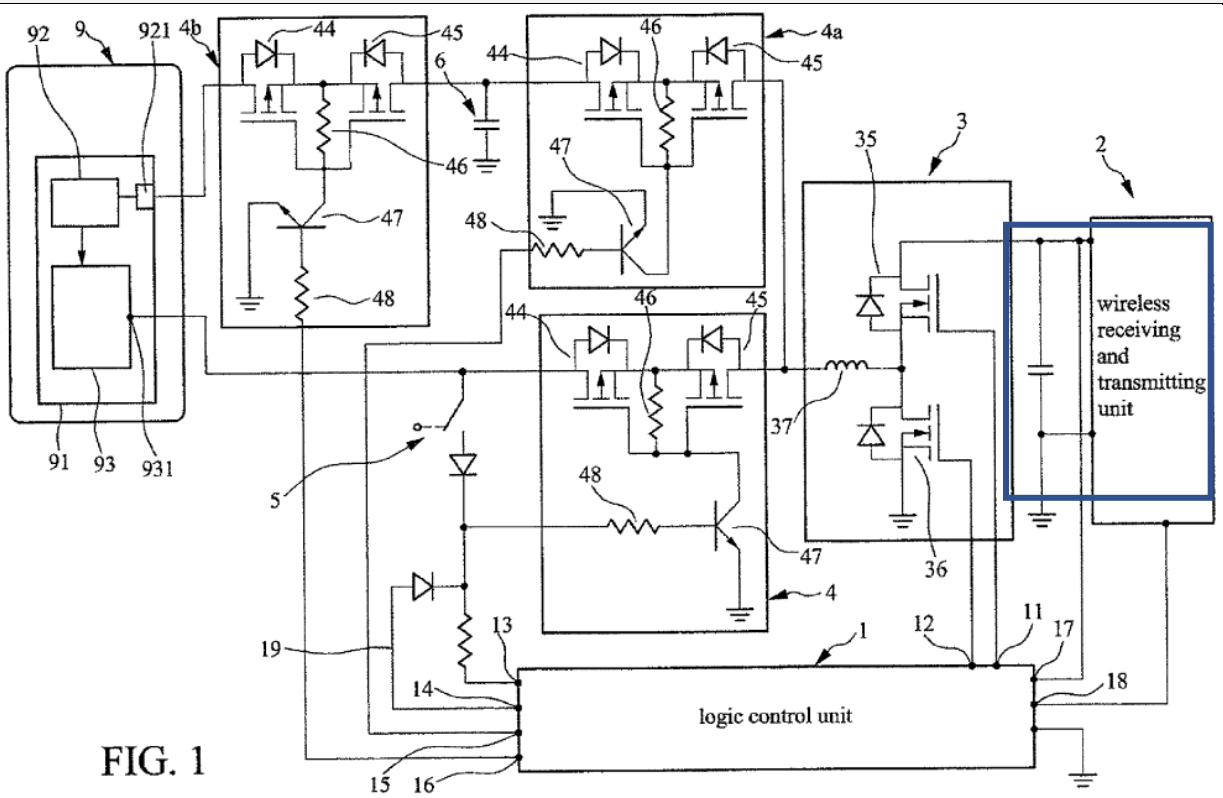
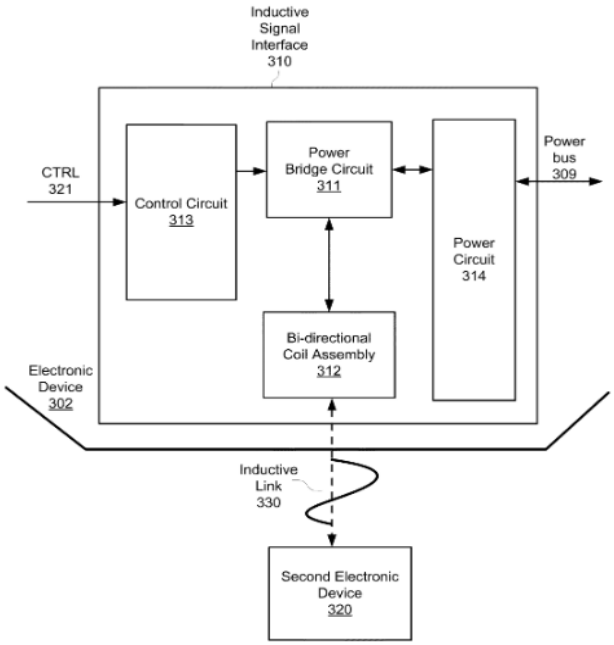


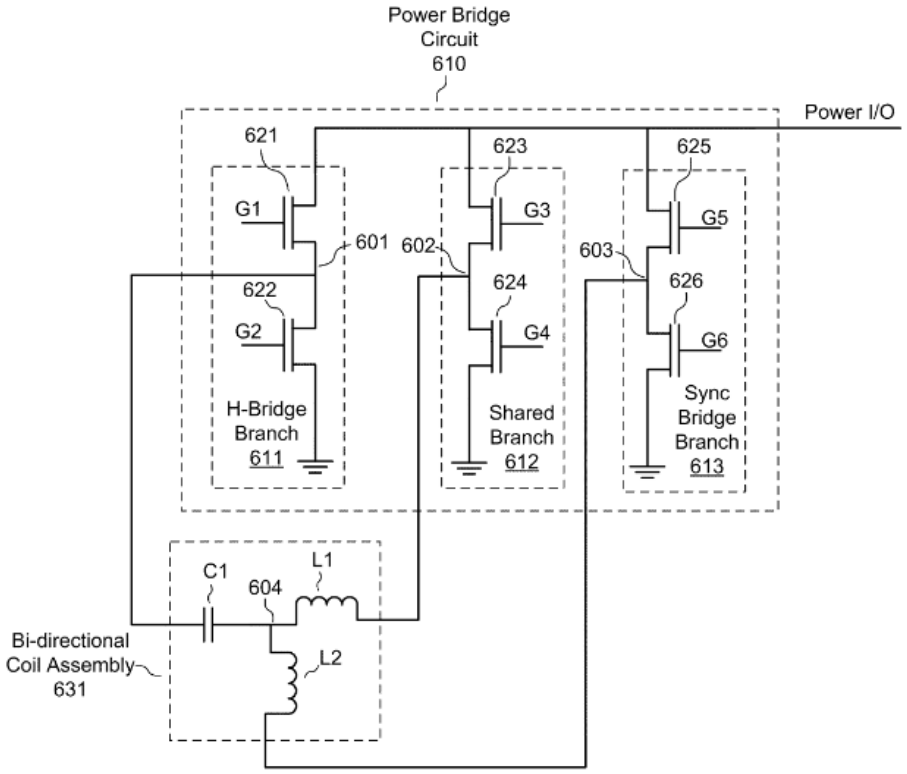
FIG. 1

Yeh, Fig. 1.

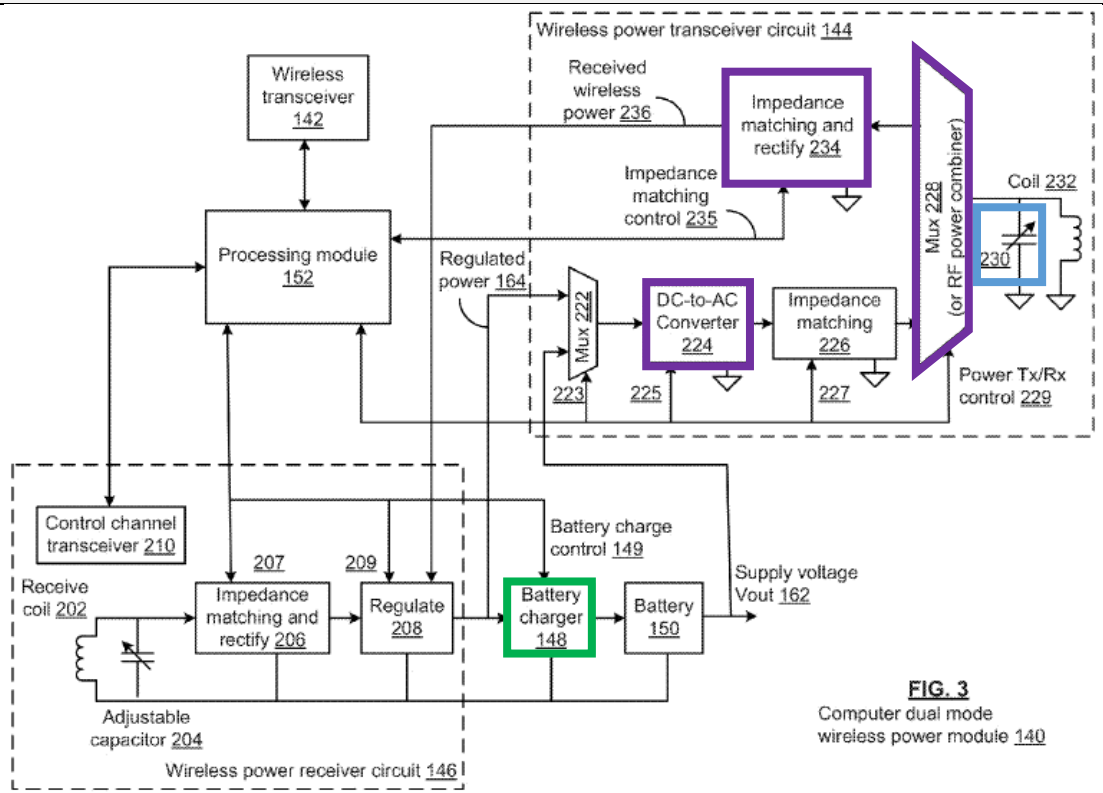
A POSA would have found it obvious to implement the impedance network taught in one or more of the following references in Yeh's bi-directional wireless charging and discharging device, because it involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA would have appreciated the benefit of providing an impedance network to provide changeable impedance to improve the power charging efficiency. A POSA would have had a reasonable expectation of success because adjusting impedance for wireless power charging is well known in the art.

Chatterjee

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee discloses a bi-directional coil assembly whose impedance is changeable. For example:  **FIG. 3** Chatterjee, Fig. 3; *see also id.* Fig. 4. By selectively turning off the H-bridge branch 611 or the sync bridge branch 613, the power bridge circuit 610 is configurable to ***selectively turn off current paths in the bi-directional coil assembly 631 to change the impedance of the bi-directional coil assembly 631 based on the mode of operation of the inductive signal interface***. For example, in the power receive mode of the inductive signal interface, the current paths through the bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the capacitor C1 and the inductive coil

Claim Limitation	Exemplary Prior Art Disclosures
	L1. In the power transmit mode, the current path through bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the inductive coils L1 and L2. Chatterjee, ¶ 66.  Chatterjee, Figs. 6A; *see also id*. Figs. 6B-6D, ¶¶ 61-73. *See generally* Chatterjee, Figs. 7, 9, 10. **Van Der Lee** Van Der Lee discloses and/or renders obvious a capacitor and/or a coil whose impedance is adjustable. For example:

Claim Limitation	Exemplary Prior Art Disclosures

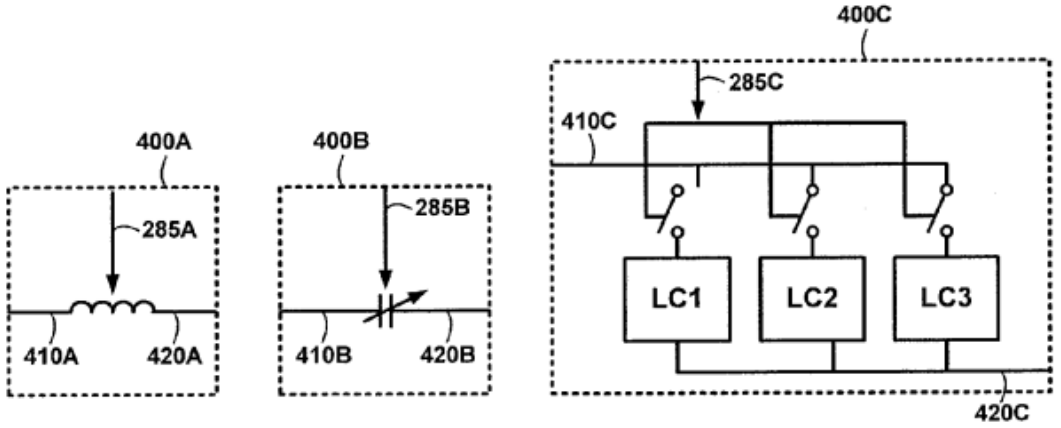


Van Der Lee, Fig. 3.

> The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, a DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, ***an adjustable capacitor 230***, and a coil 232.

Van Der Lee, ¶ 51.

> In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and

Claim Limitation	Exemplary Prior Art Disclosures
	MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. ***As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit***. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54, Fig. 3; *see also id.* ¶¶ 62, 73, Fig. 4. **Singh-167** Singh-167 teaches an impedance adjuster 400 that provides variable impedance. For example:  FIG. 4A FIG. 4B FIG. 4C

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-167 at Figs. 4A-4C; *see also* Singh-167, Figs. 2-3. The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level.

Claim Limitation	Exemplary Prior Art Disclosures
	At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal

Claim Limitation	Exemplary Prior Art Disclosures
	268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.

Claim Limitation	Exemplary Prior Art Disclosures

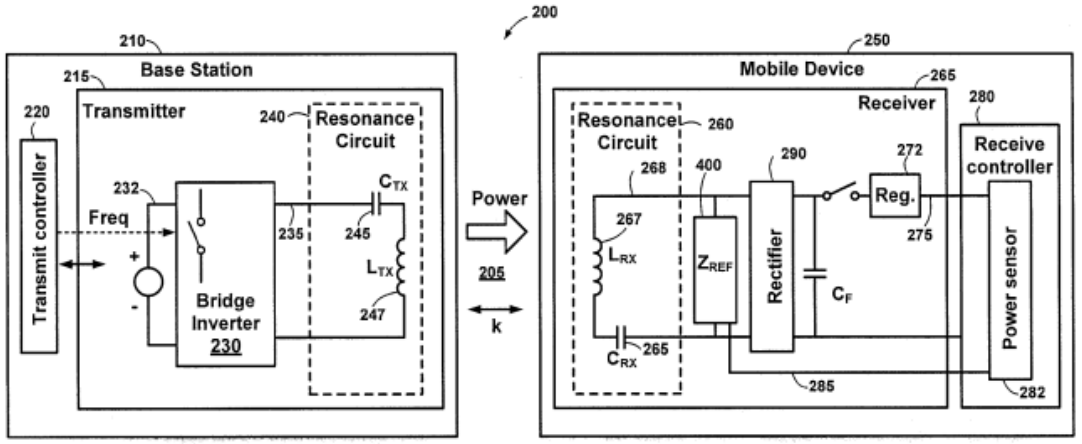


FIG. 2

Singh-167, Fig. 2.

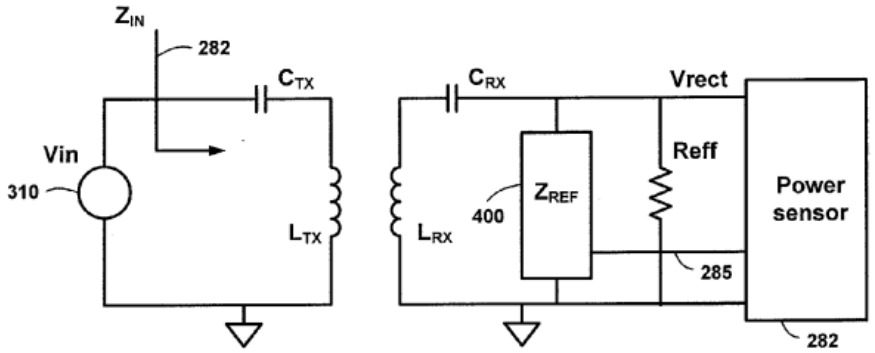


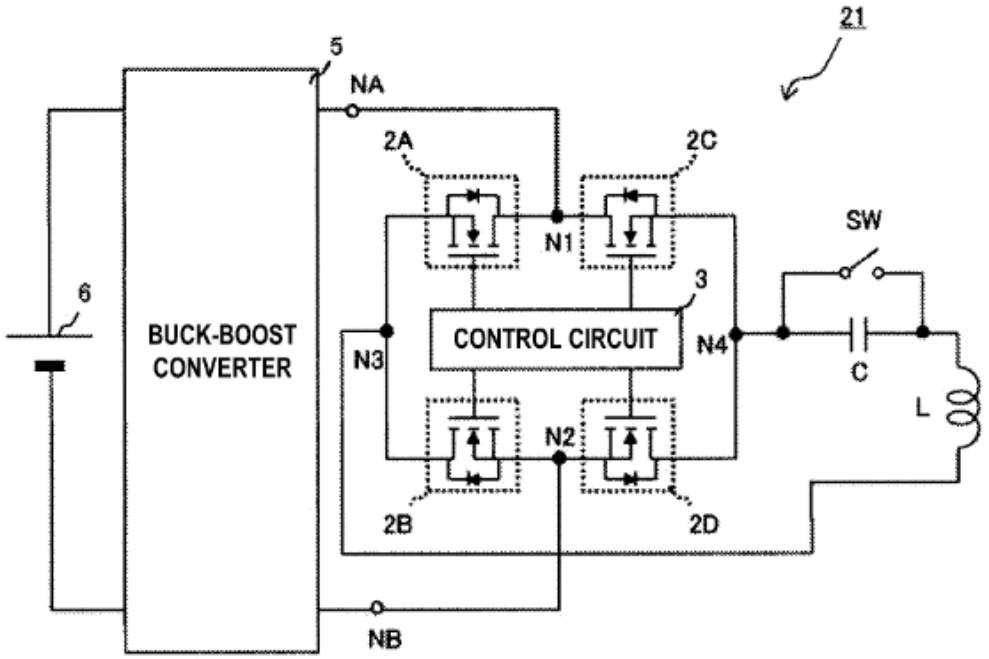
FIG. 3

Singh-167, Fig. 3.

Claim Limitation	Exemplary Prior Art Disclosures
	Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN. Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above. Singh-167, ¶¶ 48-49. FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below.

Claim Limitation	Exemplary Prior Art Disclosures
	In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line 520. This larger impedance will result in less power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240,

Claim Limitation	Exemplary Prior Art Disclosures
	which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7. **Shinoda** Shinoda discloses a resonant capacitor that can be connected or bypassed in different modes. For example: The wireless power transfer terminal 11 includes the FETs 2A to 2D, coil L, control circuit 3, a switch SW, and a resonant capacitor C. The resonant capacitor C is provided between the node N4 and the coil L, and the switch SW is provided in parallel with the resonant capacitor C. ***The capacitance of the resonant capacitor C is set such that it is connected to the coil L and resonates in series therewith***. ***For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:52-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 4, 7. **Schuessler** Schuessler discloses circuits such as a resonant circuit, a switched power amplification circuit, and/or circuits that may include the capability for tuning the energy deliver or receipt frequency. For example: Coil 205 generally is coupled to circuitry, not shown in FIG. 2, for the transfer of energy through coil 205. For example, ***coil 205 may be included in a resonant circuit for energy transfer through resonance. As another example, coil 205 may be included in a switched power amplification circuit. Coil 205 may be included in a wide variety of other circuits for delivering***

Claim Limitation	Exemplary Prior Art Disclosures
	or receiving power. Circuits including coil 205 may include the capability for tuning the energy delivery or receipt frequency. Schuessler, 4:19-27. ***Control mechanism 225 may provide adjustment to coil 205, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Schuessler, 5:57-62.

Claim Limitation	Exemplary Prior Art Disclosures

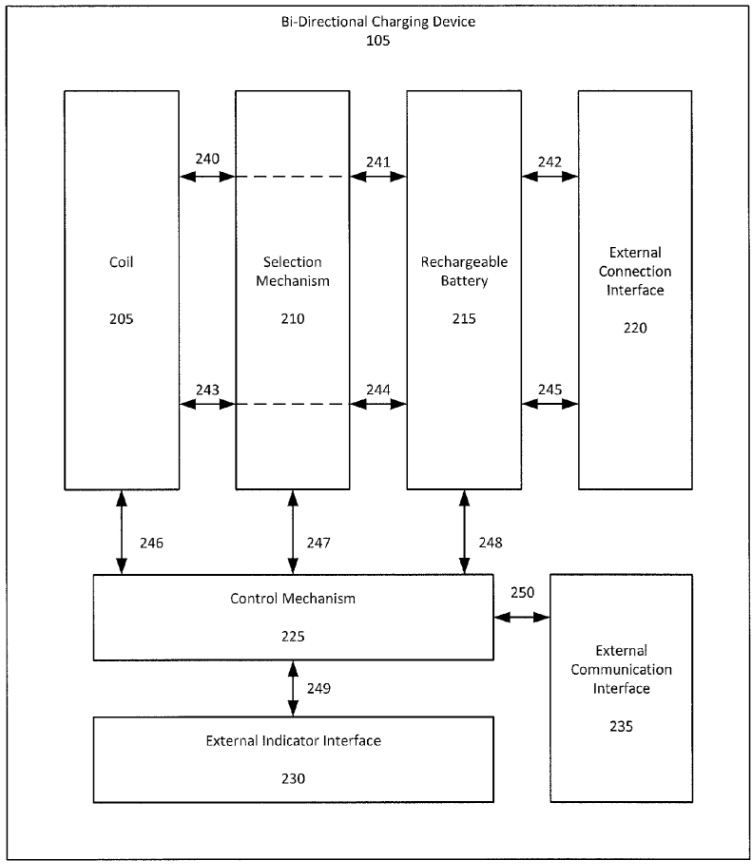


Fig. 2

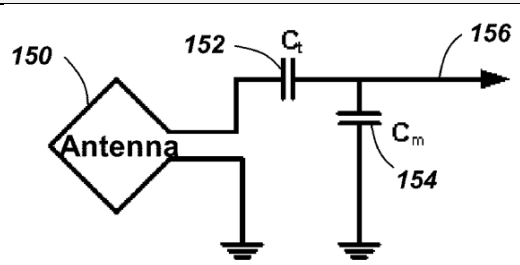
Schuessler, Fig. 2.

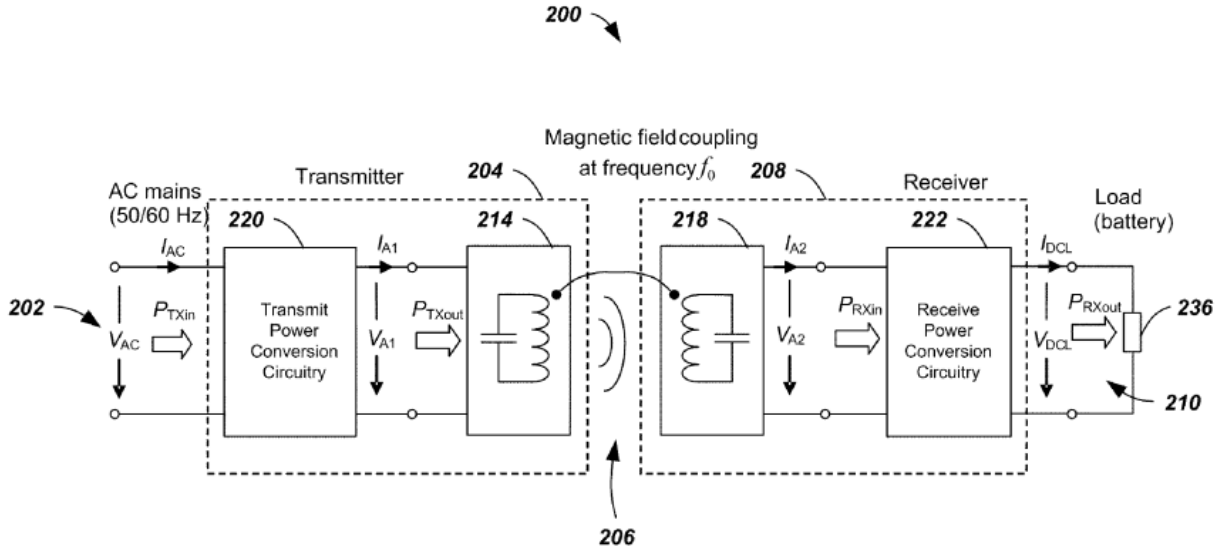
Cook

Cook discloses and/or renders obvious a capacitor connected to the coil and has adjustable capacitance.

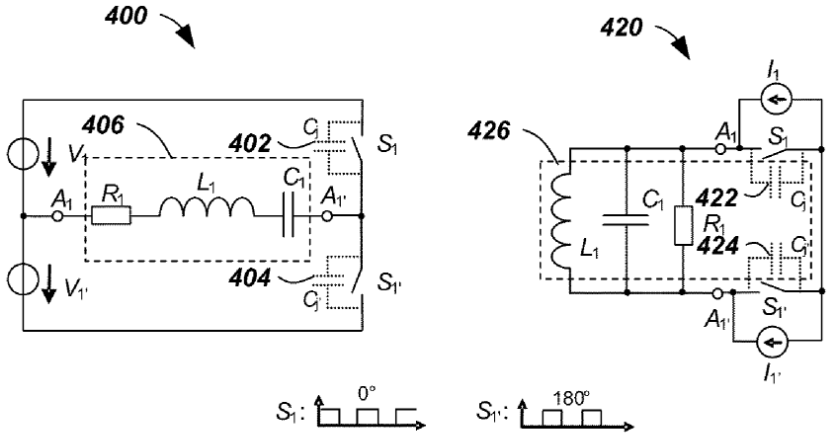
For example:

Claim Limitation	Exemplary Prior Art Disclosures
	An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to charge a battery 136 as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. ***The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118***. Cook, ¶31. As stated, ***efficient transfer of energy between the transmitter 104 and receiver 108 occurs during matched or nearly matched resonance between the transmitter 104 and the receiver 108***. However, even when resonance between the transmitter 104 and receiver 108 are not matched, energy may be transferred at a lower efficiency. Transfer of energy occurs by coupling energy from the near-field of the transmitting antenna to the receiving antenna residing in the neighborhood where this near-field is established rather than propagating the energy from the transmitting antenna into free space. ***The resonant frequency of the loop antennas is based on the inductance and capacitance. Inductance in a loop antenna is generally the inductance created by the loop, whereas, capacitance is generally added to the loop antenna's inductance to create a resonant structure at a desired resonant frequency***. As a non-limiting example, ***capacitor 152 and capacitor 154 may be added to the antenna to create a resonant circuit that generates a sinusoidal or quasi-sinusoidal signal 156***. Accordingly, for larger diameter loop antennas, the size of capacitance needed to induce resonance decreases as the diameter or inductance of the loop increases. Furthermore, as the diameter of the loop antenna increases, the efficient energy transfer area of the near-field increases for "vicinity" coupled devices. Of course, other resonant circuits are possible. As another non-limiting example, a capacitor may be placed in parallel between the two terminals of the loop antenna. In addition, those of ordinary skill in the art will recognize that for transmit antennas the resonant signal 156 may be an input to the loop antenna 150. Cook, ¶¶ 34-35.

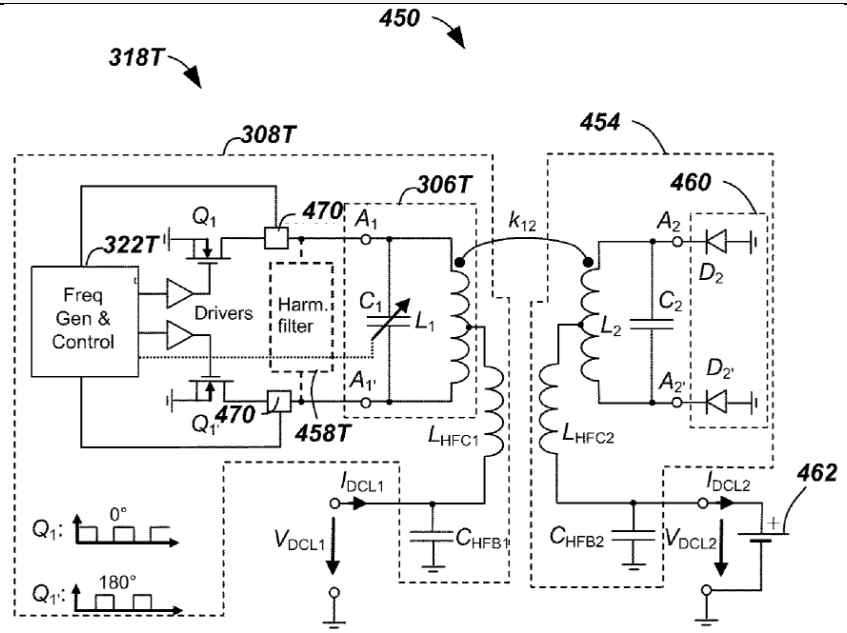
Claim Limitation	Exemplary Prior Art Disclosures
	 ***FIG. 3*** *see also* Cook, Figs. 2, 3. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter.

Claim Limitation	Exemplary Prior Art Disclosures
	Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if ***both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0***. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41.  FIG. 4 Cook, Fig. 4

Claim Limitation	Exemplary Prior Art Disclosures
	As described herein, wireless power transfer uses ***coupled resonance (e.g.*** ***capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency***. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of a half bridge rectifier topology 400 including ***a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna*** where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration. The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances

Claim Limitation	Exemplary Prior Art Disclosures
	C j 422 and Cj′ 424. ***The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency***. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.  ***FIG. 8*** Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where "T" indicates a Transmitter configuration) with a half bridge active rectifier configured with the ***switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454***.

Claim Limitation	Exemplary Prior Art Disclosures
	Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). ***Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency***. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 9 Cook, Fig. 9. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, ***low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T,***

Claim Limitation	Exemplary Prior Art Disclosures
	L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶61. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all.*** Cook, ¶61.

Claim Limitation	Exemplary Prior Art Disclosures
	See also Cook, Figs 7-10. **WPT** WPT discloses an impedance matching circuit. For example:

Claim Limitation	Exemplary Prior Art Disclosures

As shown in Figure 3-12, Power Transmitter design B1 uses a half-bridge inverter to drive the Primary Coil array. In addition, Power Transmitter design B1 uses a multiplexer to select the position of the Active Area. The multiplexer shall configure the Primary Coil array in such a way that one, two, or three Primary Coils are connected—in parallel—to the driving circuit. The connected Primary Coils together constitute a Primary Cell. As an additional constraint, the multiplexer shall select the Primary Coils such that each selected Primary Coil has an overlap with every other selected Primary Coil; see Figure 3-10(c) for an example.

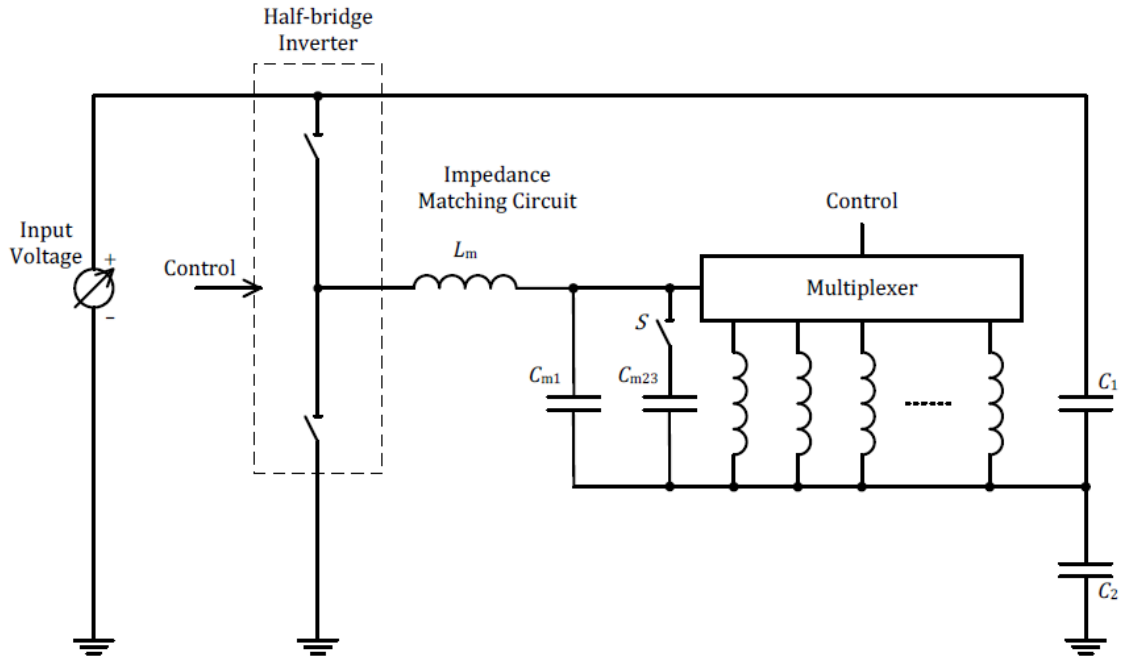


Figure 3-12: Electrical diagram (outline) of Power Transmitter design B1

Claim Limitation	Exemplary Prior Art Disclosures
	Within the Operating Frequency range $f_{op} = 105 \ldots 113$ kHz, the assembly of Primary Coil array and Shielding has an inductance of $8.1^{\pm 1}$ µH for each individual Primary Coil in layer 1 (closest to the Interface Surface), $8.7^{\pm 1}$ µH for each individual Primary Coil in layer 2, and $9.6^{\pm 1}$ µH for each individual Primary Coil in layer 3. The capacitances and inductance in the impedance matching circuit are, respectively, $C_{m1} = 300^{\pm 5\%}$ nF, $C_{m23} = 200^{\pm 5\%}$ nF,and $L_m = 3.8^{\pm 5\%}$ µH. The capacitances C_1 and C_2 in the half-bridge inverter both are 68 µF. The switch S is open if the Primary Cell consists of a single Primary Coil; otherwise, the swich S is closed. (Informative) *The voltage across the capacitance C_m can reach levels exceeding 36 V pk-pk.* WPT, 23. Second, Yeh discloses and/or renders "a first circuitry comprising: . . . a switch network". Yeh discloses a step up/step down unit, a first reverse current protector, a second reverse current protector, and/or a third reverse current protector, that comprise switches that operate differently under different modes. For example: The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, ***the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification***. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36.

Claim Limitation	Exemplary Prior Art Disclosures
	The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. Yeh, 3:58-4:30. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1. Yeh, 4:40-47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included.

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh, 4:54-5:8. Referring to FIGS. 1 and 2, ***each reverse current protector (4, 4a, 4b) comprises a first resistor 46 and serially-connected oppositely-directed first and second MOSFETs 44, 45***. Two ends of the two serially-connected MOSFETs are respectively the input terminal 41 and the output terminal 42 of the reverse current protector. The first and second MOSFETs 44, 45 each have a control terminal (not labeled), and the two control terminals are electrically connected to the control terminal 43 of the reverse current protector. The first resistor 46 has an end electrically connected between the first and second MOSFETs 44, 45 and an opposite end also electrically connected to the control terminal 43 of the reverse current protector. Further, each reverse current protector (4, 4a, 4b) further comprises a transistor 47 and a second resistor 48. The transistor 47 has a first terminal electrically connected to the control terminals (not labeled) of the first and second MOSFETs 44, 45, and a second terminal of the transistor 47 is grounded. The second resistor 48 is electrically connected between a third terminal of the transistor 47 and the control terminal 43 of the reverse current protector. Yeh, 5:17-36. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. ***When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1***. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. Yeh, 5:44-63.

Claim Limitation	Exemplary Prior Art Disclosures
	if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. ***With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:12-29. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 6:38-44. When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range

Claim Limitation	Exemplary Prior Art Disclosures
	of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:51-7:18.

Claim Limitation	Exemplary Prior Art Disclosures

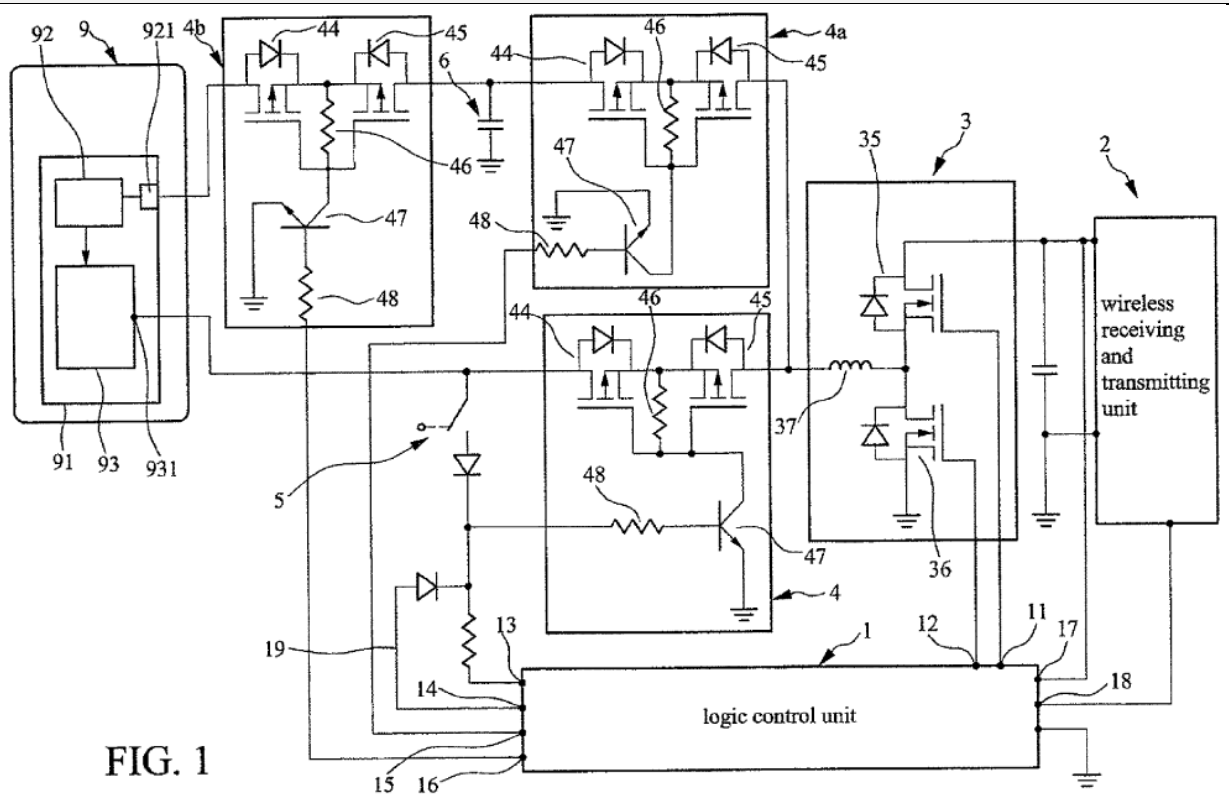


FIG. 1

Yeh, Fig. 1; *see also id.* Figs. 2-3.

In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery. ***The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with***

Claim Limitation	Exemplary Prior Art Disclosures
	synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. ***The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency***. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. Third, Yeh discloses and/or renders obvious "a first circuitry comprising . . . a filter capacitor." Yeh discloses a supercapacitor. For example: An objective of the present invention is to provide a bidirectional wireless charging and discharging device, which makes use of the arrangement of supercapacitors in specific locations and ***the supercapacitors having resistances lower than a battery to allow, in a charging operation, the supercapacitors to be charged first for blocking surges occurring in the charging operation*** and thus realizing protection against accumulated damage caused by charging of the battery; makes use of the function of preventing reverse current by first and second reverse current protectors to eliminate electrical leakage to thereby save power. Yeh, 2:52-62. To realize the above objectives, the present invention provides a bidirectional wireless charging and discharging device, which is applicable to a portable electronic device having a circuit device. The circuit device is electrically connected to a power receiving terminal and a battery. The bidirectional wireless charging and discharging device comprises a logic control unit, a wireless receiving and transmitting unit, a step-up/step-down unit, a first reverse current protector, a second reverse current protector, a control switch, and a first supercapacitor, wherein the logic control unit comprises a plurality of pins; the wireless receiving and transmitting unit has a transmission

Claim Limitation	Exemplary Prior Art Disclosures
	terminal and a test terminal, the test terminal being electrically connected to a detection pin of the logic control unit; the step-up/step-down unit has a first voltage regulation terminal, a second voltage regulation terminal, and two control terminals, the second voltage regulation terminal being electrically connected to the transmission terminal of the wireless receiving and transmitting unit, the two control terminals being respectively and electrically connected to first and second control pins of the logic control unit; a power pin of the logic control unit being electrically connected to the second voltage regulation terminal and the transmission terminal that are connected to each other; the first reverse current protector has an input terminal, an output terminal, and a control terminal, the input terminal and the output terminal being respectively and electrically connected to a discharging terminal of the battery and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a third control pin of the logic control unit; the control switch has an end electrically connected to the discharging terminal of the battery and an opposite end electrically connected to the control terminal of the first reverse current protector and the third control pin of the logic control unit; the second reverse current protector has an input terminal, an output terminal, and a control terminal, the output terminal and the input terminal being respectively and electrically connected to the power receiving terminal of the circuit device and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a fifth control pin of the logic control unit; and the ***first supercapacitor has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounde***d. As such, ***the supercapacitor may be used block surges occurring in each charging operation in order to protect a battery from accumulated damaged caused by charging***. Further, the first and second the reverse current protectors provide a function of preventing reverse current so as to eliminate electrical leakage and thus save power. Yeh, 2:20-3:3. ***The first supercapacitor 6 has an end electrically connected to connection between the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the output***

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	terminal 42 of the second reverse current protector 4a and forms a first node 61 there. Another end of the first supercapacitor 6 is grounded. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). ***The second supercapacitor is connected in parallel to the battery 93***. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. ***Since resistances of the first supercapacitor 6 and the second supercapacitor are lower than that of the battery 93, each time a charging operation is performed, the supercapacitors are charged first, whereby the supercapacitors may function to resist the surge occurring in the charging operation. Further, the supercapacitors can be easily charged in full and then immediately charge the battery 93***. Yeh, 4:48-5:15. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and ***the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b)*** to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the

Claim Limitation	Exemplary Prior Art Disclosures
	protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) Yeh, 6:59-7:10. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: ***Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery***. The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. a first supercapacitor, which has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded. Yeh, cl. 1.

Claim Limitation	Exemplary Prior Art Disclosures
	2. The bidirectional wireless charging and discharging device as claimed in claim 1 further comprising a second supercapacitor, the second supercapacitor being connected in parallel with the battery. Yeh, cl. 2; *see also* Yeh, Figs. 1-3.
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	Yeh, in view of one or more references cited below, discloses and/or renders obvious this limitation. First, Yeh discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Yeh discloses a logic control unit that controls the operation of a bi-directional wireless charging and discharging device. For example: The logic control unit 1 comprises first to sixth control pins 11-16, a power pin 17, and a detection pin 18. The remaining pin that is not labeled is a grounding pin. The wireless receiving and transmitting unit 2 comprises a transmission terminal 21 and a test terminal 22. ***The test terminal 22 is electrically connected to the detection pin 18 of the logic control unit 1***. The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. ***The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1***. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. ***The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3***. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal

Claim Limitation	Exemplary Prior Art Disclosures
	grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1***. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. ***The control switch 5 has an end electrically connected to the discharging terminal 931 of the battery 93 and an opposite end electrically connected to the control terminal 43 of the first reverse current protector 4 and the third control pin 13 of the logic control unit 1***, wherein the connection of said opposite end of the control switch 5 with the control terminal 43 of the first reverse current protector 4 forms a second node 431. Preferably, the control switch 5 is an automatic returning switch. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1***. Yeh, 3:51-4:47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. ***The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third***

Claim Limitation	Exemplary Prior Art Disclosures
	reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. The transmission mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to the transmission mode, the control switch 5 is actuated to effect switching. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. ***Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode***. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. ***When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition***.

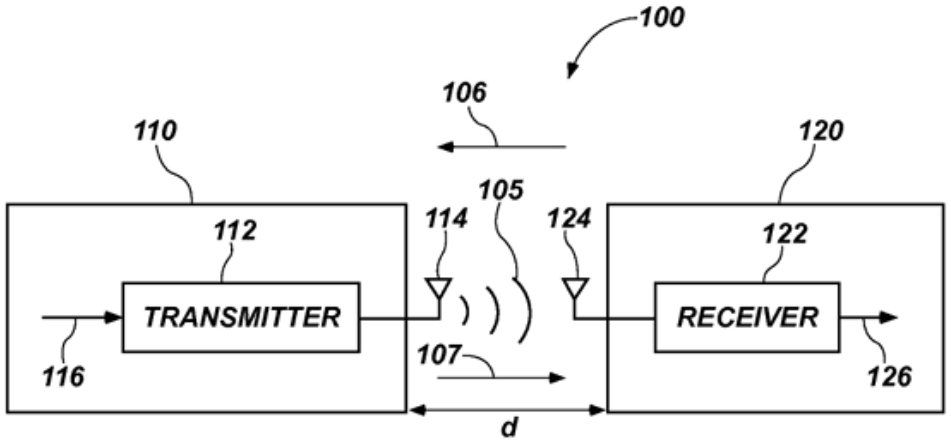
Claim Limitation	Exemplary Prior Art Disclosures
	The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; if there is a load: ***the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3***. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 5:37-6:44. The receiving mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows:

Claim Limitation	Exemplary Prior Art Disclosures
	When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18. In the bidirectional wireless charging and discharging device according to the second embodiment of the present invention, ***the second node 431 of the first reverse current protector 4 is electrically connected to the signal output terminal 911 in order to receive the control signal supplied from the signal output terminal 911 to switch the logic control unit 1 (via the third control pin 13) to the transmission mode***. Yeh, 7:38-44.

Claim Limitation	Exemplary Prior Art Disclosures
	Second, Yeh, in view of one or more of the following references, discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." Yeh discloses a wireless receiving and transmitting unit that may comprise a built-in antenna that can detect whether a second electronic device to be charged exist on the opposite side of the wireless charging and transmitting unit. For example: > ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna***. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: Yeh, 6:4-10; *see also id.* Figs. 1-3. It would have been obvious to implement a modulator/demodulator circuit disclosed in the following references in implementing Yeh's bidirectional charging and discharging device because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improve functionality in power transmission. A POSA would have had a reasonable expectation of success because modulator/demodulator circuits are well known in the art for transmitting information between a power receiving device and a power transmitting device for wireless power transfer. **Chatterjee** Chatterjee discloses a modulator and demodulator. For example: > The communication circuit **415** is coupled to the bi-directional coil assembly **412** in order to transmit and receive data over the inductive link **430**. ***The communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***.

Claim Limitation	Exemplary Prior Art Disclosures
	According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. Chatterjee, ¶¶ 51-54. **Shinoda** For example, Shinoda discloses: For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5.

Claim Limitation	Exemplary Prior Art Disclosures
	The partner device may preferably respond by the load modulation method employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20. **Singh-203** Singh-203 discloses a modulator / demodulator. For example: The embodiments shown in FIG. 2, as well as in FIGS. 3A through 3D, are shown to demonstrate a wireless power enabled device being configured to operate in either a transmit mode or a receive mode, such as for wireless OTG charging. It should be recognized that the wireless power enabled device may include additional components to perform other features not specifically described herein. For example, the wireless power enabled device may include a modulator and/or a demodulator for communicating with other devices, foreign object detection modules, I/O modules for interfacing with a user, memory for storing instructions and data, various sensors, among other components. Singh-203, 9:26-37. **Singh-624** Singh-624 describes a modulator/demodulator. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1

Claim Limitation	Exemplary Prior Art Disclosures

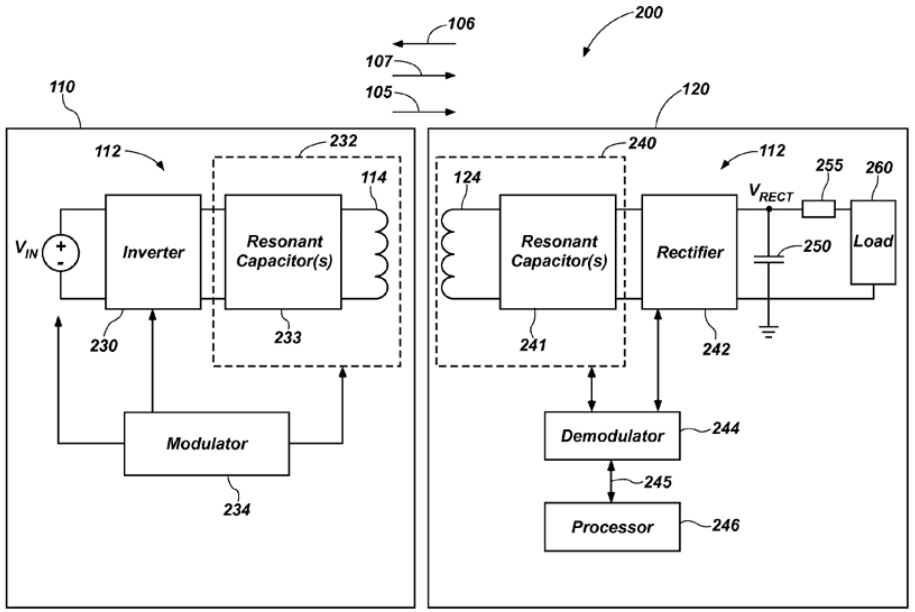


FIG. 2

Singh-624, FIGS. 1-2; *see also id.*, FIG. 7.

> An inductive wireless power transfer device comprises a transmitter that comprises a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. An inductive wireless power receiving device comprises a receiver that comprises a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Related inductive wireless power transfer systems and methods for back-channel communication from the transmitter to the receiver of an inductive wireless power transfer system are disclosed.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, Abstract. During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Embodiments of the present disclosure include an inductive wireless power transfer device. The inductive wireless power transfer device comprises a transmitter that includes a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power receiving device. The inductive wireless power receiving device comprises a receiver having a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power transfer system. The inductive wireless power transfer system comprises a transmitter having a transmit coil configured to generate a modulated wireless power signal in a coupling region for wireless power transfer, and a receiver having a receive coil configured to couple with the transmit coil by receiving the modulated wireless power signal and to generate an output signal in response thereto to provide power to a load, wherein the modulated wireless power signal includes characters. Another embodiment of the present disclosure includes a method for communicating between a transmitter to a receiver in an inductive wireless power transfer system. The method comprises

Claim Limitation	Exemplary Prior Art Disclosures
	generating a wireless power signal through a transmit coil of a transmitter to a receive coil of a receiver, and modulating the wireless power signal on the transmitter side for communicating data over the wireless power signal from the transmitter to the receiver. Singh-624, 1:56-2:25. Embodiments of the present disclosure include a back-channel communication link 107 to transmit data from the transmitter 112 to the receiver 122. The transmitter 112 may be configured to establish the back-channel communication link 107 by modulating the wireless power signal 105. In particular, the conversion gain of the wireless power signal 105 may be modulated, which may be detected responsive to the wireless power signal 105 being received and demodulated by the receiver 122. While the back-channel communication link 107 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105, it should be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils (through transmit coil 114 and receive coil 124). Thus, the wireless power signal 105 carries the communication data of the back-channel communication link 107 when the wireless power signal 105 is modulated as described herein. The arrow for the back-channel communication link 107 is merely shown separately for the purpose of indicating a direction of communication data flow. Similar to conventional wireless power transfer systems, embodiments of the present disclosure may further include a forward-channel communication link 106 for transmitting data from the receiver 122 to the transmitter 112, such as via backscatter modulation. As discussed above, conventional wireless power transfer systems may be limited to one-way communication from the receiver 122 to the transmitter 112, or else require separate RF coils for transmitting data separately from the transmit coil 114 and receive coil 124. Like the back-channel communication link 107, the forward-channel communication link 106 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105; however, it should also be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils. Thus, the wireless power signal 105 carries the communication data of the forward-channel communication link 106 when the wireless power signal 105 is modulated according to the conventional principles of back scatter modulation. The arrow for the forward-channel communication link 106 is also shown separately for the purpose of indicating a direction of communication data flow.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, 5:38-6:11. The transmitter 112 may further include an inverter 230, a resonant tank 232, and a modulator 234. The resonant tank 232 may include one or more capacitors (e.g., resonant capacitor(s) 233) coupled with an inductor (e.g., the transmit coil 114). The capacitors and inductors may be configured in an LC network, such as being coupled in series or parallel. The inverter 230 is coupled between the input voltage (VIN) and the resonant tank 232. The modulator 234 may be coupled with one or more of the inverter 230, the resonant tank 232, and the input voltage (VIN) in order to modulate the wireless power signal 105 such that communication may be achieved from the transmitter 112 to the receiver 122, as will be described in more detail below. The transmitter 112 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions such as power monitoring, foreign object detection, etc. It will also be appreciated that the transmitter 112 may include a demodulator for receiving and demodulating communication received from the receiver 122. The receiver 122 may further include a resonant tank 240, a rectifier 242, a demodulator 244, and a processor 246. The resonant tank 240 may include an inductor (e.g., receive coil 124) coupled with one or more capacitor (e.g., resonant capacitor(s) 241). The resonant tank 240 is coupled with the rectifier 242, which may further be coupled to the load 260. The demodulator 244 may be coupled with one or more of the resonant tank 240, the rectifier 242, and the processor 246 in order to demodulate the received wireless power signal 105 and transmit a demodulated signal 245 to the processor 246 for analysis or other processing. The receiver 122 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions, such as power monitoring, foreign object detection, etc. It will also be appreciated that the receiver 122 may include a modulator for modulating communication to the receiver 122. Singh-624, 6:55-7:22. **Schuessler** For example, Schuessler discloses: The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile

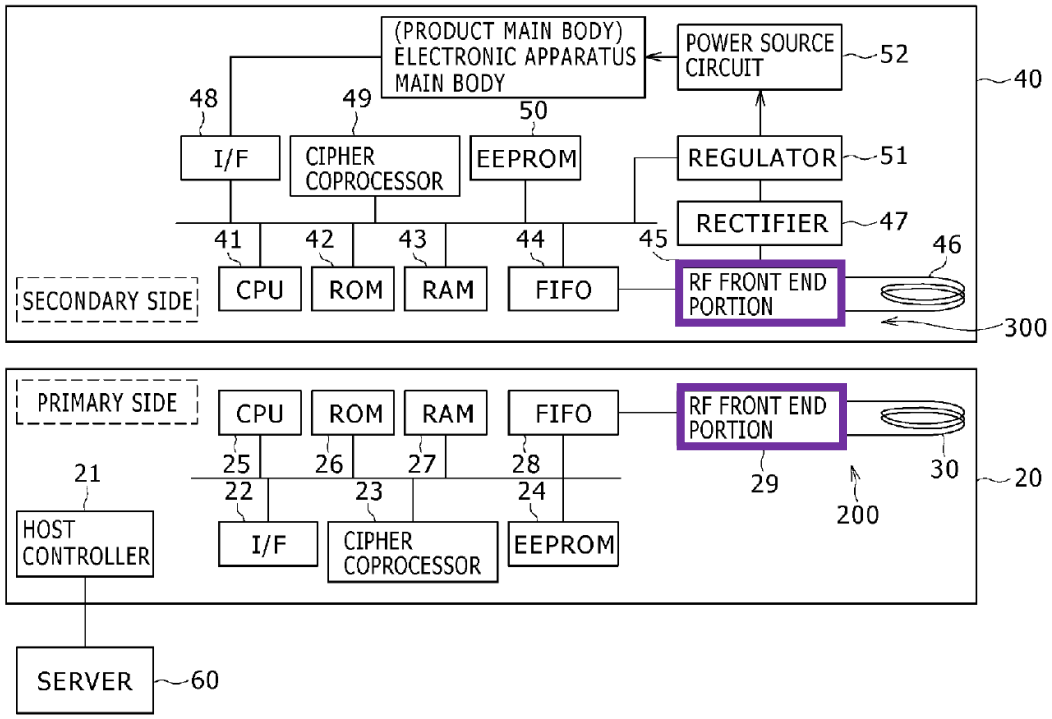
Claim Limitation	Exemplary Prior Art Disclosures
	devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Schuessler, 5:5-21. One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. Wherein the wireless communication mechanism is selected from Bluetooth, WiFi, other public or proprietary wireless protocols, ***modulation on the energy transfer itself, modulating a low frequency protocol on a high frequency energy transfer, by modulating a high frequency protocol on a low frequency energy transfer or an infrared interface***; Schuessler, cl. 1. **Corbridge** For example, Corbridge discloses: On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422

Claim Limitation	Exemplary Prior Art Disclosures
	includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. Corbridge, ¶55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.***

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶57. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0"

Claim Limitation	Exemplary Prior Art Disclosures
	values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95. **Teramoto** For example, Teramoto discloses: Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like.

Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto, ¶ 52.



Teramoto, Fig. 1; *see also id.* ¶ 55.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17. **WPT** For example, WPT discloses: The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, ***the communications modulator typically consists of a capacitor in series with a switch*** (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power

Claim Limitation	Exemplary Prior Art Disclosures
	Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme").
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Yeh discloses and/or renders obvious this limitation. Yeh discloses that a bi-directional wireless charging and discharging device receives power wirelessly in a load mode. For example: The ***receiving mode*** of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, ***the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to ***set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93*** of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; ***when the logic control unit 1 is switched to the receiving mode,***

Claim Limitation	Exemplary Prior Art Disclosures
	the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition. Yeh, 6:48-7:18; *see also* Yeh, Figs. 1-3. *See generally* Limitations [1p] and [1b].
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device;	Yeh, in view of the references cited above in Limitation [1b], discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network," as explained above in claim limitation [1b]. Yeh discloses and/or renders obvious that changing "impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device" is "based on an input from said control logic circuit." Yeh discloses a logic control unit that controls the operation of a bidirectional wireless charging and discharging device in a power receive mode to charge the battery. For example: Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby ***a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not***. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8.

Claim Limitation	Exemplary Prior Art Disclosures
	The receiving mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, ***the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9***. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; ***when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18. *See also* Limitations [1b], [1c].
[1f] said first circuitry, based on an input from said control logic	Yeh, in view of the references cited above in Limitation [1b], discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network," as explained above in claim limitation [1b].

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circuit, configured to change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	Yeh, alone or in view of the references cited above in Limitation [1c], also discloses and/or renders obvious that changing "said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver" is "based on an input from said control logic circuit." Yeh discloses a logic control unit that controls the operation of a bidirectional wireless charging and discharging device in a power transmission mode to transmit power from the battery to the wireless receiving and transmission unit to charge another device. For example: The transmission mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to the transmission mode, the control switch 5 is actuated to effect switching. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. ***When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the***

Claim Limitation	Exemplary Prior Art Disclosures
	third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition. The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. ***If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2:*** ***if there is no load: the transmission is stopped;*** ***if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3***. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. ***When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current***. ***During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3***, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 5:37-6:44.

Claim Limitation	Exemplary Prior Art Disclosures
	When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition. Yeh, 7:11-18. *See also* Limitations [1b], [1c].
[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	Yeh, in view of one or more references below, renders obvious this limitation. Yeh discloses that a logic control unit receives information about the other electronic device to control the operation of a bi-directional wireless charging and discharging device. For example: ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna***. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2.

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh, 6:4-29. A POSA would have found it obvious to apply the communication techniques taught in one or more of the following references in implementing Yeh's bi-directional wireless charging and discharging device so that the second circuitry, on power-up of said secondary wireless power receiver, is configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said wireless power receiver because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improved functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Chatterjee** Chatterjee discloses a processor in the inductive signal interface that receives and process data from a second electronic device via a modulator/demodulator, including data about type identification, status, authentication, enumeration, presence of the other device, protocol, and wireless power needs, For example: > The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. > The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 35. In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37.

Claim Limitation	Exemplary Prior Art Disclosures
	Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its

Claim Limitation	Exemplary Prior Art Disclosures
	power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The communication circuit includes a modulator 416 and a demodulator 417.*** The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data

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	signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶¶ 51-55. **Corbridge**

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. For example: FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path).

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated

Claim Limitation	Exemplary Prior Art Disclosures
	to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0" values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is

Claim Limitation	Exemplary Prior Art Disclosures
	positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step***

Claim Limitation	Exemplary Prior Art Disclosures
	1120). Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

Claim Limitation	Exemplary Prior Art Disclosures

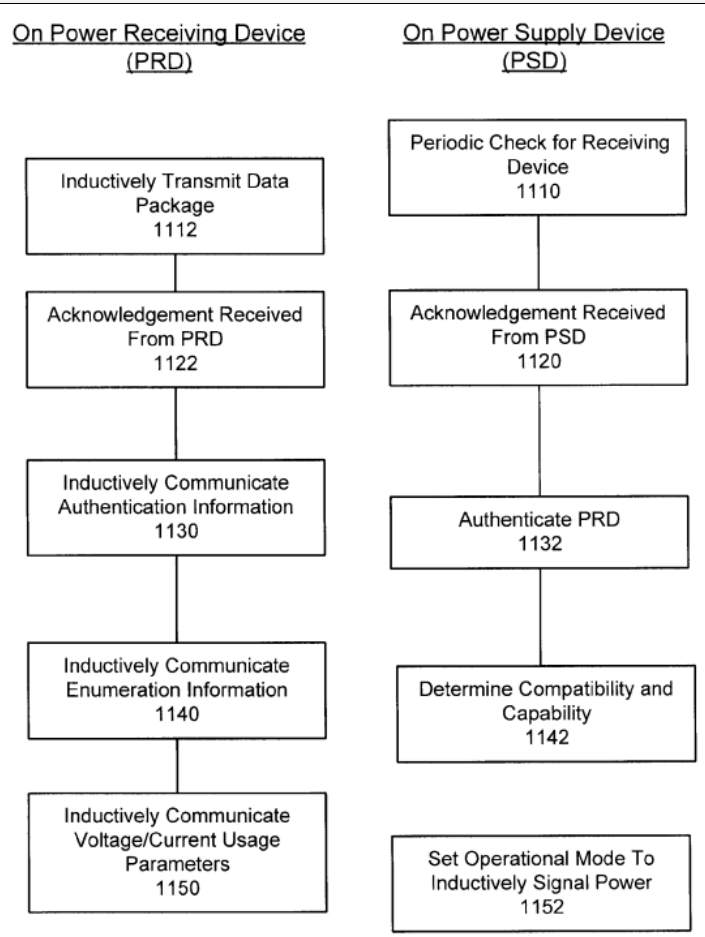


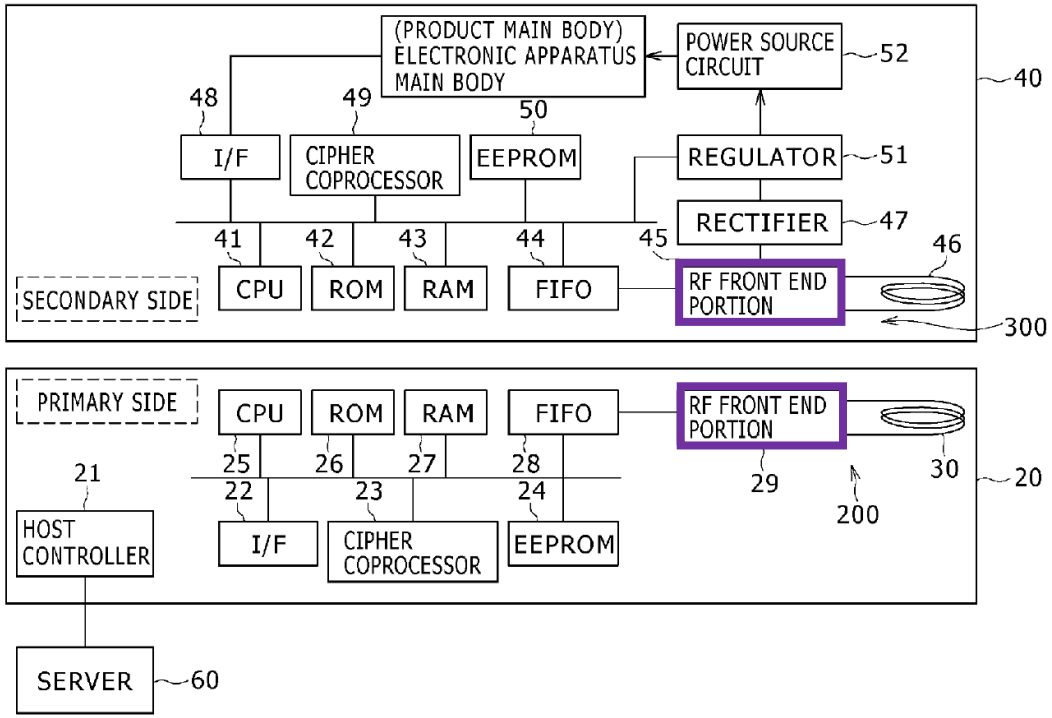
FIG. 11

Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

Teramoto

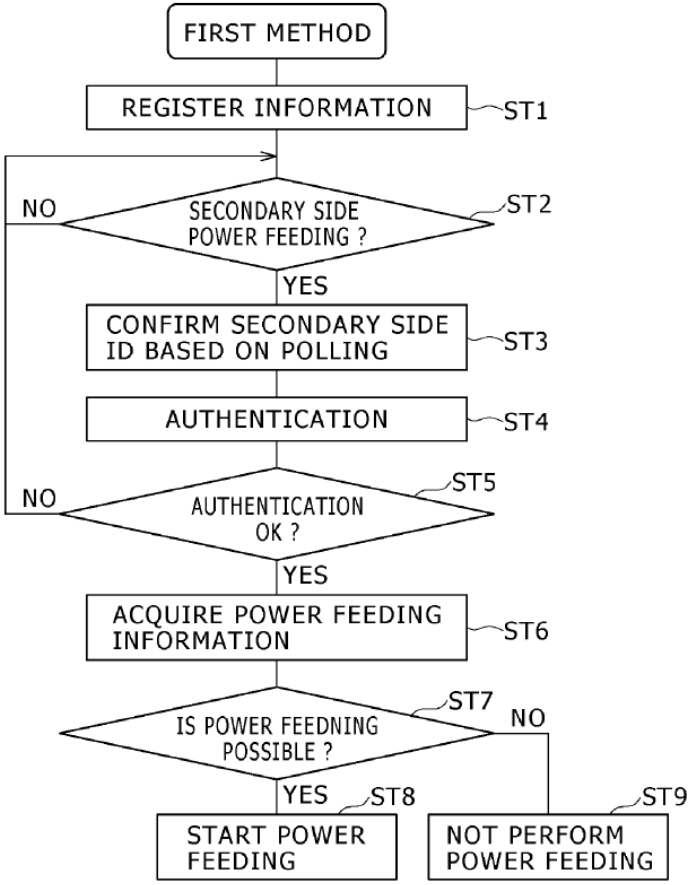
Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. For example: The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** For example, the WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of

Claim Limitation	Exemplary Prior Art Disclosures
	data defined in the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. For example: Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1.

Claim Limitation	Exemplary Prior Art Disclosures
	4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme") From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** | | b_7 | b_6 | b_5 | b_4 | b_3 | b_2 | b_1 | b_0 | | B_0 | Signal Strength Value | **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** | | b_7 | b_6 | b_5 | b_4 | b_3 | b_2 | b_1 | b_0 | | B_0 | End Power Transfer Code |

Claim Limitation	Exemplary Prior Art Disclosures

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two's complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

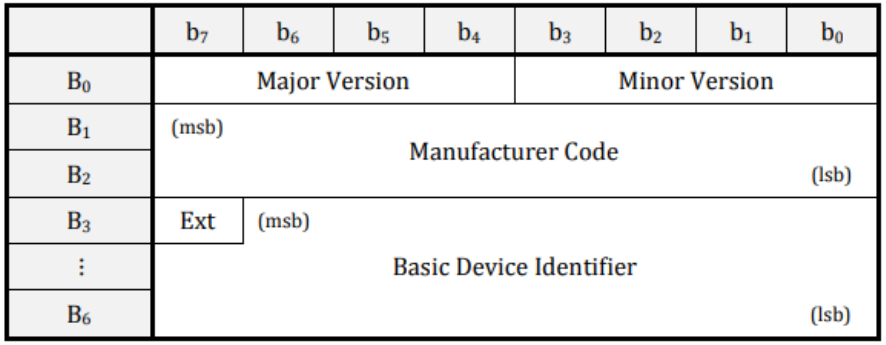
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

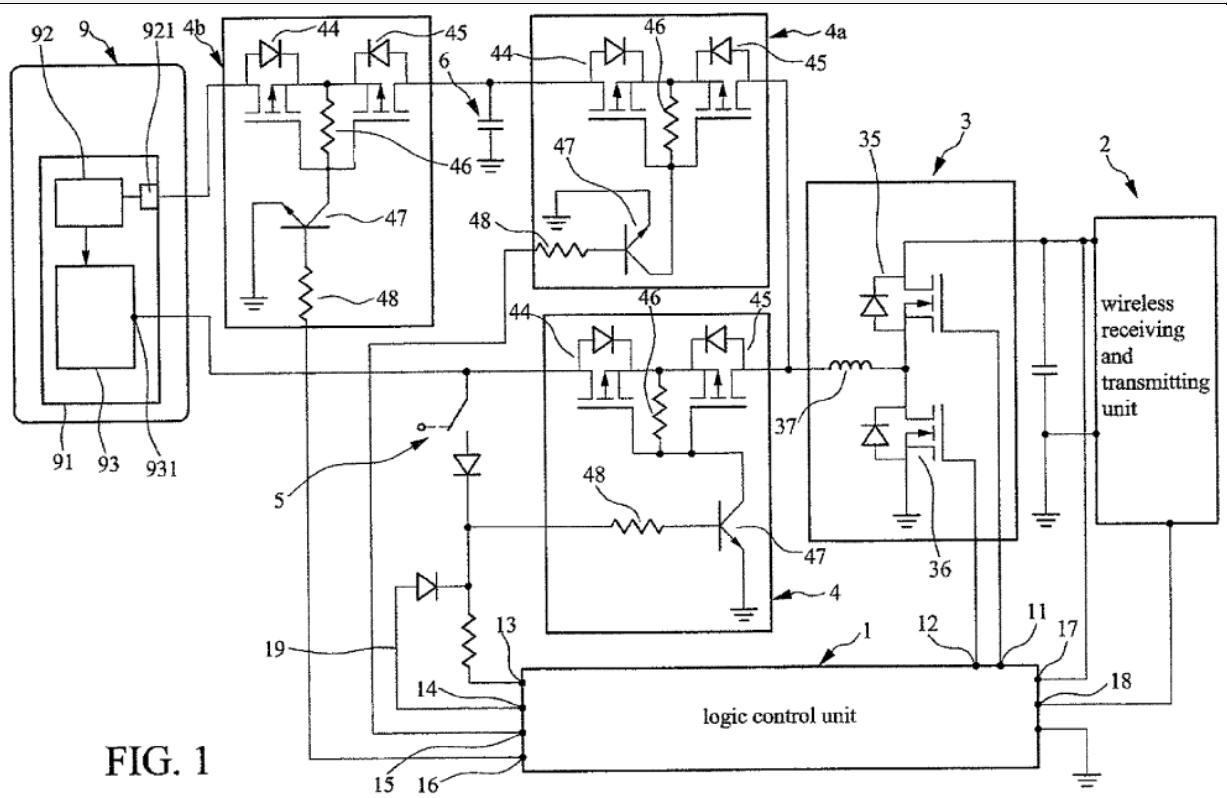
Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Yeh, alone or in combination with one or more of the references cited above for claim limitations [1c] and [1g], discloses and/or renders obvious this limitation. Yeh discloses that the logic control signal is configured to receive and interpret information about a second electronic device, such as whether the second electronic device exists on the opposite side of the wireless receiving and transmitting unit. For example: ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna***. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second

Claim Limitation	Exemplary Prior Art Disclosures
	MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. Yeh, 6:4-29. This limitation would also have been obvious in view of one or more references cited above for claim limitations [1c] and [1g]. A POSA would have found it obvious to apply the communication techniques taught in one or more of those references in implementing Yeh's bi-directional wireless charging and discharging device to provide a second circuitry that is configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have recognized the benefit of providing signaling between a wireless power transmitter and a wireless power receiver to provide improve functionality in power transmission. A POSA would have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See supra* Limitations [1c], [1g].
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Yeh, alone or in combination with one or more of the references cited above for claim limitations [1g] and [1h], discloses and/or renders obvious this limitation. Yeh disclose that the logic control signal is configured to control the operation of the circuitry of the bi-direction wireless charging and discharging device based on information about the existence of the second wireless power. For example: ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2***:

Claim Limitation	Exemplary Prior Art Disclosures
	if there is no load: the transmission is stopped; if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. Yeh, 6:4-29. It would also have been obvious to apply the teachings of one or more references discussed in Limitations [1c] and [1g] in implementing Cook's bi-directional wireless power transceiver because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer, such as to perform a function associated with said transmitted power in conjunction with said first circuitry based on interpretation of data received from the receiver. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See also supra* Limitations [1c], [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured	Yeh, alone or in combination with one or more of the references cited above for claim limitation [1b], discloses and/or renders obvious this limitation. For example: The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and

Claim Limitation	Exemplary Prior Art Disclosures
as one of an inverter and a rectifier.	transmitting unit 2. The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, ***the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification***. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. Yeh, 3:58-4:18. if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. ***With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:12-29. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is

Claim Limitation	Exemplary Prior Art Disclosures
	stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 6:38-44. ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 7:11-18.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1 Yeh, Fig. 1; *see also id.* Figs. 2-3. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery. The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. ***The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous***

Claim Limitation	Exemplary Prior Art Disclosures
	rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5.

U.S. 2010/0148723 (“Cook”)

The asserted claims of U.S. No. 10,038,339 (“’339 patent”) are anticipated and/or rendered obvious by U.S. Patent Application Publication No. 2010/0148723 (“Cook”) either alone or in combination with the knowledge of a person of ordinary skill in the art (“POSA”), and/or in combination with one or more of the following references: U.S. 2011/0018356 (“Chatterjee”), U.S. 2013/0026981 (“Van Der Lee”), U.S. 8,400,801 (“Shinoda”), U.S. Pat. No. 9,837,203 (“Singh-203”), U.S. Patent No. 8,942,624 (“Singh-624”), U.S. Pat. No. 8,901,875 (“Schuessler”), U.S. Pat. No. 8,698,450 (“Yeh”), U.S. 2010/0083012 (“Corbridge”), U.S. 2012/0049646 (“Teramoto”), and/or WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 (“WPT Standard” or “WPT”).

Cook was filed on September 1, 2009 and published on June 17, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Chatterjee was filed on December 1, 2009 and published on January 27, 2011. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Van Der Lee was filed on July 28, 2011 and published on January 31, 2013. It qualifies as prior art under either pre-AIA 102(e), or post-AIA 102(a)(2).

Shinoda was filed on October 25, 2011, published on February 16, 2012, and issued on March 19, 2013. It qualifies as prior art under pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Singh-203 was filed on March 29, 2012, published on October 3, 2013, and issued on December 5, 2017. It qualifies as prior art under pre-AIA 102(e), or post AIA 102(a)(2).

Singh-624 was filed on March 30, 2012, published on October 3, 2012, and issued on January 27, 2015. It qualifies as prior art under pre-AIA 102(a) or post-AIA 102(a)(2).

Schuessler was filed on March 3, 2011 and published on September 13, 2012. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Yeh was filed on December 27, 2011 and published on June 27, 2013. It qualifies as prior art under pre-AIA 102(e), or post-AIA 102(a)(2).

Corbridge was filed on June 4, 2009 and published on April 1, 2010. It qualifies as prior art under either pre-AIA 102(a), 102(b) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

Teramoto was filed on August 23, 2011 and published on March 1, 2012. It qualifies as prior art under either pre-AIA 102(a) or 102(e), or post-AIA 102(a)(1) or 102(a)(2).

WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1).

Claim Limitation	**Exemplary Prior Art Disclosures**
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	To the extent the preamble is limiting, Cook discloses and/or renders obvious the preamble. First, Cook discloses and/or renders obvious a “dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver.” Cook discloses a bidirectional wireless power transceiver in a device that can operate in a receive mode to charge a battery of the device and a transmit mode to provide power from the battery to charge a second device. For example: Typically, each powered device such as a wireless electronic device requires its own wired charger and power source, which is usually an alternating current (AC) power outlet. Such a wired configuration becomes unwieldy when many devices need charging. Approaches are being developed that use over-the-air or wireless power transmission between a transmitter and a receiver coupled to the electronic device to be charged. ***The receive antenna collects the radiated power and rectifies it into usable power for powering the device or charging the battery of the device***. Cook, ¶10 ***The term “wireless power” is used herein to mean any form of energy associated with electric fields, magnetic fields, electromagnetic fields, or otherwise that is transmitted from a transmitter to a receiver without the use of physical electromagnetic conductors***. Power conversion in a system is described herein to wirelessly charge devices including, for example, mobile phones, cordless phones, iPod, MP3 players, headsets, etc. Generally, one underlying principle of wireless energy transfer includes magnetic coupled resonance (i.e., resonant induction) using frequencies, for example, below 30 MHz. However, various frequencies may be employed including frequencies where license-exempt operation at relatively high radiation levels is permitted, for example, at either below 135 kHz (LF) or at 13.56 MHz (HF). At these frequencies normally used by Radio Frequency Identification (RFID) systems, systems must comply with interference and safety standards such as EN 300330 in Europe or FCC Part 15 norm in the United States. By way

Claim Limitation	Exemplary Prior Art Disclosures
	of illustration and not limitation, the abbreviations LF and HF are used herein where “LF” refers to f0=135 kHz and “HF” to refers to f0=13.56 MHz. Cook, ¶25. An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to ***charge a battery 136*** as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118. Cook, ¶31. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates ***an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210***. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204. Cook, ¶39. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). Since a device is not concurrently configured as a

Claim Limitation	Exemplary Prior Art Disclosures
	wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable. Accordingly, ***the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device***. ***Various benefits of such a configuration include the ability of a device receive and store wireless power and then to subsequently transmit or "donate" stored power to another receiving or "absorbing" device***. Accordingly, such a configuration may also be considered as a "peer-to-peer" "charitable" charging configuration. Such a device-charging arrangement provides considerable convenience in location under which charging occurs (i.e., the receiver or "absorbing" device need not necessarily receive a charge from an inconveniently located or unavailable charging pad). Cook, ¶¶42-43. FIG. 5A and FIG. 5B illustrate a bidirectional wireless power device, in accordance with an exemplary embodiment. ***Bidirectional wireless powering and charging of electronic devices*** (e.g. mobile phones, head sets, MP3 players, etc.) is disclosed in which ***electrical energy can be wirelessly transferred, as illustrated in FIG. 5A, from a power conversion circuit 220 and transmit antenna 214 of a power base 302 (e.g. charging pad) to a bidirectional wireless power transceiver 318*** including a transceiver antenna 306 and a bidirectional power conversion circuit 308 of an electronic device 300 as illustrated in FIG. 5B. Then, as illustrated with reference to FIG. 5B, ***the wirelessly transmitted power is stored in a load illustrated as battery 310. The stored power in battery 310 is then donated through the bidirectional power conversion circuit 308 and transceiver antenna 306 of electronic device 300 to a receive antenna 312 and a power conversion circuit 314 of another electronic device 304 for consumption or storage in load or battery 316***. Cook, ¶ 44. As stated, electronic device 300 is configured for bidirectional wireless power transmission. With further reference to FIG. 5A, ***in a receiving or "absorbing" mode, battery (e.g., power storage device) 310 may be wirelessly charged from an AC mains supplied power base (e.g. charging pad) 302***. With further reference to FIG. 5B, electronic device 300 may be operated in reverse ***in a***

Claim Limitation	Exemplary Prior Art Disclosures
	transmit or "donor" mode for transmission of wireless power to another electronic device 304 for operation and storage at a battery 316 that is used to power the electronic device 304. Cook, ¶47. FIG. 6A and FIG. 6B illustrate various operational contexts for an electronic device configured for bidirectional wireless power transmission, in accordance with exemplary embodiments. Specifically, an electronic device 300 configured for bidirectional wireless power transmission engages in wireless power transmission with ***a power base 302 wherein electronic device 300 receives wireless power and stores the received power in a battery***. Subsequently electronic device 300 is solicited, volunteers or otherwise is enlisted as a donor of stored power. Accordingly, one or more electronic devices 304A, 304B receive power from electronic device 300 through a wireless power transmission process. It is contemplated that the wireless transmission process with electronic device 300 operating in donor mode, may be to provide power replenishment e.g. in an urgency, or at least temporary charge, to another device 304B, or the charging of a micro-power device 304A, such as headsets, MP3 players, etc. For this purpose, device A is set into donor mode via a user interface or responsive to allowed solicitations. Furthermore, ***donor electronic device 300 may also perform energy management of its own available power to avoid excessive depletion of stored power within the battery of the donor electronic device 300***. Accordingly, assuming a standardized wireless power interface, devices may be recharged or partially recharged almost everywhere from any wireless power device that can act as donor electronic device and that provides sufficient battery capacity. Cook, ¶¶48-49. FIG. 7 illustrates a block diagram of ***an electronic device configured for bidirectional wireless power transmission***, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, a bidirectional power conversion circuit 308 and ***a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324***. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane.

Claim Limitation	Exemplary Prior Art Disclosures
	Bidirectional power conversion circuit 308 further includes a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which ***the electronic device shares its power stored in battery 310 while in donor mode***. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶¶ 50-51. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a ***battery 462 (e.g. Li-Ion)***. Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶57. FIG. 10 illustrates a circuit diagram of a wireless power transmission system, in accordance with another exemplary embodiment. This exemplary embodiment enables exchange of energy from one battery operated device to another battery operated device equally in both directions. A wireless power transmission system 500 includes a bidirectional wireless power transceiver 318T (where “T” indicates a ***Transmitter configuration or transmit mode***) and a bidirectional wireless power transceiver 318R (where “R” indicates a ***Receiver configuration or receive mode***). Cook, ¶58. FIG. 11 illustrates a flowchart of a method for transceiving wireless power, in accordance with an exemplary embodiment. Method 600 for transceiving wireless power is supported by the various structures and circuits described herein. Method 600 includes step 602 for receiving an induced current from an antenna resonating in response to a magnetic near-field and rectifying the induced current into DC power through a bidirectional power conversion circuit when the bidirectional power conversion circuit is configured in ***receive mode***. Method 600 further includes step 604 for generating an induced current at a resonant frequency into the antenna from stored DC power

Claim Limitation	Exemplary Prior Art Disclosures
	through the bidirectional power conversion circuit and generating a magnetic near-field from the antenna when the bidirectional power conversion circuit is configured in ***transmit mode***. Cook, ¶64. *See generally* Cook, Figs. 1-10. Second, Cook discloses or renders obvious a "dual mode wireless power receiver configured to . . . communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device." Cook discloses a communication channel between a transmitter and receiver, and a frequency generation control circuit operates to control the bidirectional wireless power transceiver to operate in a transmit mode. For example: ***A communication channel 119 may also exist between the transmitter 104 and the receiver 108***. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel 119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32. Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active

Claim Limitation	Exemplary Prior Art Disclosures
	rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63.

Claim Limitation	Exemplary Prior Art Disclosures
	To the extent it is argued that Cook alone does not teach this limitation, it would have been rendered obvious in view of one or more references discussed below. It would have been obvious to apply the teachings of the following references in implementing Cook’s bi-directional wireless power transceiver because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Chatterjee** Chatterjee discloses a processor in the inductive signal interface that receives and process data from a second electronic device via a modulator/demodulator, including data about type identification, status, authentication, enumeration, presence of the other device, protocol, and wireless power needs. For example: > The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. > The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35.

Claim Limitation	Exemplary Prior Art Disclosures
	In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37.

Claim Limitation	Exemplary Prior Art Disclosures
	Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its

Claim Limitation	Exemplary Prior Art Disclosures
	power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled “Inductive Signal Transfer System for Computing Devices”; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The communication circuit includes a modulator 416 and a demodulator 417.*** The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data

Claim Limitation	Exemplary Prior Art Disclosures
	signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶¶ 51-55. **Corbridge**

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. For example: FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path).

Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated

Claim Limitation	Exemplary Prior Art Disclosures
	to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0” values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is

Claim Limitation	Exemplary Prior Art Disclosures
	positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step***

Claim Limitation	Exemplary Prior Art Disclosures
	1120). Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

Claim Limitation	Exemplary Prior Art Disclosures

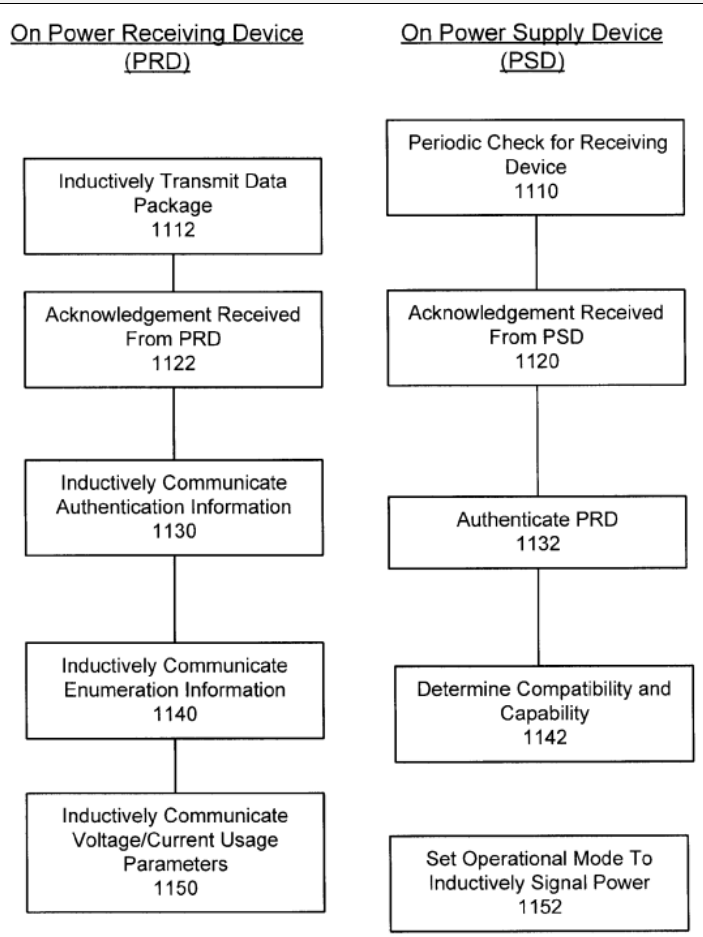


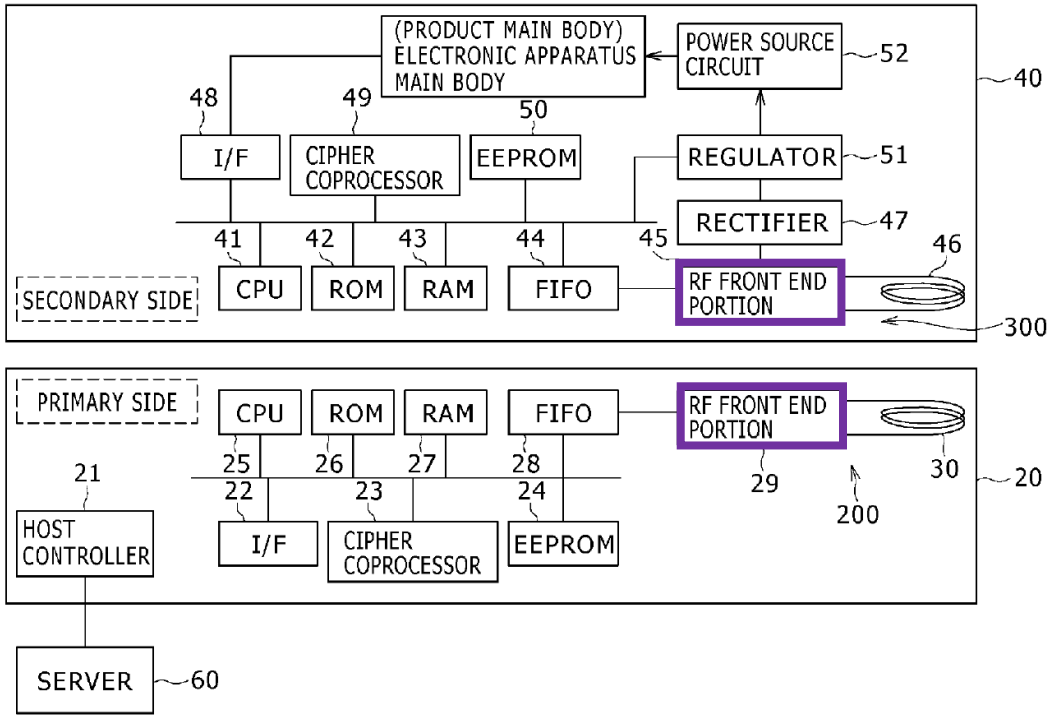
FIG. 11

Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

Teramoto

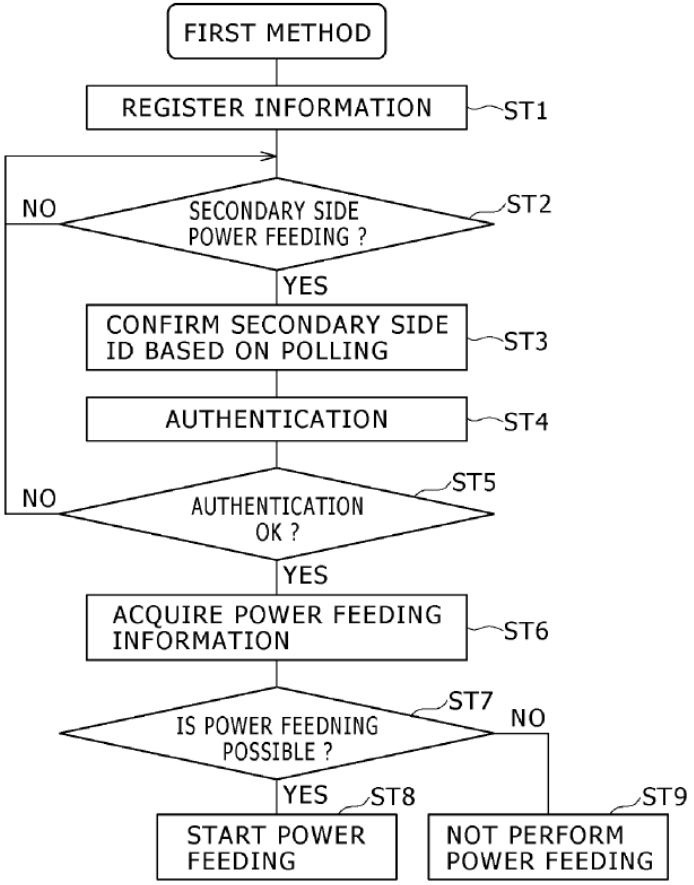
Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. For example: The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** The WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of data defined in

Claim Limitation	Exemplary Prior Art Disclosures
	the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. For example: Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1.

Claim Limitation	Exemplary Prior Art Disclosures
	4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 (“Modulation scheme”) From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 Signal Strength Value **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 End Power Transfer Code

Claim Limitation	Exemplary Prior Art Disclosures

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two’s complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

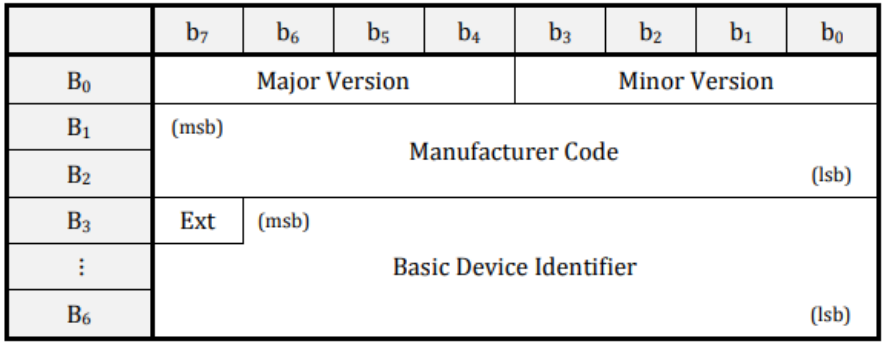
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages).
[1a] one of coil and capacitor electrodes;	Cook discloses and/or renders obvious this limitation. Cook discloses antenna coupling (including coil antenna) via magnetic field or electric field. For example: FIG. 1 illustrates wireless power transmission system 100, in accordance with various exemplary embodiments. Input power 102 is provided to ***a transmitter 104 for generating a magnetic field 106 for providing energy transfer. A receiver 108 couples to the magnetic field 106 and generates an output power 110*** for storing or consumption by a device (not shown) coupled to the output power 110. Both the transmitter 104 and the receiver 108 are separated by a distance 112. In one exemplary embodiment, transmitter 104 and receiver 108 are configured according to a mutual resonant relationship and when the resonant frequency of receiver 108 and the resonant frequency of transmitter 104 are matched, transmission losses between the transmitter 104 and the receiver 108 are minimal when the receiver 108 is located in the “near-field” of the magnetic field 106. Transmitter 104 further includes ***a transmit antenna 114 for providing a means for energy transmission and receiver 108 further includes a receive antenna 118 for providing a means for energy reception or coupling***. The transmit and receive antennas are sized according to applications and devices to be associated therewith. As stated, an efficient energy transfer occurs

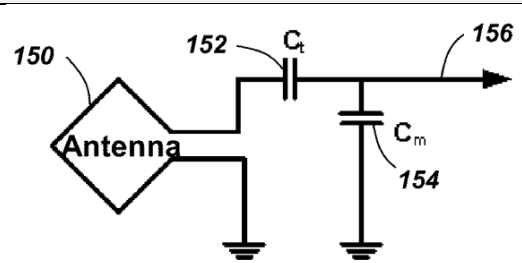
Claim Limitation	Exemplary Prior Art Disclosures
	by coupling a large portion of the energy in the near-field of the transmitting antenna to a receiving antenna rather than propagating most of the energy in an electromagnetic wave to the far-field. In this near-field, a coupling may be established between the transmit antenna 114 and the receive antenna 118. The area around the antennas 114 and 118 where this near-field coupling may occur is referred to herein as a coupling-mode region. Cook, ¶¶28-29; *see also* Cook, Figs. 1-3. As illustrated in FIG. 3, ***antennas used in exemplary embodiments may be configured as a “loop” antenna 150, which may also be referred to herein as a “magnetic,” “resonant” or a “magnetic resonant” antenna***. Loop antennas may be configured to include an air core or a physical core such as a ferrite core. Furthermore, an air core loop antenna allows the placement of other components within the core area. In addition, an air core loop may more readily enable placement of the receive antenna 118 (FIG. 2) within a plane of the transmit antenna 114 (FIG. 2) where the coupled-mode region of the transmit antenna 114 (FIG. 2) may be more effective. Cook, ¶33 Exemplary embodiments of the invention include coupling power between two antennas that are in the near-fields of each other. As stated, the near-field is an area around the antenna in which electromagnetic fields exist but may not propagate or radiate away from the antenna. They are typically confined to a volume that is near the physical volume of the antenna. In the exemplary embodiments of the invention, antennas such as single and multi-turn loop antennas are used for both transmit (Tx) and receive (Rx) antenna systems since most of the environment possibly surrounding the antennas is dielectric and thus has less influence on a magnetic field compared to an electric field. Furthermore, antennas dominantly configured as “electric” antennas (e.g., dipoles and monopoles) or a combination of magnetic and electric antennas is also contemplated. The Tx antenna can be operated at a frequency that is low enough and with an antenna size that is large enough to achieve good coupling efficiency (e.g., >10%) to a small Rx antenna at significantly larger distances than allowed by far-field and inductive approaches mentioned earlier. If the Tx antenna is sized correctly, high coupling efficiencies (e.g., 30%) can be achieved when the Rx antenna on a host device is placed within a coupling-mode region (i.e., in the near-field or a strongly coupled regime) of the driven Tx loop antenna

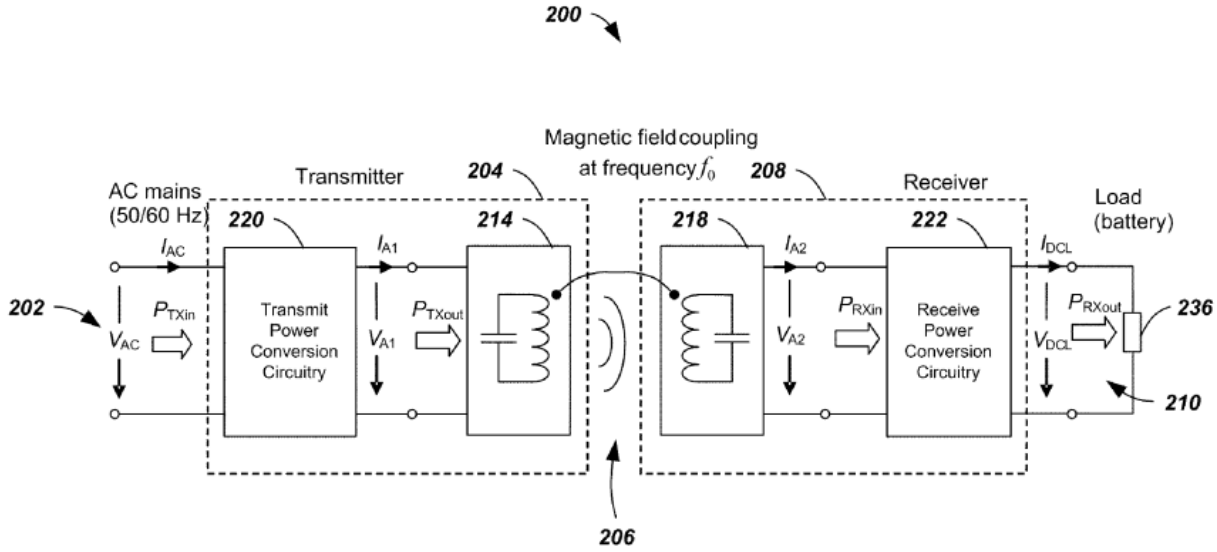
Claim Limitation	Exemplary Prior Art Disclosures
	Furthermore, wireless power transmission approaches may be affected by the transmission range including device positioning (e.g., close “proximity” coupling for charging solutions at virtually zero distance or “vicinity” coupling for short range wireless power solutions). Close proximity coupling applications (i.e., strongly coupled regime, coupling factor typically k>0.1) provide energy transfer over short or very short distances typically in the order of millimeters or centimeters depending on the size of the antennas. Vicinity coupling applications (i.e., loosely coupled regime, coupling factor typically k<0.1) provide energy transfer at relatively low efficiency over distances typically in the range from 10 cm to 2 m depending on the size of the antennas. Cook, ¶¶36-38. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204. ***Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception***. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter. ***Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple***

Claim Limitation	Exemplary Prior Art Disclosures
	energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. ***Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein***. Cook, ¶¶39-41. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/***coil***) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes ***an antenna 306***, a bidirectional power conversion circuit 308 and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane. Cook, ¶50. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active

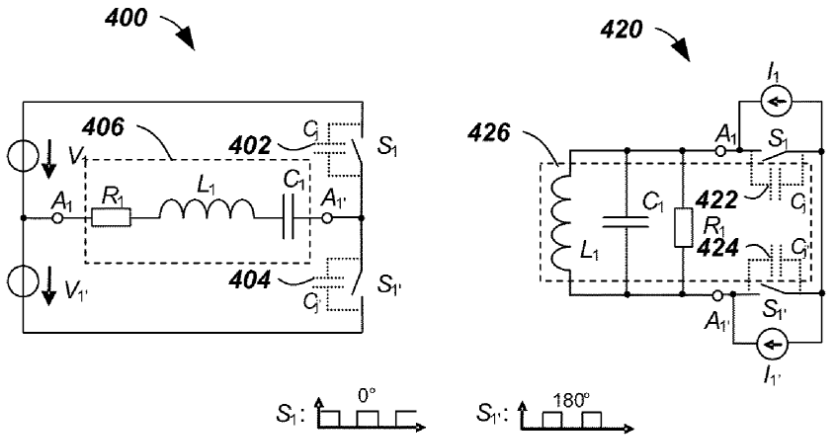
Claim Limitation	Exemplary Prior Art Disclosures
	rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an ***antenna 306R***. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. Cook, Figs. 7-10.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	Cook discloses and/or renders obvious this limitation. First, Cook discloses and/or renders obvious “a first circuitry comprising: an impedance network.” Cook discloses and/or renders obvious a capacitor connected to the coil and has adjustable capacitance. For example: An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to

Claim Limitation	Exemplary Prior Art Disclosures
	charge a battery 136 as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. ***The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118***. Cook, ¶31. As stated, ***efficient transfer of energy between the transmitter 104 and receiver 108 occurs during matched or nearly matched resonance between the transmitter 104 and the receiver 108***. However, even when resonance between the transmitter 104 and receiver 108 are not matched, energy may be transferred at a lower efficiency. Transfer of energy occurs by coupling energy from the near-field of the transmitting antenna to the receiving antenna residing in the neighborhood where this near-field is established rather than propagating the energy from the transmitting antenna into free space. ***The resonant frequency of the loop antennas is based on the inductance and capacitance. Inductance in a loop antenna is generally the inductance created by the loop, whereas, capacitance is generally added to the loop antenna's inductance to create a resonant structure at a desired resonant frequency***. As a non-limiting example, ***capacitor 152 and capacitor 154 may be added to the antenna to create a resonant circuit that generates a sinusoidal or quasi-sinusoidal signal 156***. Accordingly, for larger diameter loop antennas, the size of capacitance needed to induce resonance decreases as the diameter or inductance of the loop increases. Furthermore, as the diameter of the loop antenna increases, the efficient energy transfer area of the near-field increases for “vicinity” coupled devices. Of course, other resonant circuits are possible. As another non-limiting example, a capacitor may be placed in parallel between the two terminals of the loop antenna. In addition, those of ordinary skill in the art will recognize that for transmit antennas the resonant signal 156 may be an input to the loop antenna 150. Cook, ¶¶ 34-35.

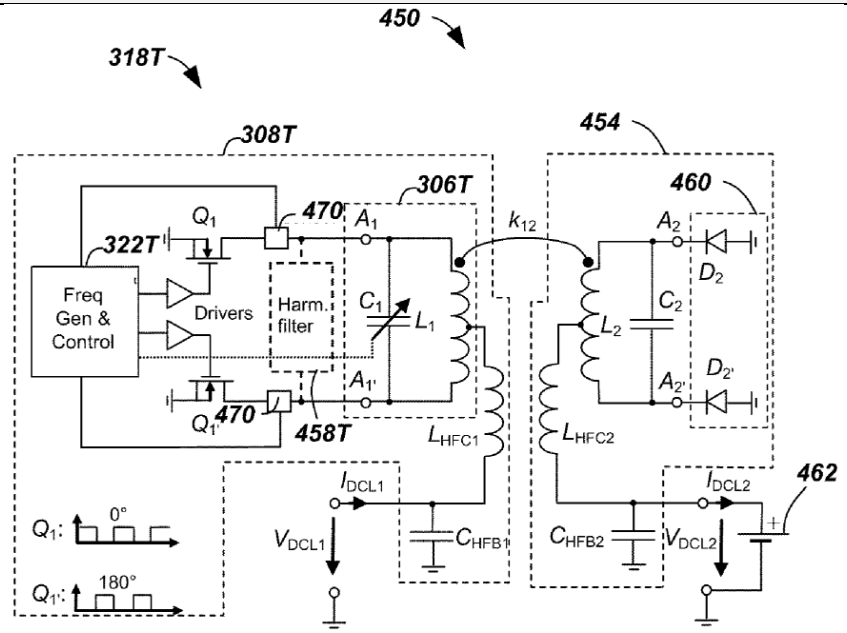
Claim Limitation	Exemplary Prior Art Disclosures
	 **FIG. 3** *see also* Cook, Figs. 2, 3. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter.

Claim Limitation	Exemplary Prior Art Disclosures
	Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if ***both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0***. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41.  FIG. 4 Cook, Fig. 4

Claim Limitation	Exemplary Prior Art Disclosures
	As described herein, wireless power transfer uses ***coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency***. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of a half bridge rectifier topology 400 including ***a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna*** where ‘dual’ refers to the dualism of electrical circuits that is well known in electrical engineering. A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration. The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. ***The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency***.

Claim Limitation	Exemplary Prior Art Disclosures
	The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.  ***FIG. 8*** Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration) with a half bridge active rectifier configured with the ***switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454***. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs)

Claim Limitation	Exemplary Prior Art Disclosures
	with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). ***Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency***. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 9 Cook, Fig. 9. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, ***low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T,***

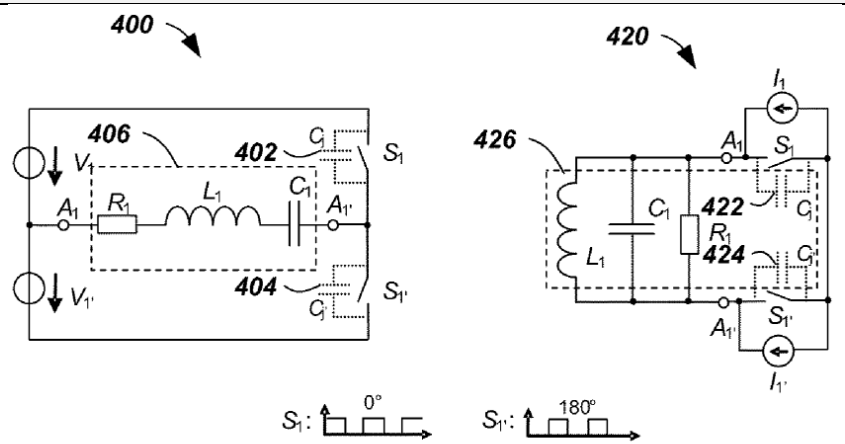
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Claim Limitation	Exemplary Prior Art Disclosures
	L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶61. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all.*** Cook, ¶61.

Claim Limitation	Exemplary Prior Art Disclosures
	See also Cook, Figs 7-10. Second, Cook discloses and/or renders obvious “a first circuitry comprising: . . . switch network”. Cook discloses a power conversion circuit that comprises synchronous switches that operate differently under different modes. For example: FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the “near-field” of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes ***a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter***. Receiver 208 further includes ***a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter***. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various

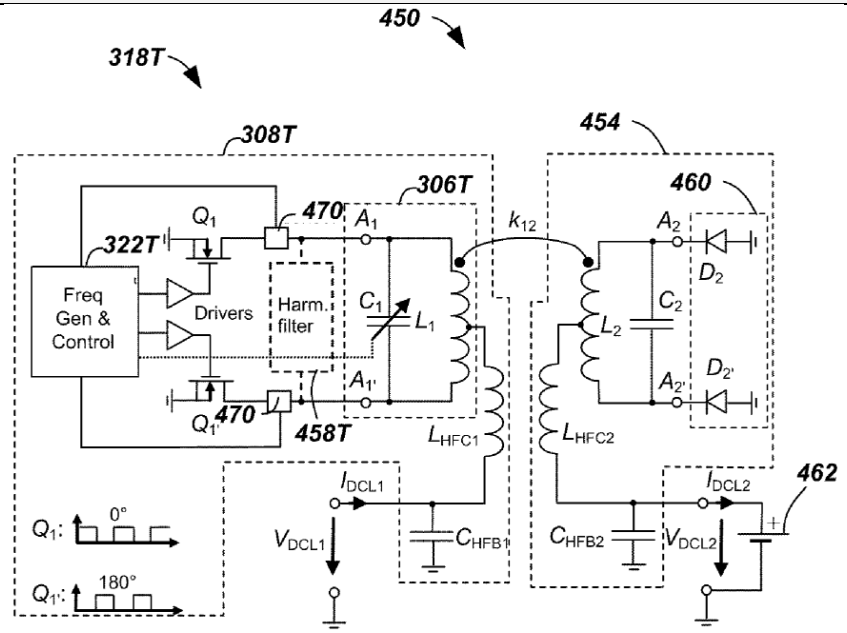
Claim Limitation	Exemplary Prior Art Disclosures
	transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). ***Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable***. Accordingly, the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device. Cook, ¶42. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and ***a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow)***. The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. ***The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein***. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, ***a bidirectional power conversion circuit 308*** and a switch 326 for

Claim Limitation	Exemplary Prior Art Disclosures
	supplying power to the battery 310 or directly to the host device electronics 324. ***Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane***. Cook, ¶50. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of ***a half bridge rectifier topology 400*** including a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna where ‘dual’ refers to the dualism of electrical circuits that is well known in electrical engineering. ***A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration.*** The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.

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	 ***FIG. 8*** Cook, Fig. 8. FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration) with a ***half bridge active rectifier*** configured with the switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, ***a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low

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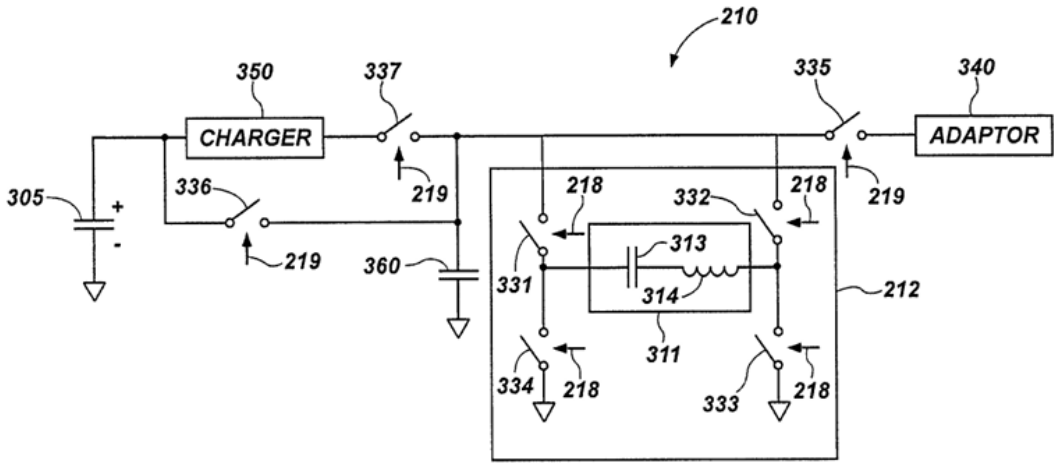
Claim Limitation	Exemplary Prior Art Disclosures
	loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , ***a half bridge passive diode rectifier*** 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶¶54-57.

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	 FIG. 9 Cook, Fig. 9. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional ***power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna

Claim Limitation	Exemplary Prior Art Disclosures
	306T, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, ***a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. ***In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier*** and switches are controlled based on sensed voltage. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶63. Third, Cook discloses “a first circuitry comprising: . . . filter capacitor.” For example: FIG. 2 shows a simplified schematic diagram of a wireless power transmission system. The transmitter 104, driven by input power 102, includes an oscillator 122, a power amplifier or power stage 124 and a ***filter*** and matching circuit 126. The oscillator is configured to generate a desired

Claim Limitation	Exemplary Prior Art Disclosures
	frequency, which may be adjusted in response to adjustment signal 123. The oscillator signal may be amplified by the power amplifier 124 with a power output responsive to control signal 125. The filter and matching circuit 126 may be included to ***filter out harmonics or other unwanted frequencies*** and match the impedance of the transmitter 104 to the transmit antenna 114. Cook, ¶ 30. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd ***harmonics filtering in form of a series resonant L-C circuits*** e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶56. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), ***odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T***, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶60; *see also id.* ¶62. To the extent it is argued that Cook does not disclose "a first circuitry comprising: . . . filter capacitor," it would have been obvious in view of one or more of the following to include a filter capacitor in Cook's bidirectional wireless power transceiver because it involves nothing more than combining prior art elements according to known methods to yield predictable results, and a POSA would have appreciated the benefit of adding a filter capacitor for filtering out the unwanted frequencies. A POSA would have had a reasonable expectation of success because filter capacitors are well known in the art. **Chatterjee** For example, Chatterjee discloses: The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. ***The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power***

Claim Limitation	Exemplary Prior Art Disclosures
	transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. Chatterjee, ¶ 37. The power circuit 414 operates in a similar fashion as the power circuit 314 of FIG. 3 to handle current received in either the power transfer mode or the power receive mode. The power bridge circuit 411 operates in a similar fashion as the power bridge circuit 311 of FIG. 3. Chatterjee, ¶ 44. FIG. 10 illustrates a power bridge circuit and a bi-directional coil assembly, together **1010**, coupled to current conditioning circuitry, under an embodiment. The power bridge circuit and bi-directional coil assembly combination **1010**, which may be any of the above described embodiments, is coupled via a signal line Power I/O to a decoupling circuit 1020. ***The decoupling circuit 1020 operates to act as a filter for certain signal frequencies and prevents those signals from passing through.*** Chatterjee, ¶¶ 89; *see also id.* Fig. 10. **Van Der Lee** For example, Van Der Lee discloses: The primary device and/or the peripheral device may include an integrated circuit (IC) to support the above-described functions. For example, an IC may include at least a portion of the wireless power transceiver circuit (for example, one or more of the coil, capacitor, and diodes of the rectifying circuit may be off-chip), ***at least a portion of the battery charger (for example***, one or more of the switching transistors, ***the output filter capacitor***, the inductor may be off-chip), the transceiver, and the processing module. Van Der Lee, ¶ 36.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203 The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25; *see also* FIGS. 3A-3D.  *FIG. 3A* **Yeh**

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh discloses a supercapacitor. For example: An objective of the present invention is to provide a bidirectional wireless charging and discharging device, which makes use of the arrangement of supercapacitors in specific locations and ***the supercapacitors having resistances lower than a battery to allow, in a charging operation, the supercapacitors to be charged first for blocking surges occurring in the charging operation*** and thus realizing protection against accumulated damage caused by charging of the battery; makes use of the function of preventing reverse current by first and second reverse current protectors to eliminate electrical leakage to thereby save power. Yeh, 2:52-62. To realize the above objectives, the present invention provides a bidirectional wireless charging and discharging device, which is applicable to a portable electronic device having a circuit device. The circuit device is electrically connected to a power receiving terminal and a battery. The bidirectional wireless charging and discharging device comprises a logic control unit, a wireless receiving and transmitting unit, a step-up/step-down unit, a first reverse current protector, a second reverse current protector, a control switch, and a first supercapacitor, wherein the logic control unit comprises a plurality of pins; the wireless receiving and transmitting unit has a transmission terminal and a test terminal, the test terminal being electrically connected to a detection pin of the logic control unit; the step-up/step-down unit has a first voltage regulation terminal, a second voltage regulation terminal, and two control terminals, the second voltage regulation terminal being electrically connected to the transmission terminal of the wireless receiving and transmitting unit, the two control terminals being respectively and electrically connected to first and second control pins of the logic control unit; a power pin of the logic control unit being electrically connected to the second voltage regulation terminal and the transmission terminal that are connected to each other; the first reverse current protector has an input terminal, an output terminal, and a control terminal, the input terminal and the output terminal being respectively and electrically connected to a discharging terminal of the battery and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a third control pin of the logic control unit; the control switch has an end electrically connected to the discharging terminal of the battery and an opposite end electrically connected to the control

Claim Limitation	Exemplary Prior Art Disclosures
	terminal of the first reverse current protector and the third control pin of the logic control unit; the second reverse current protector has an input terminal, an output terminal, and a control terminal, the output terminal and the input terminal being respectively and electrically connected to the power receiving terminal of the circuit device and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a fifth control pin of the logic control unit; and the ***first supercapacitor has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded***. As such, ***the supercapacitor may be used block surges occurring in each charging operation in order to protect a battery from accumulated damaged caused by charging***. Further, the first and second the reverse current protectors provide a function of preventing reverse current so as to eliminate electrical leakage and thus save power. Yeh, 2:20-3:3. ***The first supercapacitor 6 has an end electrically connected to connection between the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the output terminal 42 of the second reverse current protector 4a and forms a first node 61 there. Another end of the first supercapacitor 6 is grounded***. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). ***The second supercapacitor is connected in parallel to the battery 93***. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first

Claim Limitation	Exemplary Prior Art Disclosures
	supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. ***Since resistances of the first supercapacitor 6 and the second supercapacitor are lower than that of the battery 93, each time a charging operation is performed, the supercapacitors are charged first, whereby the supercapacitors may function to resist the surge occurring in the charging operation. Further, the supercapacitors can be easily charged in full and then immediately charge the battery 93***. Yeh, 4:48-5:15. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and ***the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b)*** to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) Yeh, 6:59-7:10. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: ***Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a batter***y. The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous

Claim Limitation	Exemplary Prior Art Disclosures
	rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. a first supercapacitor, which has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded. Yeh, cl. 1. 2. The bidirectional wireless charging and discharging device as claimed in claim 1 further comprising a second supercapacitor, the second supercapacitor being connected in parallel with the battery. Yeh, cl. 2; *see also* Yeh, Figs. 1-3.
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	Cook discloses or renders obvious this limitation. First, Cook discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Cook discloses a frequency generation and control circuit that controls the operation of a bidirectional wireless power transceiver. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also***

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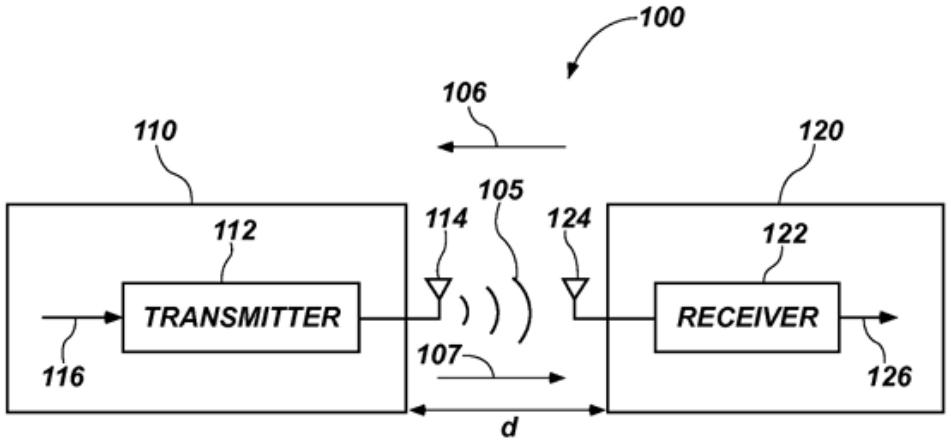
Claim Limitation	Exemplary Prior Art Disclosures
	performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59.

Claim Limitation	Exemplary Prior Art Disclosures
	Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. Second, Cook discloses and/or renders obvious “a second circuitry comprising: . . . a modulator/demodulator circuit.” Cook discloses a communication channel that is combined with magnetic field between the transmitter and receiver. For example: A communication channel 119 may also exist between the transmitter 104 and the receiver 108. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel

Claim Limitation	Exemplary Prior Art Disclosures
	119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32. To the extent it is argued that Cook does not teach "a second circuitry comprising: . . . modulator/demodulator circuit," Cook in view of the any of the following references would have rendered this limitation obvious. It would have been obvious to use a modulator/demodulator circuit disclosed in the following references in implementing Cook's wireless power module because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have had a reasonable expectation of success because modulator/demodulator circuits are well known in the art for transmitting information between a power receiving device and a power transmitting device for wireless power transfer. **Chatterjee** Chatterjee discloses a modulator and demodulator. For example: The communication circuit **415** is coupled to the bi-directional coil assembly **412** in order to transmit and receive data over the inductive link **430**. ***The communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402.

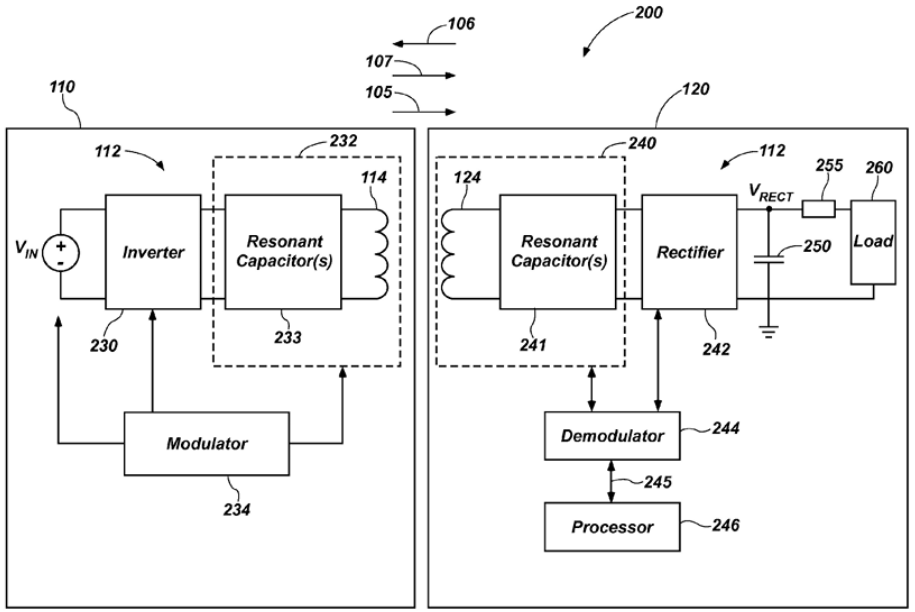
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	Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. Chatterjee, ¶¶ 51-54. **Shinoda** For example, Shinoda discloses: For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5. ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20. **Singh-203**

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	Singh-203 discloses a modulator / demodulator. For example: > The embodiments shown in FIG. 2, as well as in FIGS. 3A through 3D, are shown to demonstrate a wireless power enabled device being configured to operate in either a transmit mode or a receive mode, such as for wireless OTG charging. It should be recognized that the wireless power enabled device may include additional components to perform other features not specifically described herein. For example, the wireless power enabled device may include a modulator and/or a demodulator for communicating with other devices, foreign object detection modules, I/O modules for interfacing with a user, memory for storing instructions and data, various sensors, among other components. Singh-203, 9:26-37. **Singh-624** Singh-624 describes how a modulator/demodulator may be employed. For example:

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	 FIG. 1

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	 *FIG. 2* Singh-624, FIGS. 1-2; *see also id.*, FIG. 7. An inductive wireless power transfer device comprises a transmitter that comprises a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. An inductive wireless power receiving device comprises a receiver that comprises a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Related inductive wireless power transfer systems and methods for back-channel communication from the transmitter to the receiver of an inductive wireless power transfer system are disclosed.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, Abstract. During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Embodiments of the present disclosure include an inductive wireless power transfer device. The inductive wireless power transfer device comprises a transmitter that includes a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power receiving device. The inductive wireless power receiving device comprises a receiver having a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power transfer system. The inductive wireless power transfer system comprises a transmitter having a transmit coil configured to generate a modulated wireless power signal in a coupling region for wireless power transfer, and a receiver having a receive coil configured to couple with the transmit coil by receiving the modulated wireless power signal and to generate an output signal in response thereto to provide power to a load, wherein the modulated wireless power signal includes characters. Another embodiment of the present disclosure includes a method for communicating between a transmitter to a receiver in an inductive wireless power transfer system. The method comprises

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	generating a wireless power signal through a transmit coil of a transmitter to a receive coil of a receiver, and modulating the wireless power signal on the transmitter side for communicating data over the wireless power signal from the transmitter to the receiver. Singh-624, 1:56-2:25. Embodiments of the present disclosure include a back-channel communication link 107 to transmit data from the transmitter 112 to the receiver 122. The transmitter 112 may be configured to establish the back-channel communication link 107 by modulating the wireless power signal 105. In particular, the conversion gain of the wireless power signal 105 may be modulated, which may be detected responsive to the wireless power signal 105 being received and demodulated by the receiver 122. While the back-channel communication link 107 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105, it should be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils (through transmit coil 114 and receive coil 124). Thus, the wireless power signal 105 carries the communication data of the back-channel communication link 107 when the wireless power signal 105 is modulated as described herein. The arrow for the back-channel communication link 107 is merely shown separately for the purpose of indicating a direction of communication data flow. Similar to conventional wireless power transfer systems, embodiments of the present disclosure may further include a forward-channel communication link 106 for transmitting data from the receiver 122 to the transmitter 112, such as via backscatter modulation. As discussed above, conventional wireless power transfer systems may be limited to one-way communication from the receiver 122 to the transmitter 112, or else require separate RF coils for transmitting data separately from the transmit coil 114 and receive coil 124. Like the back-channel communication link 107, the forward-channel communication link 106 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105; however, it should also be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils. Thus, the wireless power signal 105 carries the communication data of the forward-channel communication link 106 when the wireless power signal 105 is modulated according to the conventional principles of back scatter modulation. The arrow for the forward-channel communication link 106 is also shown separately for the purpose of indicating a direction of communication data flow.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, 5:38-6:11. The transmitter 112 may further include an inverter 230, a resonant tank 232, and a modulator 234. The resonant tank 232 may include one or more capacitors (e.g., resonant capacitor(s) 233) coupled with an inductor (e.g., the transmit coil 114). The capacitors and inductors may be configured in an LC network, such as being coupled in series or parallel. The inverter 230 is coupled between the input voltage (VIN) and the resonant tank 232. The modulator 234 may be coupled with one or more of the inverter 230, the resonant tank 232, and the input voltage (VIN) in order to modulate the wireless power signal 105 such that communication may be achieved from the transmitter 112 to the receiver 122, as will be described in more detail below. The transmitter 112 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions such as power monitoring, foreign object detection, etc. It will also be appreciated that the transmitter 112 may include a demodulator for receiving and demodulating communication received from the receiver 122. The receiver 122 may further include a resonant tank 240, a rectifier 242, a demodulator 244, and a processor 246. The resonant tank 240 may include an inductor (e.g., receive coil 124) coupled with one or more capacitor (e.g., resonant capacitor(s) 241). The resonant tank 240 is coupled with the rectifier 242, which may further be coupled to the load 260. The demodulator 244 may be coupled with one or more of the resonant tank 240, the rectifier 242, and the processor 246 in order to demodulate the received wireless power signal 105 and transmit a demodulated signal 245 to the processor 246 for analysis or other processing. The receiver 122 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions, such as power monitoring, foreign object detection, etc. It will also be appreciated that the receiver 122 may include a modulator for modulating communication to the receiver 122. Singh-624, 6:55-7:22. **Schuessler** For example: The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile

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	devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Schuessler, 5:5-21. One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. Wherein the wireless communication mechanism is selected from Bluetooth, WiFi, other public or proprietary wireless protocols, ***modulation on the energy transfer itself, modulating a low frequency protocol on a high frequency energy transfer, by modulating a high frequency protocol on a low frequency energy transfer or an infrared interface***; Schuessler, cl. 1. **Corbridge** For example: On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422

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	includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. Corbridge, ¶55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.***

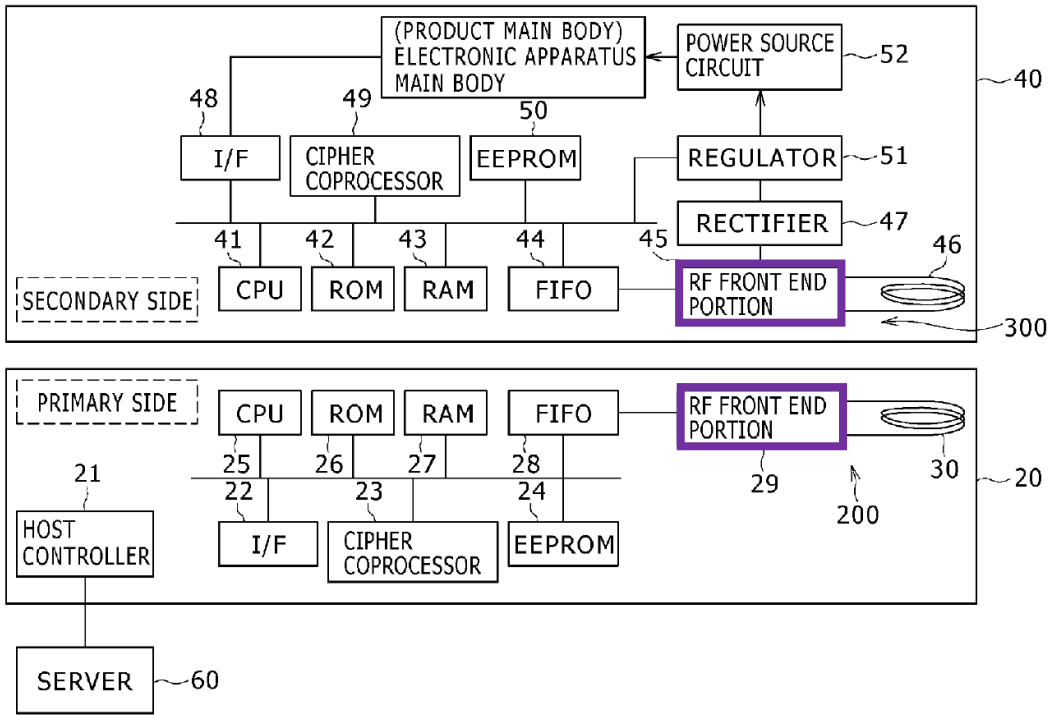
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	Corbridge, ¶57. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device’s CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0”

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	values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal’s timing and voltage levels. Corbridge, 95. **Teramoto** For example, Teramoto discloses: Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like.

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	Teramoto, ¶ 52.



Teramoto, Fig. 1; *see also id.* ¶ 55.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17. **WPT** For example: The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, ***the communications modulator typically consists of a capacitor in series with a switch*** (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power

Claim Limitation	Exemplary Prior Art Disclosures
	Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme").
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	Cook discloses and/or renders "said first circuitry configured to receive said power from a wireless power transmitter." Cook discloses that a bi-directional wireless power transceiver receives power wirelessly in a power receive mode. For example: FIG. 5A and FIG. 5B illustrate a bidirectional wireless power device, in accordance with an exemplary embodiment. Bidirectional wireless powering and charging of electronic devices (e.g. mobile phones, head sets, MP3 players, etc.) is disclosed in which ***electrical energy can be wirelessly transferred, as illustrated in FIG. 5A, from a power conversion circuit 220 and transmit antenna 214 of a power base 302 (e.g. charging pad) to a bidirectional wireless power transceiver 318 including a transceiver antenna 306 and a bidirectional power conversion circuit 308 of an electronic device 300 as illustrated in FIG. 5B. Then, as illustrated with reference to FIG. 5B, the wirelessly transmitted power is stored in a load illustrated as battery 310.*** The stored power in battery 310 is then donated through the bidirectional power conversion circuit 308 and transceiver antenna 306 of electronic device 300 to a receive antenna 312 and a power conversion circuit 314 of another electronic device 304 for consumption or storage in load or battery 316. Cook, ¶ 44. FIG. 7 illustrates a block diagram of ***an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, a bidirectional power conversion circuit 308 and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324***. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane. Cook, ¶ 50.

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	FIG. 10 illustrates a circuit diagram of a wireless power transmission system, in accordance with another exemplary embodiment. This exemplary embodiment enables exchange of energy from one battery operated device to another battery operated device equally in both directions. A wireless power transmission system 500 includes a bidirectional wireless power transceiver 318T (where “T” indicates a Transmitter configuration or transmit mode) and a bidirectional wireless power transceiver 318R (where “R” indicates a ***Receiver configuration or receive mode***). Cook, ¶58. FIG. 11 illustrates a flowchart of a method for transceiving wireless power, in accordance with an exemplary embodiment. Method 600 for transceiving wireless power is supported by the various structures and circuits described herein. Method 600 includes step 602 for ***receiving an induced current from an antenna resonating in response to a magnetic near-field and rectifying the induced current into DC power through a bidirectional power conversion circuit when the bidirectional power conversion circuit is configured in receive mode***. Method 600 further includes step 604 for generating an induced current at a resonant frequency into the antenna from stored DC power through the bidirectional power conversion circuit and generating a magnetic near-field from the antenna when the bidirectional power conversion circuit is configured in transmit mode. Cook, ¶64. *See also* Figs. 1-10; *see generally* Limitation [1p]
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said	Cook discloses and/or renders obvious “said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network.” Cook discloses a capacitor whose capacitance is adjustable and a bidirectional power conversion circuit that operates differently under different modes, as explained above in claim limitation [1b]. Cook further discloses and/or renders obvious that changing “impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device” is “based on an input from said control logic circuit.” Cook discloses that a frequency generation and control circuit controls a bidirectional wireless circuit to operate in a power receive mode.

Claim Limitation	Exemplary Prior Art Disclosures
modified form of said power to said load device;	For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit

Claim Limitation	Exemplary Prior Art Disclosures
	begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. *See also* Limitations [1b] and [1c].
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	Cook discloses and/or renders obvious "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network." Cook discloses a synchronous rectifier that operates different in different modes, as explained above in claim limitation [1b]. Cook further discloses and/or renders obvious that changing "said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver" is "based on an input from said control logic circuit." Cook discloses that a frequency generation and control circuit controls a bidirectional wireless circuit to operate in a power transmit mode. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode.*** Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored***

Claim Limitation	Exemplary Prior Art Disclosures
	by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′***. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. *See also* Limitations [1b] and [1c].
[1g] said second circuitry, on power-up of said secondary	Cook, in view of one or more references below, discloses and/or renders obvious this limitation. Cook discloses a communication link between a wireless power transmitter and a receiver over a magnetic field, and

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wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	a frequency generation and control circuit for controlling the operation of the bi-directional wireless power transceiver. A communication channel 119 may also exist between the transmitter 104 and the receiver 108. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel 119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32. Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1.

Claim Limitation	Exemplary Prior Art Disclosures
	Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′

Claim Limitation	Exemplary Prior Art Disclosures
	ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. It would have been obvious to apply the teachings of the following references in implementing Cook's bi-directional wireless power transceiver because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. **Chatterjee** Chatterjee discloses a processor in the inductive signal interface that receives and process data from a second electronic device via a modulator/demodulator, including data about type identification, status, authentication, enumeration, presence of the other device, protocol, and wireless power needs. For example: The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode;

Claim Limitation	Exemplary Prior Art Disclosures
	and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In

Claim Limitation	Exemplary Prior Art Disclosures
	the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to

Claim Limitation	Exemplary Prior Art Disclosures
	enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled “Inductive Signal Transfer System for Computing Devices”; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50.

Claim Limitation	Exemplary Prior Art Disclosures
	The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The communication circuit includes a modulator 416 and a demodulator 417. The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶¶ 51-55.

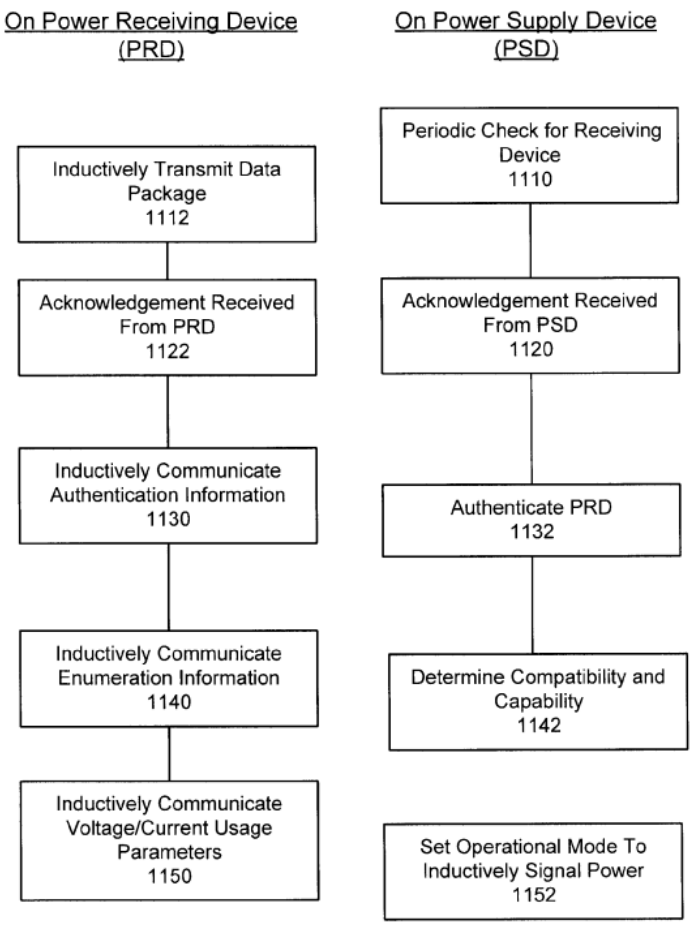
Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. For example: FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410.

Claim Limitation	Exemplary Prior Art Disclosures
	Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path). Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be***

Claim Limitation	Exemplary Prior Art Disclosures
	used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using “1” and “0” values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled

Claim Limitation	Exemplary Prior Art Disclosures
	to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the***

Claim Limitation	Exemplary Prior Art Disclosures
	inductive communication link (e.g. three packets) until acknowledgement is received (step 1120). Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium.

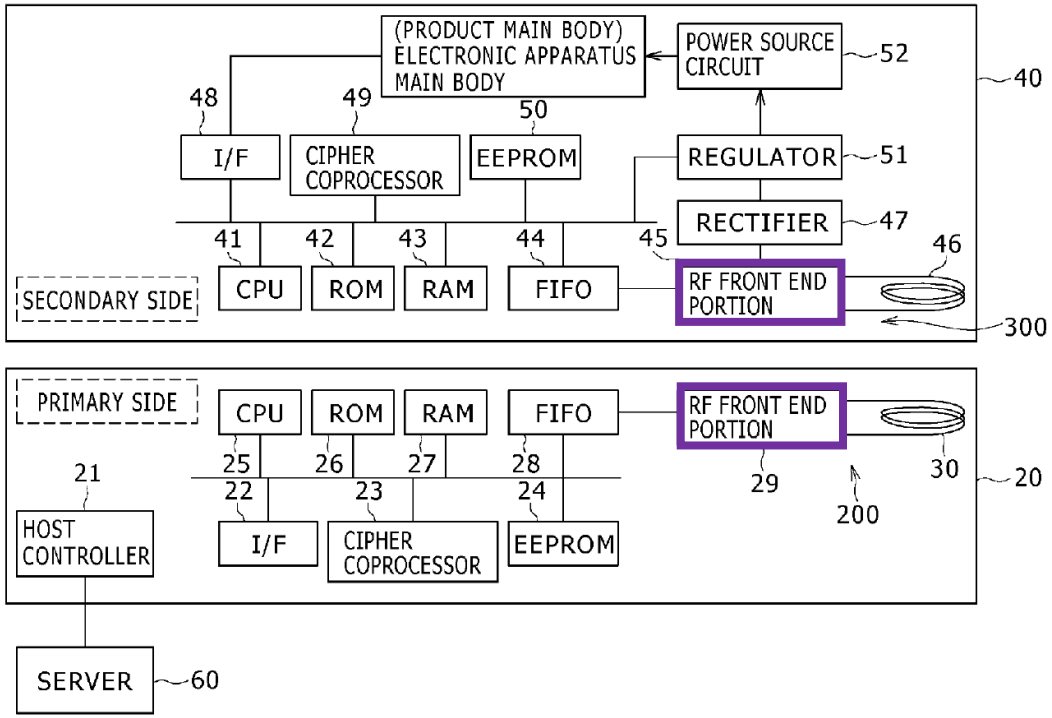
Claim Limitation	Exemplary Prior Art Disclosures
	Corbridge, ¶¶ 109-113.  **FIG. 11** Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

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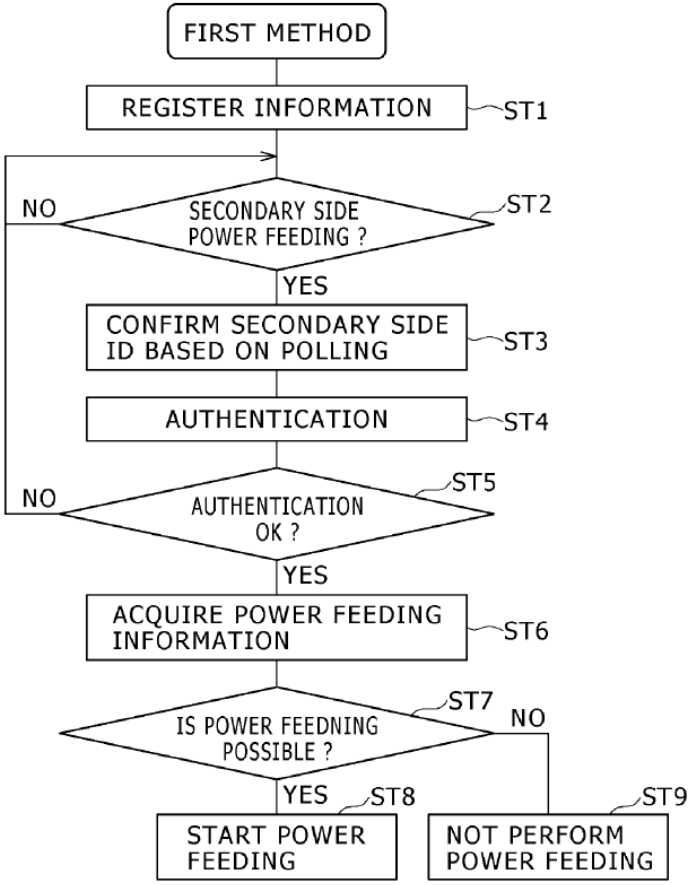
Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. For example: The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

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Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT Standard** The WPT Standard discloses a communications and control unit in the power transmitter decodes and processes signal sent from the power receiver via modulation, including various types of data defined in

Claim Limitation	Exemplary Prior Art Disclosures
	the Qi protocol, such as in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet. For example: Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1.

Claim Limitation	Exemplary Prior Art Disclosures
	4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 (“Modulation scheme”) From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the

Claim Limitation	Exemplary Prior Art Disclosures
	Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 Signal Strength Value **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 End Power Transfer Code

Claim Limitation	Exemplary Prior Art Disclosures

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two’s complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

Claim Limitation	Exemplary Prior Art Disclosures

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

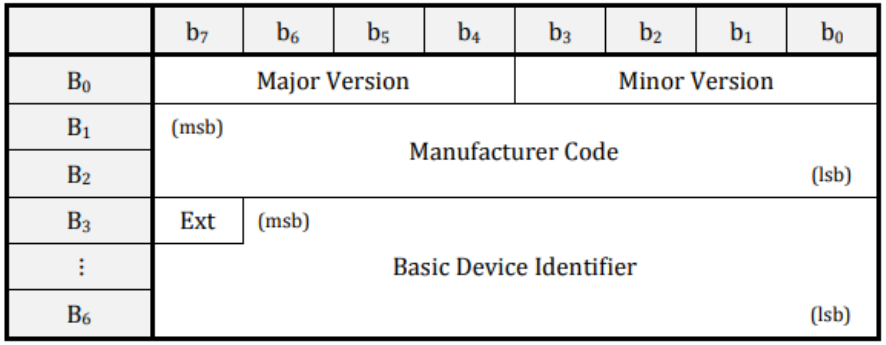
Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class		Maximum Power					
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

Claim Limitation	Exemplary Prior Art Disclosures
	Table 6-12: Identification  WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol;	Cook, alone or in view of one or more references discussed in Limitations [1c] and [1g], discloses and/or renders obvious this limitation. Cook discloses a communication link between the wireless power transmitter and a receiver over the magnetic field and a frequency generation and control circuit for controlling the operation of the bi-directional wireless power transceiver. For example: > A communication channel 119 may also exist between the transmitter 104 and the receiver 108. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel 119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32. It would have been obvious to apply the teachings of one or more references discussed in Limitations [1c] and [1g] in implementing Cook’s bi-directional wireless power transceiver because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide

Claim Limitation	Exemplary Prior Art Disclosures
	improved functionality for wireless power transfer, such as to provide a function associated with said transmitted power in conjunction with said first circuitry based on interpretation of data received from the receiver. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See generally* Limitations [1c] and [1g].
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	Cook, alone or in view of one or more references discussed in Limitations [1c] and [1g], discloses and/or renders obvious this limitation. Cook discloses that the frequency generation and control circuit controls the operation of the bi-directional wireless power transceiver to, e.g., select the operation mode, adjust the switching frequency, tune the capacitance, perform battery management, and/or adjusting based on a voltage and/or current. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit

Claim Limitation	Exemplary Prior Art Disclosures
	antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶ 61.

Claim Limitation	Exemplary Prior Art Disclosures
	In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. It would have been obvious to apply the teachings of one or more references discussed in Limitations [1c] and [1g] in implementing Cook’s bi-directional wireless power transceiver because it involves nothing more than combining prior art elements according to known methods to yield predictable results. A POSA would have appreciated the benefit of providing signaling between a wireless power transmitter and receiver to provide improved functionality for wireless power transfer, such as to perform a function associated with said transmitted power in conjunction with said first circuitry based on interpretation of data received from the receiver. A POSA would also have had a reasonable expectation of success because signaling for power transmission between a wireless power transmitter and a wireless power receiver circuit is well known in the art. *See generally* Limitations [1c] and [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured as one of an inverter and a rectifier.	Cook discloses and/or renders obvious this limitation. For example: As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of ***a half bridge rectifier topology 400*** including a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna where ‘dual’ refers to the dualism of electrical circuits that is well known in electrical engineering. ***A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration.*** The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion.

Claim Limitation	Exemplary Prior Art Disclosures
	As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54. *see also* claim limitation [1b].

Fulton eCoupled two-way wireless charging solution ("Fulton Solution")

On information and belief, the asserted claims of U.S. No. 10,038,339 (the "'339 patent") are anticipated and/or rendered obvious by Fulton eCoupled two-way wireless charging solution ("Fulton Solution") either alone or in combination with the knowledge of a person of ordinary skill in the art ("POSA"), and/or in combination with one or more of the references disclosed in Samsung's invalidity contentions, including in other exhibits of the invalidity contentions.

The Fulton Solution was made public at least by January 7, 2013 at the International Consumer Electronics Show 2013 in Las Vegas and thus qualifies as prior art under pre-AIA § 102(a) or § 102(a)(1) at least to the extent the '339 patent is entitled to a priority date of August 12, 2013 or later. The Fulton Solution is described at least in part in the following publications:

- "Android Tablet to Smartphone eCoupled Two-Way Wireless Charging by Fulton Innovation" https://www.youtube.com/watch?v=SnxVO33mEFc (dated Jan. 15, 2013)
- "CES 2013: Fulton Innovation a finalist for emerging technology at 2013 International Consumer Electronics Show" https://www.mlive.com/business/west-michigan/2013/01/ces_2013_fulton_innovation_a_f.html (published on Jan. 10, 2013)
- "Closer look at Fulton's 2-way wireless charging (Charge your phone with your tablet)" https://liliputing.com/closer-look-at-fultons-2-way-wireless-charging-charge-your-phone-with-your-tablet/ (dated Jan. 8, 2013)
- "Fulton Innovation eCoupled Hands-on" https://www.youtube.com/watch?v=SvUYzmEq-eI (dated Jan 8, 2013)
- "Fulton Innovation launches eCoupled technology for bi-directional wireless charging (hands on)" https://www.engadget.com/2013-01-07-fulton-innovation-launches-ecoupled-technology-for-bi-directiona.html (dated Jan. 7, 2013)
- "Fulton Innovation offers device-to-device wireless charging demo at CES" https://phys.org/news/2013-01-fulton-device-to-device-wireless-demo-ces.html (dated Jan. 11, 2013)
- "Fulton Innovation prototype can use a tablet battery to wirelessly charge a phone (or vice versa)" https://www.youtube.com/watch?v=rA8-v9G4si0 (dated Jan. 8, 2013)
- "Fulton Innovation's Two-Way Wireless Power Named A Finalist In The CNET Best Of CES Awards At The 2013 International CES" https://www.prnewswire.com/news-releases/fulton-innovations-two-way-wireless-power-named-a-finalist-in-the-cnet-best-of-ces-awards-at-the-2013-international-ces-186533521.html (dated Jan. 11, 2013)
- "Power up with this device-to-device wireless charging tech" https://www.cnet.com/tech/tech-industry/power-up-with-this-device-to-device-wireless-charging-tech/ (dated Jan 7, 2013)

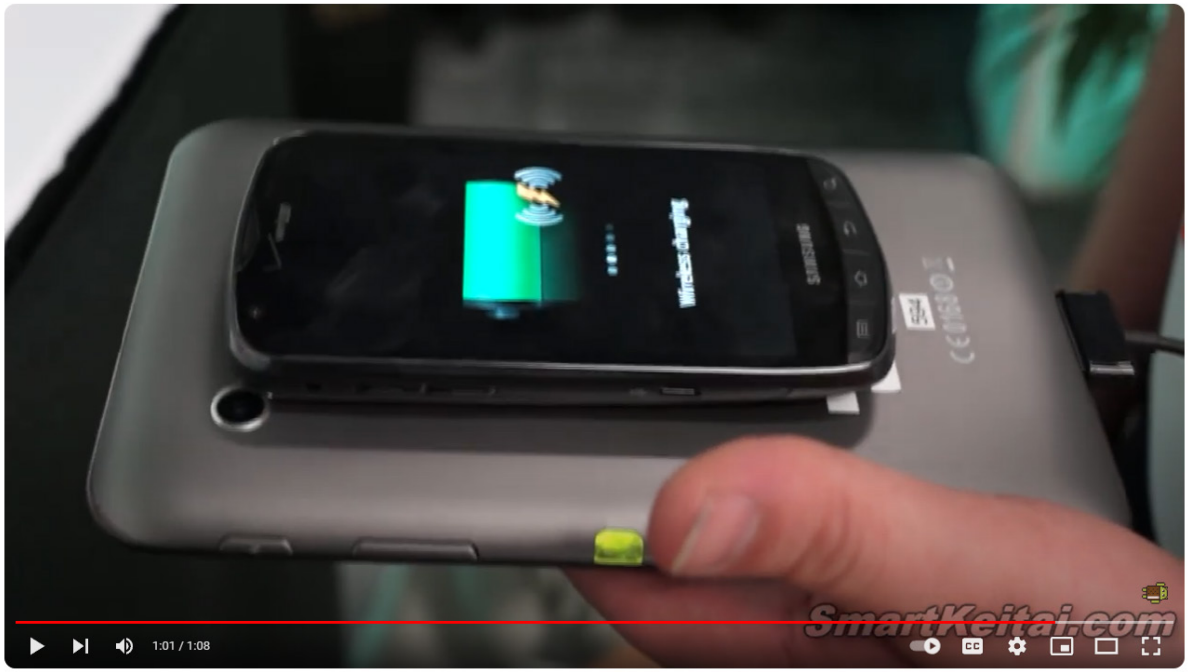
On information and belief, the Fulton Solution is compliant with the "Qi Standard" (*e.g.* https://liliputing.com/closer-look-at-fultons-2-way-wireless-charging-charge-your-phone-with-your-tablet/), thus is expected to have circuitry similar to examples disclosed in the

WPC Wireless Power Transfer Standard System Description Part 1. Version 1.0.3 ("WPT Standard" or "WPT," also known as the "Qi Standard").

WPT Standard is dated September 2011. It qualifies as prior art under either pre-AIA 102(a) or post-AIA 102(a)(1). The contentions in this exhibit are based on information presently available to Samsung. Samsung is conducting third party discovery regarding the Fulton Solution and reserves the right to supplement these contentions.

Claim Limitation	**Exemplary Prior Art Disclosures**
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	On information and belief, the Fulton Solution includes a "dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary wireless power receiver." The Fulton Solution (installed on a Samsung Galaxy Tablet that includes a built-in battery) can be wirelessly charged via a charging dock, and can charge another device (such as a Samsung mobile phone) wirelessly. For example: 2,300 views Jan 15, 2013 LINK: http://www.smartkeitai.com At Fulton Innovation's booth at the 2013 CES, we received a tech demo of the new eCoupled two-way wireless charging solution for tablets and smartphones. Essentially, a tablet that's being charged wirelessly or traditionally with a cable can actually be used to charge a Qi enabled mobile phone. By placing the two devices back-to-back, the power transfers wirelessly between them - almost like magic. It's all demonstrated using a Samsung Galaxy Tab and Droid Charge. Recent smartphones, like the Google Nexus 4, HTC Droid DNA, Nokia Lumia 920 and 820, are Qi-enabled, so perhaps we'll see this become a reality for them in the future. Check out more videos from our 2013 Consumer Electronics Show playlist: http://www.smartkeitai.com/tag/ces-2013/ (https://www.youtube.com/watch?v=SnxVO33mEFc)

Claim Limitation	Exemplary Prior Art Disclosures
	

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	 (https://www.youtube.com/watch?v=SnxVO33mEFc)

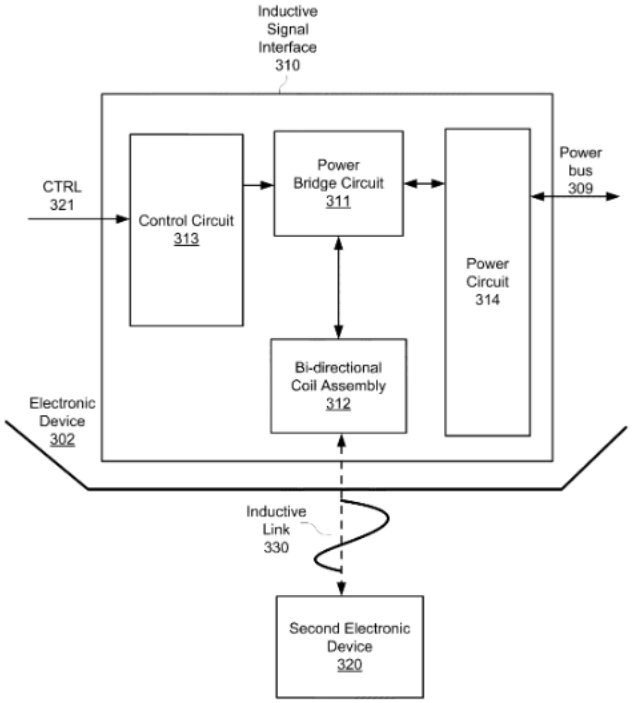
Claim Limitation	Exemplary Prior Art Disclosures
	Say, for instance, your cell phone is completely out of power, but you have a powered-up laptop or tablet. The phone will charge by resting it on top of that laptop or tablet.  A cell phone is being charged through wireless power from a tablet inside Ada-based Fulton Innovation's CES room in Las Vegas on Thursday, Jan. 10. (https://www.mlive.com/business/west-michigan/2013/01/ces_2013_fulton_innovation_a_f.html) On information and belief, the Fulton Solution comprises a "dual mode wireless power receiver configured to . . . communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device." The Fulton Solution complies with the Qi wireless charging standard, and thus is configured to communicate with a mobile phone according to the Qi protocol to charge the mobile device.

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	> Since the system is compatible with the Qi wireless charging standard, if you ever buy a tablet with the Fulton Innovation technology and happen to have a Qi-compatible phone, they'll work together. https://liliputing.com/closer-look-at-fultons-2-way-wireless-charging-charge-your-phone-with-your-tablet/ To the extent the Fulton Solution does not disclose the preamble, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Fulton Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses an electronic device that can be used to create an inductive link with a second electronic device for transmitting or receiving power. For example: > The disclosed embodiments relate generally to the field of inductive signal interfaces. In particular, the disclosed embodiments relate to ***an inductive signal interface capable of bi-directional inductive signaling***. Chatterjee, ¶ 2. > Embodiments described herein include ***an inductive signal interface that uses shared circuit elements to be operable as either a power transmitter or a power receiver***. More specifically, an inductive signal interface includes a three-legged (or three-branched) structure that uses separate pairs of legs or branches to operate as an inductive power transmitter or an inductive power receiver. > An inductive signal interface includes a coil assembly which has one or more inductive coils. The inductive signal interface also has a bridge circuit that couples to the coil assembly to a power input/output (I/O). ***The bridge circuit has components that operate to enable the inductive signal interface to selectively operate in either a power transmit mode or a power receive mode.***

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	Chatterjee, ¶¶ 29-30. Still further, another embodiment provides a computing system that includes a first and a second computing devices, each computing device including a similarly structured inductive signal interface. The inductive signal interface of each computing device includes a coil assembly which has one or more inductive coils and a bridge circuit that couples to the coil assembly to a power input/output (I/O). ***Each bridge circuit has components that operate to enable the respective inductive signal interface to selectively operate in either a power transmit mode or a power receive mode***. Chatterjee, ¶ 33. A device having inductive signal interface **310**, may be referenced as an 'electronic device', and correspond to, for example, a mobile computing device or docking station. ***The inductive signal interface 310 is shown in FIG. 1 to be provided on a first electronic device 302, and used to create an inductive link 330 with a second electronic device 320. The second electronic device 320 may be any device capable of inductively receiving or transmitting signals.*** For example, in one implementation, the first electronic device corresponds to a docking station, and the second electronic device corresponds to a mobile computing device. In another implementation, both the first and second computing device may correspond to mobile computing devices. Other variations are similarly possible. On the first electronic device **302**, the combination of the bi-directional coil assembly **312** and the power bridge circuit **311** establish the inductive link **330** with the second electronic device **320**. ***In one implementation, the first device 302 operates to transmit power to the second electronic device 320, in which case inductive signal interface 310 uses a power bus 309 and power circuits 314 to inductively transmit power to the second device 320***. As mentioned below, the power bridge circuit **311** may be structured to handle a DC current that originates from a power source, such as a wall outlet (in which case rectifiers may be used to convert the AC signal to DC) or battery unit. ***In another implementation, the first device 302 operates to receive power over the inductive link 330. The same power bridge circuit 311 may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes***, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device

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	may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶¶ 34, 35. ***In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302***, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. Chatterjee, ¶ 37. In usages ***when inductive signal interface 310 is in a power receive mode, the power signal is received from the second electronic device 320 over the inductive link 330***. The inductive signal interface 310 may be coupled to a power storage element, such as a rechargeable battery. The inductive signal interface 310 may be configured to charge the power storage element or to provide power to other circuitry within the first electronic device through the voltage supply line. The power circuit 314 receives current transmitted from the power bridge circuit 311 and is configurable to perform voltage and current regulation in order to charge the power storage element or provide power to other circuitry. The bi-directional coil assembly 312 receives power inductively from the second electronic device 320, the power bridge circuit 311 converts AC current received inductively at the bi-directional coil assembly 312 to DC current to be transferred to the power circuit via the power bus. FIG. 4 illustrates an embodiment of the ***inductive signal interface capable of performing data transfer through an inductive link***. According to an embodiment, the inductive signal interface 410 resides on an electronic device 402 (e.g. mobile computing device or dock) and includes a power bridge circuit 411, a bi-directional coil assembly 412, a processor 413, a power circuit 414, and a communication circuit 415. Similar to the inductive signal interface 310 of FIG. 3, the inductive signal interface 410 may reside on any device that is capable of inductively receiving or transmitting power with another suitably configured device. As with an embodiment of FIG. 3, a first computing device uses the inductive signal interface 410 to form an inductive link 430 with a

Claim Limitation	Exemplary Prior Art Disclosures
	second electronic device 420. The second electronic device may also include an embodiment of inductive signal interface 410. Chatterjee, ¶¶ 40-41. Similar to the inductive signal interface 310 of FIG. 3, ***certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes***. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. Chatterjee, 42. ***During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420***. The power signal is transmitted in modulated form over the power bridge circuit 411, which performs rectification to output a DC current to the power circuit 414. The power circuit 414 is configured to clamp current levels, regulate voltage levels, and perform other functions to transmit an outgoing power signal in the power receive mode. According to embodiments, the resulting power signal is a DC signal and is routed to: (i) charge a rechargeable battery within the electronic device 402, and/or (ii) provide power to circuit elements within the electronic device. Chatterjee, ¶ 46.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3

Claim Limitation	Exemplary Prior Art Disclosures

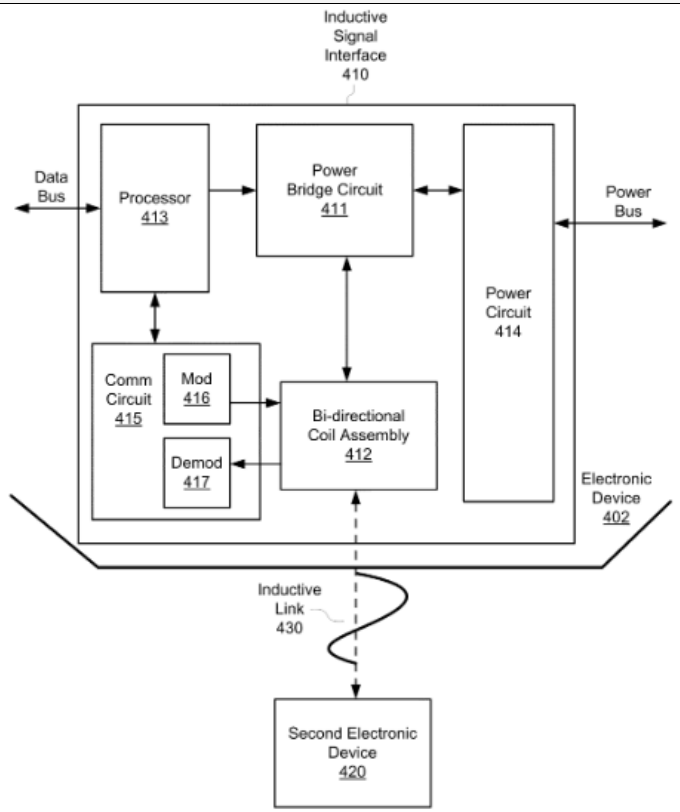


FIG. 4

Chatterjee, Figs. 3, 4, 5.

> In usages when inductive signal interface 310 is in a power receive mode, the power signal is received from the second electronic device 320 over the inductive link 330. The inductive signal interface 310 may be coupled to a power storage element, such as a rechargeable battery.

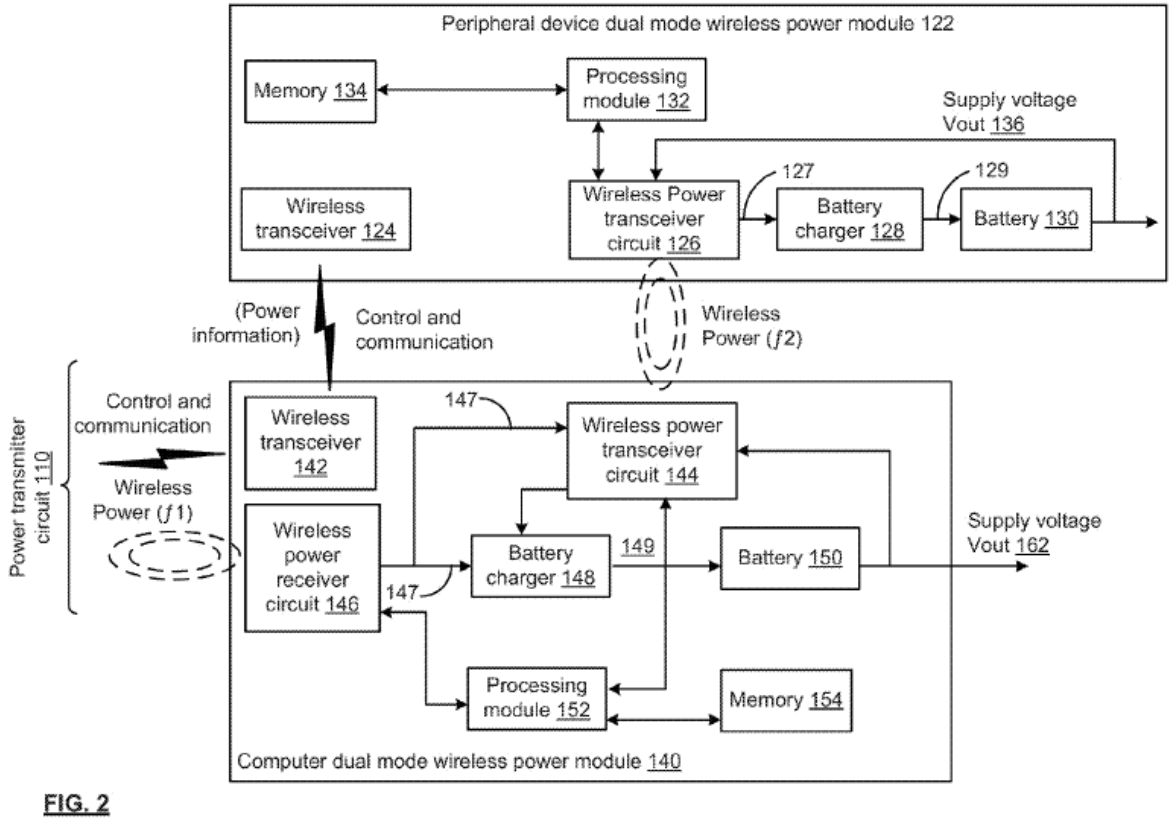
Chatterjee, ¶ 40.

> ***FIG. 4 illustrates an embodiment of the inductive signal interface capable of performing data transfer through an inductive link***. According to an embodiment, the inductive signal interface

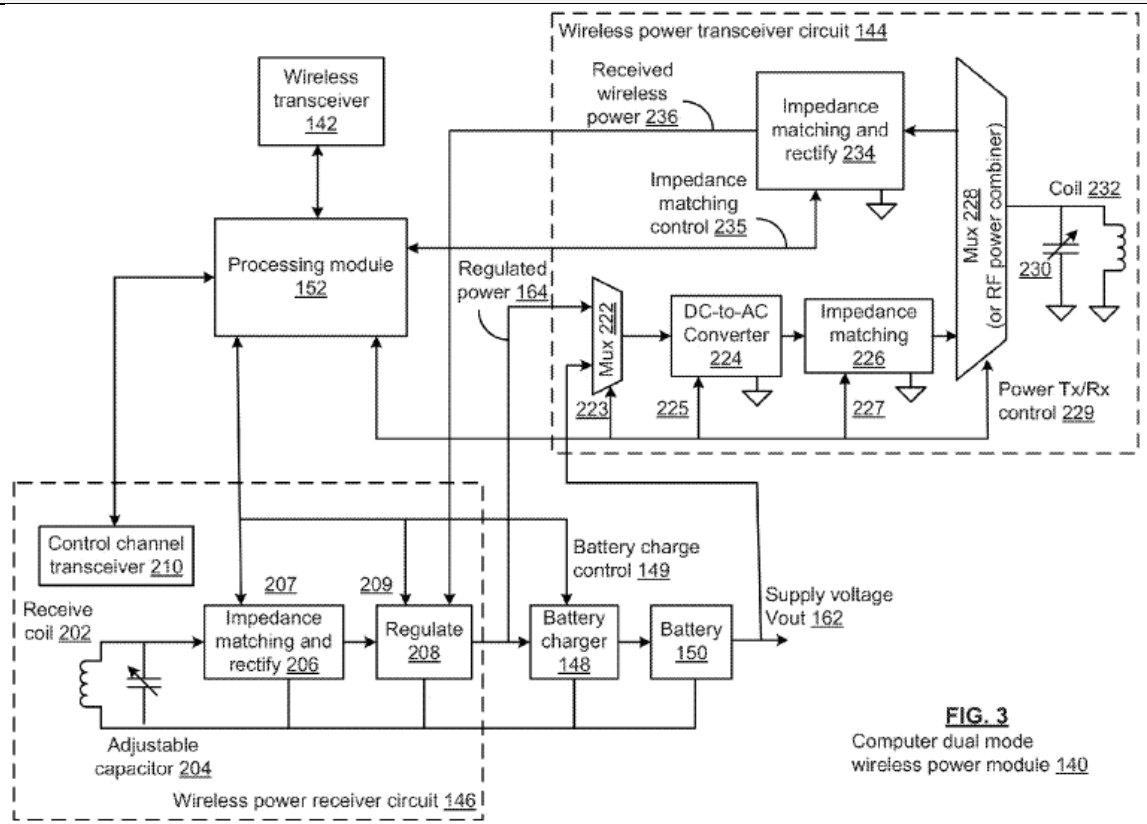
Claim Limitation	Exemplary Prior Art Disclosures
	410 resides on an electronic device 402 (e.g. mobile computing device or dock) and includes a power bridge circuit 411, a bi-directional coil assembly 412, a processor 413, a power circuit 414, and a communication circuit 415. Similar to the inductive signal interface 310 of FIG. 3, the inductive signal interface 410 may reside on any device that is capable of inductively receiving or transmitting power with another suitably configured device. ***As with an embodiment of FIG. 3, a first computing device uses the inductive signal interface 410 to form an inductive link 430 with a second electronic device 42***0. The second electronic device may also include an embodiment of inductive signal interface 410. Chatterjee, ¶ 41. The bi-directional coil assembly 412 is configurable to form the inductive link 430 with the second electronic device 420. The bi-directional coil assembly 412 is coupled to the power bridge circuit 411 to transmit and/or receive a power signal. The bi-directional coil assembly 412 operates in a similar fashion as the bi-directional coil assembly 312 of FIG. 3 to transmit and receive the power signal. ***The bi-directional coil assembly 412 is also coupled to the communication circuit 415 to receive and transmit modulated data signals***. Chatterjee, ¶ 45. The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The ***communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. Chatterjee, ¶ 51. ***The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal***. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402.

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	Chatterjee, ¶ 53. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. *See generally* Chatterjee, Figs. 3-10. Chatterjee also discloses communication between the two electronic devices that results in charging of the second electronic device. For example: In some embodiments, ***the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from*** (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) ***by identification of the second electronic device 320*** in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit **411** to control the operation of the power

Claim Limitation	Exemplary Prior Art Disclosures
	bridge circuit **411** based on the determined mode of operation. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. *See generally* Figs. 3-5. **Van Der Lee** Van Der Lee discloses a "dual mode wireless power module for a device that includes a wireless power transceiver circuit" that can transmit or receive power. (Van Der Lee, Abstract). For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 2 Van Der Lee, Fig. 2.

Claim Limitation	Exemplary Prior Art Disclosures

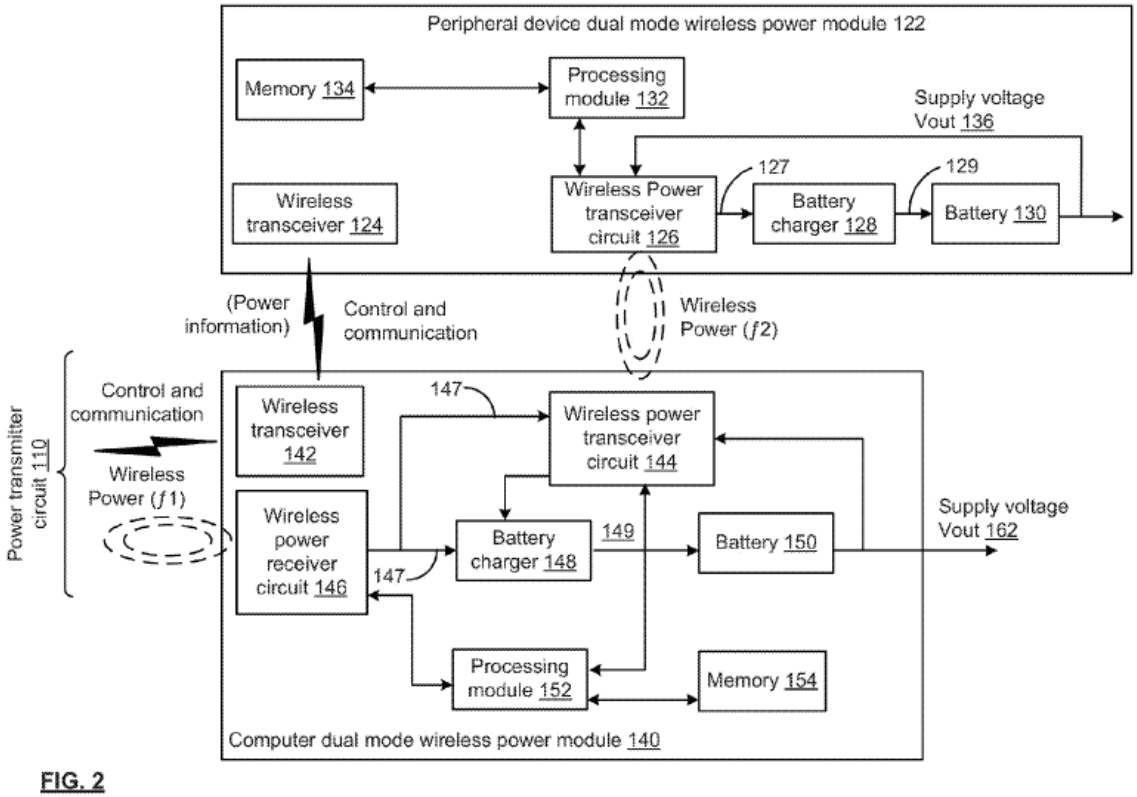


Van Der Lee, Fig. 3.

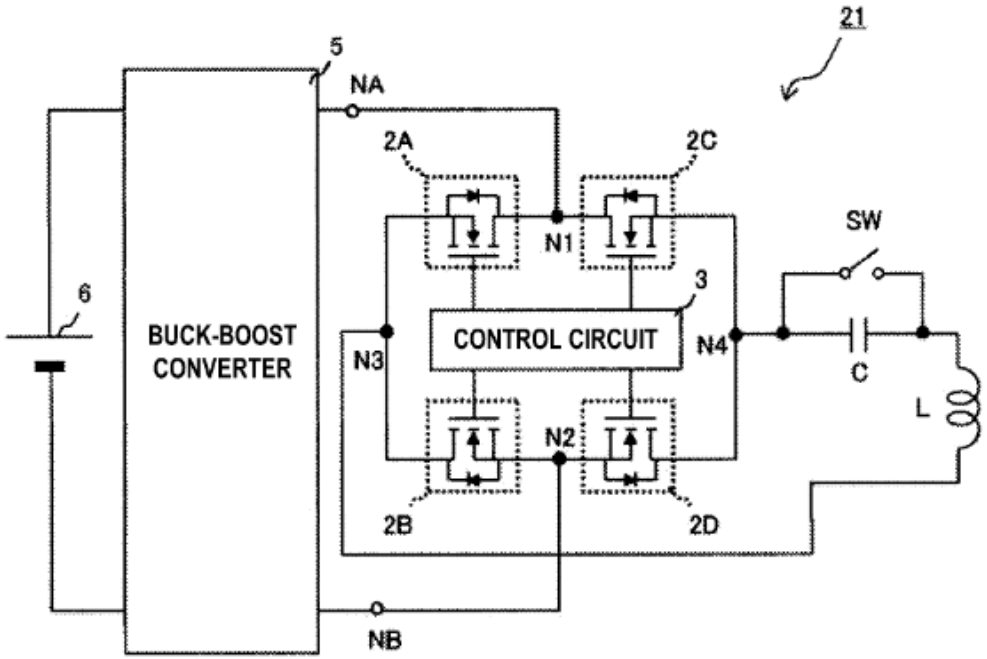
When in ***a wireless power transmit mode, the wireless power transceiver circuit 144 generates an electromagnetic field that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122***. The wireless power transceiver circuit 144 may be sourced by the DC rail voltage 147 when the computer dual mode wireless power module 140 is sufficiently proximal to the power transmitter circuit 110, or

Claim Limitation	Exemplary Prior Art Disclosures
	sourced by the supply voltage Vout 162 from the battery 150 when the computer dual mode wireless power module 140 is not sufficiently proximal to the power transmitter circuit 110. When ***in a wireless power receive mode, the wireless power transceiver circuit 144 receives an electromagnetic field that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122***. The wireless power transceiver circuit 144 converts the wireless power link into a voltage delivered to the battery charger 148, which in turn charges the battery 150. Van Der Lee, ¶¶ 46-47. ***When in a wireless power transmit mode,*** as dictated by the power Tx/Rx control 229 from the processing module 152, ***the wireless power transceiver circuit 144 is powered by*** two possible sources, the first being the regulated power 164 (that is, a regulated rail voltage) when receiving wireless power from wireless power receiver circuit 146, and the second being ***the battery 150 via the supply voltage Vout 162*** when the computer is in a battery operated mode (further presuming the battery 150 has sufficient energy to charge other devices, as is discussed later in further detail with respect to FIGS. 5 and 6). ***In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228***. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232 to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. ***The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module***. When ***in a wireless power receive mode***, such as when the computer dual mode wireless power module 140 does not receive wireless power via the wireless power receiver circuit 146, as indicated through the power Tx/Rx control 229 from the processing module 152, ***the coil 232 of the wireless power transceiver circuit 144 receives a wireless power signal*** transmitted by the coil

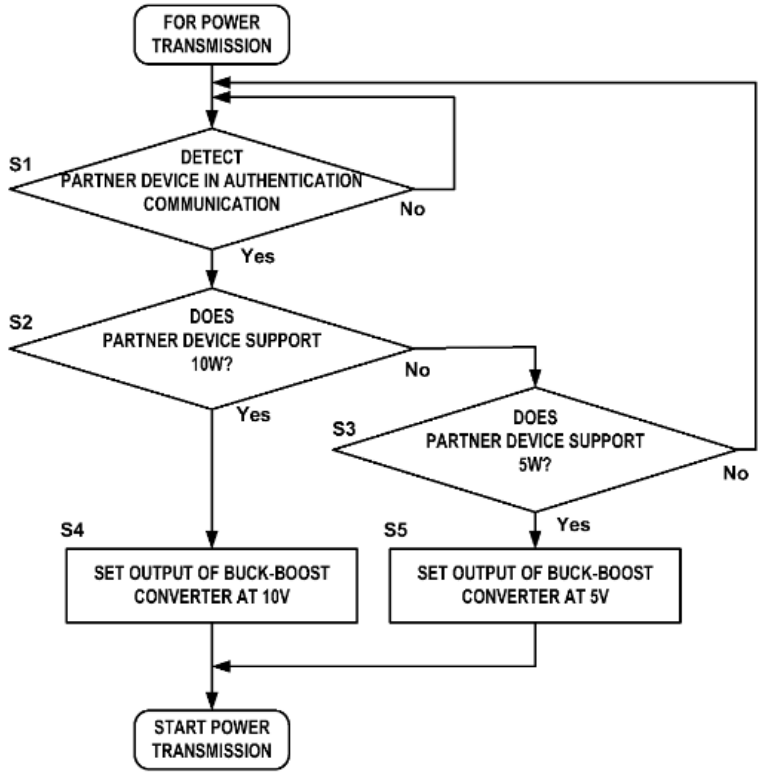
Claim Limitation	Exemplary Prior Art Disclosures
	another device having a peripheral device dual mode wireless power module. In this mode, ***the impedance matching and rectify circuit 234 converts the AC voltage into a received wireless power 236, which is rectified to a DC voltage. The DC voltage is regulated via the regulate circuit 208 for the battery charger 148, which in turn charges the battery 150***. Van Der Lee, ¶¶ 53–55. For clarity, in discussion of the Figures, the computer 100 may be referred to as a primary device, and the other devices as peripheral devices. The understanding being that these labels for the purpose of convenience and clarity, and with the further understanding that some or all of the devices may include a dual mode wireless power module as discussed herein. Van Der Lee, ¶ 23. Van Der Lee also discloses a first wireless power module that receives power information from a second wireless power module to place the first wireless power module in, for example, a power transmit mode. For example: ***The computer dual mode wireless power module 140 communicates with the peripheral device dual mode wireless power module 122 with power information*** via the wireless transceivers 142 and 124, respectively, using a control and communication link (for example, Radio Frequency (RF), Bluetooth, Millimeter Wave (MMW), Near Field Communications (NFC), et cetera) regarding wireless power matters (such as, frequency selection, operating frequency, impedance matching settings, power levels, et cetera). Van Der Lee, ¶ 48. ***From the frame-of-reference of the device receiving the power information, a determination is made whether to place that the dual mode wireless power device in either of a receive wireless power mode when the power status of the other device is favorable, or of a transmit wireless power mode when the power status of the other device is unfavorable***. Van Der Lee, ¶ 77. In the other context ***when the power status of the other device is unfavorable***, indicating that the other, or peripheral, device seeks to charge or replenish the peripheral device's battery, and the

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	primary, or computer, device has the voltage capacity and ***the wireless power transceiver of the computer dual mode wireless power module is placed in a power transmit mode*** at step 408. Van Der Lee, ¶ 79.  FIG. 2 Van Der Lee, Fig. 2; *see also id.* ¶¶ 75-79, Fig. 5. **Shinoda** Shinoda discloses a wireless power transfer terminal that enables a power device to be used for both power transmission and power reception.

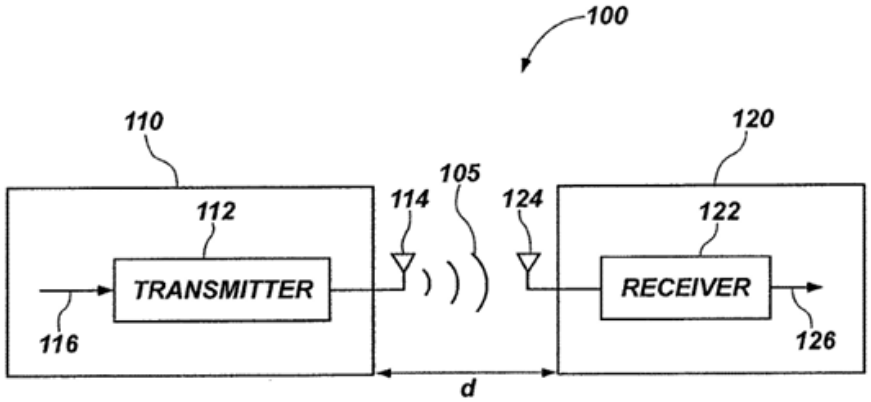
Claim Limitation	Exemplary Prior Art Disclosures
	For example: This disclosure provides ***a wireless power transfer terminal that enables a power device to be used for both power transmission and power reception*** and allows space savings of circuits and a reduction in the cost of manufacturing. Shinoda, Abstract. The present invention relates ***to a wireless power transfer terminal that transmits and receives power to and from an electronic device*** in a noncontact manner. Shinoda, 1:15-17 Traditionally, ***a wireless power transfer terminal used for both transmission and reception that can both receive and transmit power by wireless power transfer*** has been proposed. See, for example, Japanese Unexamined Patent Application Publication No. 2006-60910 (Patent Literature 1). Such a wireless power transfer terminal can be utilized as an auxiliary power source of an electronic device, such as a cellular phone terminal or a potable player, and in giving power to and receiving power from other electronic devices. FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. ***The power transmission circuit 103 includes an inverter for converting an input voltage from, for example, a battery, into an alternating-current output***. ***The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device***. The power reception circuit 104 includes a rectifier circuit for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 2:22-46. FIGS. 2A to 3B are circuit diagrams of a wireless power transfer terminal 1 according to the present embodiment. The arrows with the broken lines in FIGS. 2A and 2B indicate a current for

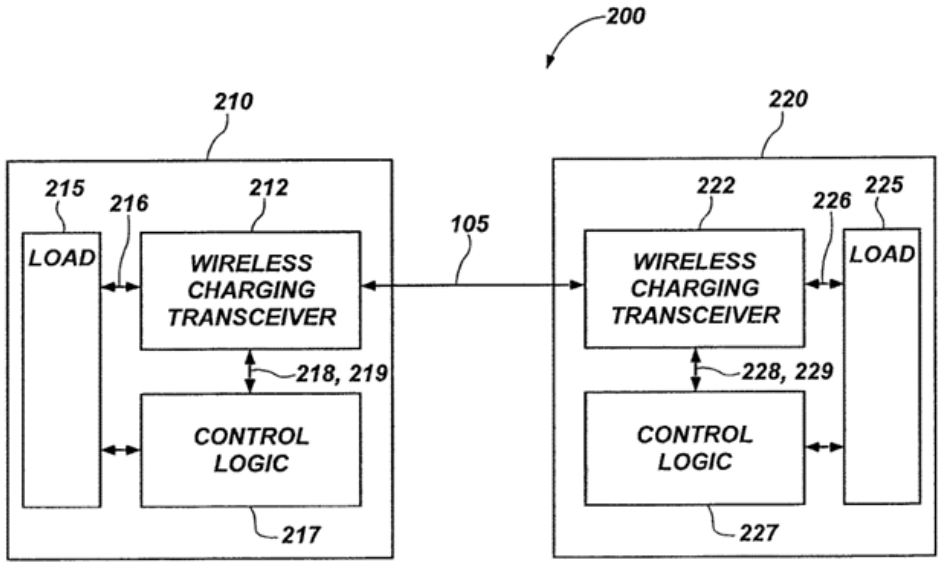
Claim Limitation	Exemplary Prior Art Disclosures
	power transmission mode and those in FIGS. 3A and 3B indicate a current ***for power reception mode***. Shinoda, 3:23-27.  FIG.5 Shinoda Figs. 5; *see also id.* Figs. 1-5, 7. Shinoda also discloses communication between a wireless power transfer terminal and a partner device before transmitting power to charge the partner device. For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating***

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	voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.6 Shinoda, Fig. 6. ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20.

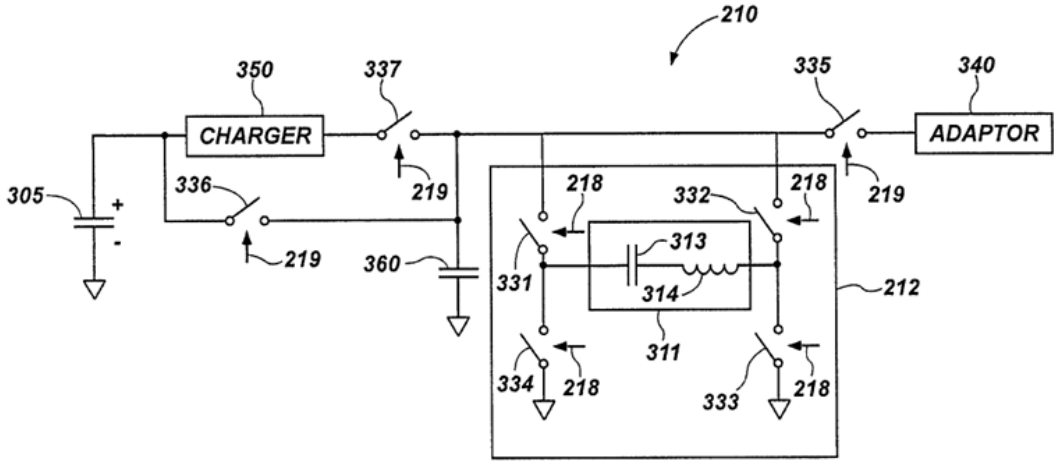
Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203 Singh-203 discloses an electronic device that can wirelessly share power by an inductive method, and that the electronic device can operate in a load mode in which it can be supplied power from another device, or a source mode in which it can provide power to another device. For example: > Embodiments of the present disclosure relate generally to inductive wireless power transfer and, more particularly, to apparatuses and related method for having different modes of operation for inductive wireless power transfer. Singh-203, 1:8-11. > Embodiments of the present disclosure include an inductive wireless power enabled device. The inductive wireless power enabled device comprises a transceiver including a plurality of switches coupled with a resonant tank, and control logic configured to drive the plurality of switches to operate the resonant tank in one of a transmit mode and a receive mode. > Another embodiment of the present disclosure includes an inductive wireless power enabled device. The inductive wireless power enabled device comprises a transceiver including a plurality of switches coupled with a resonant tank. The transceiver is configured to both transmit a wireless power signal through the resonant tank and generate power from an incoming wireless power signal through the resonant tank depending on a current operational mode. Singh-203, 1:45-59. > FIG. 1 is a schematic block diagram of an inductive wireless power transfer system 100. The inductive wireless power transfer system 100 includes a wireless power transmitting apparatus 110, and a wireless power receiving apparatus 120. The wireless power transmitting apparatus 110 includes a transmitter 112 having a transmit coil 114 configured to generate an electromagnetic field 105 for providing energy transfer to the wireless power receiving apparatus 120. The wireless power receiving apparatus 120 includes a receiver 122 having a receive coil 124 configured to couple with the electromagnetic field 105. The transmit coil 114 and the receive coil 124 may be sized according to the particular devices and applications to be associated therewith. The

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	electromagnetic field 105 may also be referred to as the wireless power signal 105 for energy transfer from the transmitter 112 to the receiver 122. An input signal 116 may be provided to the transmitter 112 for providing the transmitter 112 with the power for generating the wireless power signal 105 that provides an energy transfer to the wireless power receiving apparatus 120. The receiver 122 may couple to the wireless power signal 105 and generates an output signal 126 in response thereto. The output signal 126 may provide the power that is used by the wireless power receiving apparatus 120 for storing (e.g., charging a battery), consumption (e.g., providing system power), or both. Singh-203, 3:39-64.  FIG. 1 The wireless power transmitting apparatus 110 may be a wireless power charger. The wireless power receiving apparatus 120 may be a mobile electronic device, such as a cell phone, smart phone, media player (e.g., mp3 player, DVD player, etc.), electronic reader, tablet computer, personal digital assistant (PDA), camera, laptop computer, and personal electronic device in which wireless power may be received. The wireless power receiving apparatus 120 may also be a less mobile electronic device, such as a television, personal computer, media player (e.g., DVD player, Blu-ray player, etc.) or any other device that may operate by, and/or store electrical power. The

Claim Limitation	Exemplary Prior Art Disclosures
	wireless power receiving apparatus 120 may be one of a number of other items, such as an automobile or any other devices that may include batteries that may be charged through the wireless power transmitting apparatus 110. Singh-203, 4:44-59. FIG. 2 is a schematic block diagram of an inductive wireless power transfer system 200 according to an embodiment of the present disclosure. The inductive wireless power transfer system 200 includes a first wireless power enabled device 210 and a second wireless power enabled device 220. The first wireless power enabled device 210 may include a wireless charging transceiver 212, a load 215, and control logic 217. Similarly, the second wireless power enabled device 220 may include a wireless charging transceiver 222, a load 225, and control logic 227. Singh-203, 5:3-12.  FIG. 2

Claim Limitation	Exemplary Prior Art Disclosures
	The first wireless power enabled device 210 and the second wireless power enabled device 220 may each be configured to either transmit or receive the wireless power signal 105 depending on its mode of operation. For example, the first wireless power enabled device 210 may be configured to have a transmit mode and a receive mode. In the transmit mode, the first wireless power enabled device 210 may generate the wireless power signal 105 for energy transfer another device. In the receive mode, the first wireless power enabled device 210 may receive the wireless power signal 105 and generate an output power signal 216 for a load 215. Likewise, the second wireless power enabled device 220 may be configured to have a transmit mode and a receive mode. In the transmit mode, the second wireless power enabled device 220 may generate the wireless power signal 105 for energy transfer another device. In the receive mode, the second wireless power enabled device 220 may receive the wireless power signal 105 and generate an output power signal 226 for a load 225. The control logic 217, 227 may be configured to determine which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. The control signals 218, 219, 228, 229 may be transmitted to the wireless charging transceivers 212, 222 to drive the desired operations. As an example, the control logic 217, 227 may include a processor (e.g., microcontroller) that is configured (e.g., programmed) to determine whether the respective wireless charging transceiver 212, 222 is to operate in transmit mode or receive mode. The control logic 217, 227 may further include computer-readable media (e.g., memory) storing computing instructions for execution by the processor related to performing processes of the embodiments of the present disclosure. Memory may include volatile and non-volatile memory. The loads 215, 225 may include energy storage devices (e.g., batteries), system components of the wireless power enabled devices 210, 220, or both. Thus, the output power signals 216, 226 may be a charging signal for an energy storage device, or a system power signal for the various system components. Because each of the wireless power enabled devices 210, 220 may be configured for either transmitting or receiving power, the wireless power enabled devices 210, 220 may be configured for wireless power “charging on the go” (OTG charging). For example, each of the wireless power enabled devices 210, 220 may be an electronic device (e.g., cell phone, tablet, laptop, etc.) that may provide power to, or receive power from, another electronic device (e.g., cell phone, tablet, laptop, etc.). Of course, a wireless power enabled devices that is configured for OTG charging

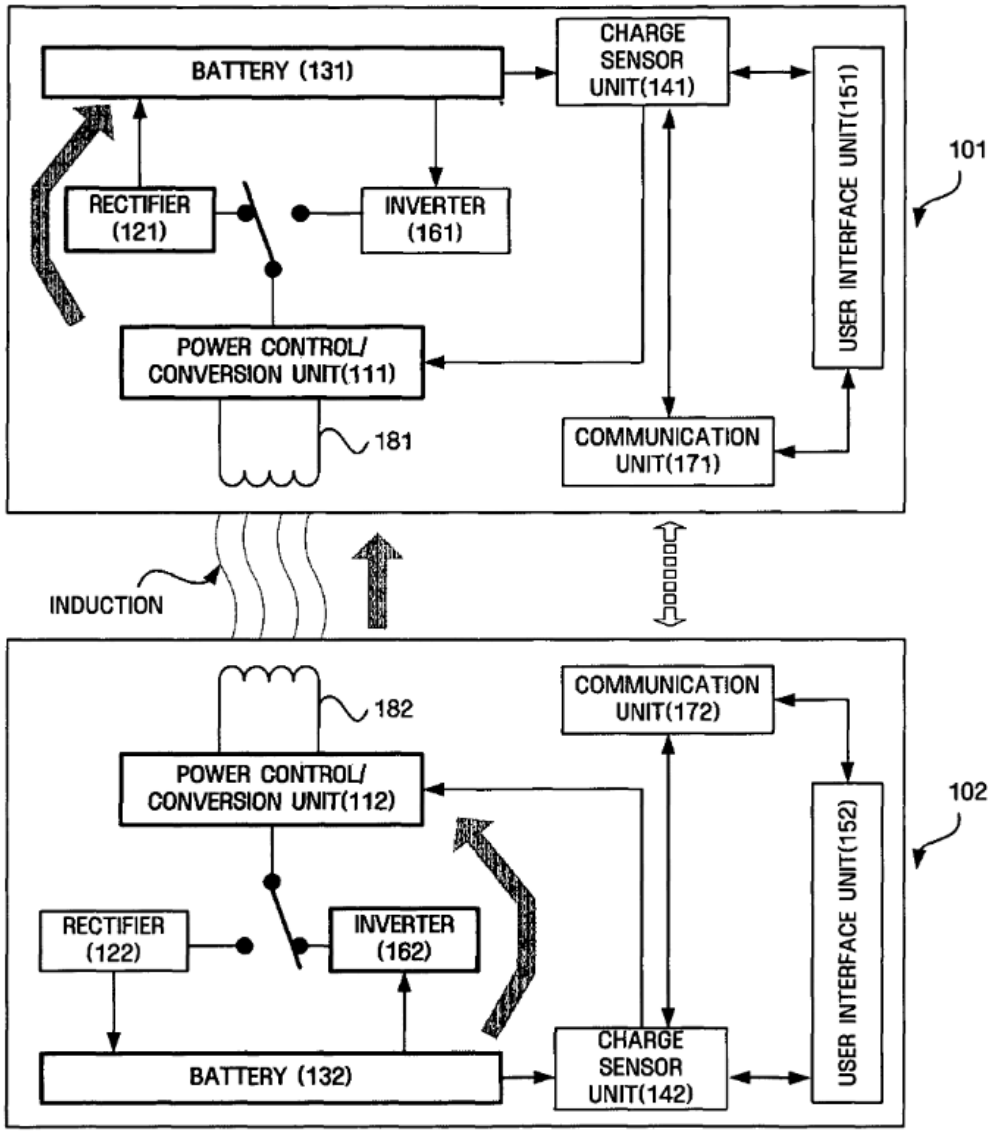
Claim Limitation	Exemplary Prior Art Disclosures
	may inductively couple with wireless power devices that are only configured for one-way charging. For example, the first wireless power enabled device 210 may operate in receive mode to receive the wireless power signal 105 generated from a wireless power transmitting apparatus that only operates in a transmit mode. Likewise, the first wireless power enabled device 210 may operate in transmit mode to generate the wireless power signal 105 for reception from a wireless power receiving apparatus that only operates in a receive mode. In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated. Singh-203, 5:13-6:38. Referring specifically to FIG. 3A, the wireless power enabled device 210 may include a wireless charging transceiver 212 that is coupled to an energy storage device 305. As discussed above, the energy storage device 305 may be included as part of the load 215 (FIG. 2) that receives the power

Claim Limitation	Exemplary Prior Art Disclosures
	from the wireless energy transfer. The wireless charging transceiver 212 may provide power to the energy storage device 305 through a charger 350 during receive mode. Although not specifically shown in FIGS. 3A through 3D, it is recognized that other system components of the wireless power enabled device 210 may receive power from the wireless charging transceiver 212, and that a path for system power may also be provided. The wireless charging transceiver 212 may receive power from the energy storage device 305 through the path parallel to the charger 350 to generate the wireless power signal 105 (FIG. 2) during transmit mode. In some embodiments, the wireless power enabled device 210 may receive power through non-wireless methods, such as being coupled with an adaptor 340 that may be plugged in to a traditional AC outlet. A plurality of switches 335, 336, 337 are coupled with the wireless charging transceiver 212 to control the power flow for the appropriate mode of operation. The plurality of switches 335, 336, 337 may be controlled by control signals 219 from the control logic 217 (FIG. 2). Singh-203, 6:39-7:9; *see also* FIGs 3A & 3B and descriptions thereof.  FIG. 3A Singh-203, FIG. 3A. **Sagoo**

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo discloses an electronic device that can wirelessly share power by an inductive method, and that the electronic device can operate in a load mode in which it can be supplied power from another device, or a source mode in which it can provide power to another device. For example: Apparatuses and methods consistent with the present invention relate to ***charging a power supply in a non-contact manner***, and more particularly, to ***wirelessly sharing power by an inductive method***. Sagoo, 1:16-19. The present invention provides a method of ***inductively charging a battery in a non-contact or wireless manner***, and more particularly, a method of charging a battery by providing a common interface among mobile/portable devices and sharing power supplies in a wireless or non-contact manner. The present invention also provides ***a device which detects other devices to enable charging or discharging in a non-contact manner***. Sagoo, 2:9-16. According to an aspect of the invention, there is provided an apparatus for wirelessly sharing power by induction, the apparatus including a first battery supplying power; a rectifier supplied with an AC voltage, converts the AC voltage into a DC voltage, and outputs the DC voltage; an inverter supplied with the DC voltage, converts the DC voltage into the AC voltage, and outputs the AC voltage; a power control/conversion unit connected to the rectifier or the inverter and supplying power to charge the first battery or a second battery that is provided in an external device as a power supply for the first battery; and a local communication unit communicating with the external device. According to another aspect of the invention, ***there is provided a method of wirelessly loading power by induction***, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; setting an inductive coil coupled***

Claim Limitation	Exemplary Prior Art Disclosures
	with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. According to still another aspect of the invention, ***there is provided a method of wirelessly supplying power by induction***, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil***. Sagoo, 2:22-55. Hereinafter, a mode in which a mobile device provides energy to another device is referred to as a ***source mode***, and a mode in which the battery of the mobile device is charged by energy from another device is referred to as a ***load mode***. Sagoo, 4:30-33. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode)***. The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. The charge sensor unit 140 checks the charge state of the battery 130 and supplies the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160. Sagoo, 4:56-5:4.

FIG. 4

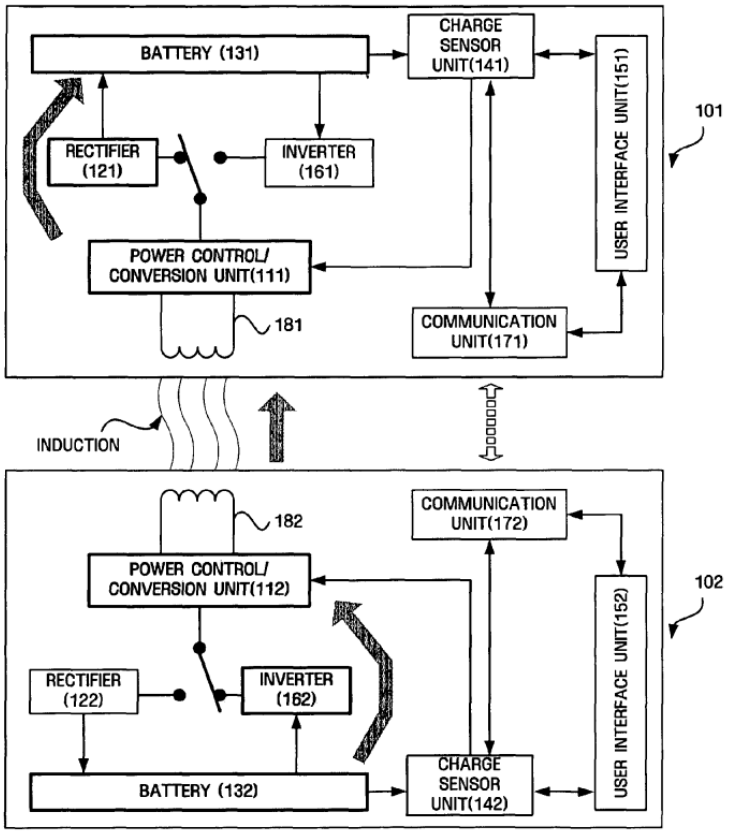


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Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Fig. 4; *see also id.* Figs. 3-8. FIG. 4 is a view showing two mobile devices according to an exemplary embodiment of the invention, which perform charging in a non-contact manner. ***In FIG. 4, a first device 101 is in the load mode, and a second device 102 is in the source mode***. Sagoo, 5:40-44. FIG. 6 is a flowchart showing ***an operation in the load mode in which a mobile device according to an exemplary embodiment of the invention receives energy from another mobile device***. First, the charge state of the battery is checked (S210). The charge state of the battery is checked by the charge sensor unit. When the battery needs to be charged (Yes in S220), a process of receiving energy is performed. When the battery does not need to be charged (No in S220), the charge sensor unit periodically checks the charge state of the battery (S210). When the battery needs to be charged, a device capable of operating in the source mode is detected among neighboring devices (S230). The mobile device performs local area communication with the neighboring devices through a local area communication unit so as to detect the amounts of charge in the neighboring devices. The detected charge states of the neighboring devices are output (S240). A specific device is selected among the neighboring devices through the user interface unit (S250). Alternatively, it is possible to automatically select a special device without requiring input from the user. It is checked whether the selected mobile device can operate in the source mode (S260). For example, the selected mobile device may be set so as not to operate in the source mode. Further, in a case in which the selected mobile device operates in the source mode only when the two devices authenticate each other, if the authentication fails, the selected mobile device does not operate in the source mode. When the selected mobile device cannot operate in the source mode, another mobile device can be selected. When the selected mobile device (hereinafter, referred to as a source device) can operate in the source mode, ***the mobile device to be charged is switched to the load mode (S270). When the mobile device to be charged is switched to the load mode, the rectifier is connected to the battery and the power control/conversion unit such that energy can be received from the outside. Further, the inductive coil is set as the secondary coil (S280). Energy is received from the secondary coil and the primary coil of the source device (S290)***. The charge state of the battery

Claim Limitation	Exemplary Prior Art Disclosures
	can be checked while the energy is being received such that the battery is prevented from being excessively charged. FIG. 7 is a flowchart showing ***the operation of the mobile device according to an exemplary embodiment of the invention when the mobile device is in the source mode for providing energy to another mobile device.*** The charge state of the battery is transmitted to a mobile device requiring charging (referred to as a charge device) (S310). The source device receives data instructing the source device to operate in the source mode from the charge device (S320). The source device performs an authentication process with respect to the charge device (S330). This is to prevent the source device from being discharged by an unauthenticated device. Next, it is determined whether the authentication process succeeded (S340). When the authentication fails, the source device does not provide energy. When the authentication succeeds, the source device performs an operation for supplying energy. ***First, the source device is switched to the source mode (S350). As described above, in order for the source device to be switched to the source mode, the inverter is connected to the battery and the power control/conversion unit such that the power of the battery can be supplied to the charge device. Then, the inductive coil is set to the primary coil (S360). Next, the source device provides energy to the charge device by using the power of the battery (S370).*** While providing energy, the source device can check the charge state of the battery such that the battery is prevented from being excessively discharged. Sagoo, 7:4-8:6. Sagoo also discloses communication between two electronic devices that results in charging of the second electronic device. ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field

Claim Limitation	Exemplary Prior Art Disclosures
	Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. An example of a process in which the two mobile devices share energy in a non-contact manner will now be described. A user having the first device 101 is informed through a user interface unit 151 that the battery does not have enough charge. The charge sensor unit 141 measures the charge state of the battery and communicates with the communication unit about the charge state of the battery. Rechargeable batteries such as the battery 131 of the first device 101 can be installed in devices, such as a notebook computer, a PDA, an MP3 player, and a game console, and have different voltages, currents, and capacities. The battery can be formed of, for example, a nickel metal hydride (NiMH) battery or a lithium-ion battery. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device and outputs the received information to the user interface unit 151***. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:4-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, the communication units can perform authentication with respect to each other such that charging is performed between authenticated devices. Sagoo, 6:43-48.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 4  Sagoo, Fig. 4; *see also id.* Figs. 3-7. **Schuessler**

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler discloses a bi-directional wireless charger that includes a coil for wireless power transfer and a rechargeable battery, and can selectively cause power to be delivered from its battery to the coil to recharge another device, or from the coil to its battery. For example: ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively causes power to be delivered from the coil to the battery and selectively causes power to be delivered from the battery to the coil, and a control mechanism***. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the coil to the battery***, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the battery to the coi***l. Schuessler, Abstract. ***A bi-directional charging device may wirelessly receive power and wirelessly deliver power***. When the bi-directional charging device is in the vicinity of a charging bay it may receive power from the charging bay to recharge an internal battery. When the bi-directional charging device is in the vicinity of a rechargeable electronic device it may deliver power to the electronic device for recharging an internal battery of the electronic device. Thus, the bi-directional charging device may be kept near rechargeable electronic devices to recharge batteries in the electronic devices, for example throughout the day. The bi-directional charging device may itself be recharged when it is placed in the vicinity of a charging bay, for example overnight. Schuessler, 1:41-53. FIG. 1A illustrates a bi-directional charging device 105 and a rechargeable electronic device 115 placed in the vicinity of a charging bay 110. In the configuration illustrated in FIG. 1A, ***bi-directional charging device 105 and electronic device 115 receive power from charging bay 110 wirelessly, for example, through a near field or far field coil-to-coil energy transfe***r. The distance d between bi-directional charging device 105 and charging bay 110 or between electronic device 115 and charging bay 110 depends on the charging mechanism used. In some

Claim Limitation	Exemplary Prior Art Disclosures
	implementations, distance d may be small, in terms of a few centimeters. In other implementations, distance d may be several centimeters or meters. ***Bi-directional charging device 105 is a portable unit that may be selectively configured to receive power from a charging bay 110 or selectively configured to deliver power***, as described below. In some implementations, bi-directional charging device 105 may be configured only for the receiving or delivering of power. In many other implementations, bi-directional charging device 105 may be configured for the receiving and delivering of power as only one of many functions with device 105. For example, ***bi-directional charging device 105 may be a portable device such as a notebook computer, laptop computer, tablet computer, or a cellular phone, to name just a few examples. In such a device 105, the device 105 may both use the power received from charging bay 110 and share the power with a rechargeable electronic device 115***. In this manner, a portable device may provide power for other portable devices in the vicinity, including providing power for other rechargeable electronic devices 115. Schuessler, 1:56-2:19. While being charged by charging bay 110, bi-directional charging device 105 may provide power to charge electronic devices 115. For example, power may be received by bi-directional charging device 105 at one coil and power may be delivered to an electronic device 115 from another coil substantially concurrently. For another example, power may be received by bi-directional charging device 105 at a coil at one frequency and power may be delivered to an electronic device 115 from the same coil at a different frequency substantially concurrently. ***The capability to both receive power and deliver power substantially concurrently*** may be used to stack devices oh a charging bay 110 for maximum utilization of available surface space of charging bay 110. Schuessler, 3:23-35. FIG. 1B illustrates an exemplary system 100 in which a bi-directional charging device 105 is placed in the vicinity of a rechargeable electronic device 115 away from charging bay 110, in an exemplary configuration for charging the electronic device 115. The distance d between bi-directional charging device 105 and electronic device 115 depends on the charging mechanism used, as described above. The same mechanism used to charge devices 105 and 115 from charging bay 110 may be used to ***charge rechargeable electronic device 115 from bi-directional charging device 105***. For example, rechargeable electronic device 115 may use the same coil for receiving

Claim Limitation	Exemplary Prior Art Disclosures
	power from bi-directional charging device 105 as used for receiving power from charging bay 110, and ***bi-directional charging device 105 may use the same coil to provide power to rechargeable electronic device 115 as used for receiving power from charging bay 110***. However, in some implementations, ***bi-directional charging device 105 may use one coil to receive power from charging bay 110 and a separate coil to provide power to rechargeable electronic device 115***. Schuessler, 3:36-55. Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in ***a power receiving mode*** or directing power from rechargeable battery 215 ***in a power delivering mode***. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. ***Rechargeable battery 215 represents a device capable of storing charge, accepting charge for storage, and delivering charge from the stored charge***. Some examples of rechargeable battery technology include the use of lead-acid; alkaline; combinations with nickel such as nickel-iron, nickel-cadmium, and nickel-zinc; lithium forms or combinations with lithium such as lithium ion, lithium polymer, lithium-sulfur, lithium titanate, and thin film lithium; and other elemental combinations such as zinc-bromium; sodium-sulfur; and silver-zinc. ***Rechargeable battery 215 may represent multiple rechargeable batteries*** 215, as discussed above. In a bi-directional charging device 105 with multiple rechargeable batteries 215, the batteries 215 may be of different technologies. Schuessler, 4:61-5:7.

Claim Limitation	Exemplary Prior Art Disclosures
	Control mechanism 225 represents the control hardware, firmware, and/or software that determines ***the mode for the bi-directional charging device 105, for example, a power receiving mode or a power delivering mode***. As discussed above, there may be multiple concurrent modes. Schuessler, 5:39-43. FIG. 3A illustrates an exemplary charging bay 305 that may be plugged into a wall receptacle for connection to a building main power supply. A charging bay such as bay 305 may be placed in an entryway or a corner or the like so that as occupants of the building enter, they may place a bag on charging bay 305. Inside the bag is a ***bi-directional charging device 105 to be charged from charging bay 305. Exemplary bags illustrated in FIG. 3A are a handbag 310, briefcase 315, and backpack 320 each containing one bi-directional charging device 105***. Of course, more than one bi-directional charging device 105 may be carried in a bag. As a bag is placed on charging bay 305, a bi-directional charging device 105 inside the bag may recognize the presence of charging bay 305 and begin receiving power from charging bay 305. Bi-directional charging device 105 may recognize the presence of charging bay 305 by, for example, recognizing that a large power source at an appropriate frequency is nearby, or by communicating with charging bay 105 through external communication interface 235. In some implementations, charging bay 305 may be able to charge a bi-directional device 105 from a distance. For example, as illustrated in FIG. 3A, backpack 320 is placed a distance from charging bay 305, but may still be able to receive energy transfer from charging bay 305 if the energy transfer mechanism is able to span the distance. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. ***If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested***. A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 7:49-8:21; *see also* Schuessler, Figs. 1-5. Schuessler also discloses communication between two electronic devices that results in charging the second electronic device. For example: ***One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status***. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. If communication capability is included in both bi-directional charging device 105 and rechargeable electronic device 115 as described above, then the devices may communicate with each other to coordinate energy transfer. Coordination of energy transfer may include beginning and ending energy transfer and status communication during energy transfer. Schuessler, 3:56-61. External communication interface 235 optionally provides the capability for communication with external devices such as charging bay 110 or rechargeable electronic device 115, as discussed above. External communication interface 235 includes the hardware, firmware and/or software necessary for communication through the implemented protocol. For example, interface 235 may include integrated circuit transceiver chips with associated circuitry and multiple levels of software to enable communications using Bluetooth protocol. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, ***external communication interface 235 may perform handshaking with an external device, and then inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure

Claim Limitation	Exemplary Prior Art Disclosures
	rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. ***External communication interface 235 may be used by bi-directional charging device 105 to make requests to external devices for charging***. For example, upon recognizing that a charging bay 110 is in the vicinity, bi-directional charging device 105 may request the charging bay 110 to begin delivering power. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215. Schuessler, 6:52-7:6. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. ***A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge***. Schuessler, 8:7-21. **Yeh** Yeh discloses a bidirectional wireless charging and discharging device for an electronic device that selectively operates in a receiving mode and a transmission mode to charge a battery of the electronic device, or to transmit power from the battery to charge a second electronic device. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	Disclosed is a ***bidirectional wireless charging and discharging device*** for portable electronic device. The bidirectional wireless charging and discharging device includes: a wireless receiving and transmitting unit and a logic control unit, a step-up/step-down unit, first and second reverse current protectors, a control switch, and at least a supercapacitor. The first and second reverse current protectors function to prevent reverse current and to switch. The step-up/step-down unit controls step-up conversion in discharging and step-down conversion in charging. The logic control unit detects if a load exists on an opposite side of the wireless receiving and transmitting unit and controls the operations of the step-up/step-down unit and the first and second reverse current protectors, and can be even combined with a control switch to control selectively charging and discharging operations. The supercapacitor absorbs surge occurring in each charging operation. Yeh, Abstract. The present invention relates to a bidirectional wireless charging and discharging device, and in particular to ***a bidirectional wireless charging and discharging device for portable electronic device that protects a rechargeable battery*** from accumulated damage caused by repeated charging and improves wireless charging/discharging efficiency and step-up/step-down efficiency. Yeh, 1:7-14. The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to ***the transmission mode***, the control switch 5 is actuated to effect switching. Presumably, ***a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device***. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the

Claim Limitation	Exemplary Prior Art Disclosures
	second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition. The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so ***that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37***. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, ***the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current***. Yeh, 5:40-6:37.

Claim Limitation	Exemplary Prior Art Disclosures
	The ***receiving mode*** of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with ***a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93*** of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition. Yeh, 6:48-7:18; *see also* Yeh, Figs. 1-3. Yeh also discloses communication between two electronic devices such as whether a load exists on the detection pin, that results in charging of the second electronic device. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; ***if there is a load***: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that ***electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:4-29; *see also id.* Figs. 3-7. **Cook** Cook discloses a bidirectional wireless power transceiver in a device that can operate in a receive mode to charge a battery of the device and a transmit mode to provide power from the battery to charge a second device. For example: Typically, each powered device such as a wireless electronic device requires its own wired charger and power source, which is usually an alternating current (AC) power outlet. Such a wired configuration becomes unwieldy when many devices need charging. Approaches are being developed that use over-the-air or wireless power transmission between a transmitter and a receiver coupled to the electronic device to be charged. ***The receive antenna collects the radiated***

Claim Limitation	Exemplary Prior Art Disclosures
	power and rectifies it into usable power for powering the device or charging the battery of the device. Cook, ¶10 ***The term "wireless power" is used herein to mean any form of energy associated with electric fields, magnetic fields, electromagnetic fields, or otherwise that is transmitted from a transmitter to a receiver without the use of physical electromagnetic conductors***. Power conversion in a system is described herein to wirelessly charge devices including, for example, mobile phones, cordless phones, iPod, MP3 players, headsets, etc. Generally, one underlying principle of wireless energy transfer includes magnetic coupled resonance (i.e., resonant induction) using frequencies, for example, below 30 MHz. However, various frequencies may be employed including frequencies where license-exempt operation at relatively high radiation levels is permitted, for example, at either below 135 kHz (LF) or at 13.56 MHz (HF). At these frequencies normally used by Radio Frequency Identification (RFID) systems, systems must comply with interference and safety standards such as EN 300330 in Europe or FCC Part 15 norm in the United States. By way of illustration and not limitation, the abbreviations LF and HF are used herein where "LF" refers to f0=135 kHz and "HF" to refers to f0=13.56 MHz. Cook, ¶25. An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to ***charge a battery 136*** as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118. Cook, ¶31. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates ***an output power***

Claim Limitation	Exemplary Prior Art Disclosures
	PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Cook, ¶39. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable. Accordingly, ***the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device***. ***Various benefits of such a configuration include the ability of a device receive and store wireless power and then to subsequently transmit or "donate" stored power to another receiving or "absorbing" device***. Accordingly, such a configuration may also be considered as a "peer-to-peer" "charitable" charging configuration. Such a device-charging arrangement provides considerable convenience in location under which charging occurs (i.e., the receiver or "absorbing" device need not necessarily receive a charge from an inconveniently located or unavailable charging pad). Cook, ¶¶42-43. FIG. 5A and FIG. 5B illustrate a bidirectional wireless power device, in accordance with an exemplary embodiment. ***Bidirectional wireless powering and charging of electronic devices*** (e.g. mobile phones, head sets, MP3 players, etc.) is disclosed in which ***electrical energy can be wirelessly transferred, as illustrated in FIG. 5A, from a power conversion circuit 220 and***

Claim Limitation	Exemplary Prior Art Disclosures
	transmit antenna 214 of a power base 302 (e.g. charging pad) to a bidirectional wireless power transceiver 318 including a transceiver antenna 306 and a bidirectional power conversion circuit 308 of an electronic device 300 as illustrated in FIG. 5B. Then, as illustrated with reference to FIG. 5B, ***the wirelessly transmitted power is stored in a load illustrated as battery 310. The stored power in battery 310 is then donated through the bidirectional power conversion circuit 308 and transceiver antenna 306 of electronic device 300 to a receive antenna 312 and a power conversion circuit 314 of another electronic device 304 for consumption or storage in load or battery 316***. Cook, ¶ 44. As stated, electronic device 300 is configured for bidirectional wireless power transmission. With further reference to FIG. 5A, ***in a receiving or "absorbing" mode, battery (e.g., power storage device) 310 may be wirelessly charged from an AC mains supplied power base (e.g. charging pad) 302***. With further reference to FIG. 5B, electronic device 300 may be operated in reverse ***in a transmit or "donor" mode for transmission of wireless power to another electronic device 304 for operation and storage at a battery 316 that is used to power the electronic device 304***. Cook, ¶47. FIG. 6A and FIG. 6B illustrate various operational contexts for an electronic device configured for bidirectional wireless power transmission, in accordance with exemplary embodiments. Specifically, an electronic device 300 configured for bidirectional wireless power transmission engages in wireless power transmission with ***a power base 302 wherein electronic device 300 receives wireless power and stores the received power in a battery***. Subsequently electronic device 300 is solicited, volunteers or otherwise is enlisted as a donor of stored power. Accordingly, one or more electronic devices 304A, 304B receive power from electronic device 300 through a wireless power transmission process. It is contemplated that the wireless transmission process with electronic device 300 operating in donor mode, may be to provide power replenishment e.g. in an urgency, or at least temporary charge, to another device 304B, or the charging of a micro-power device 304A, such as headsets, MP3 players, etc. For this purpose, device A is set into donor mode via a user interface or responsive to allowed solicitations. Furthermore, ***donor electronic device 300 may also perform energy management of its own available power to avoid excessive depletion of stored power***

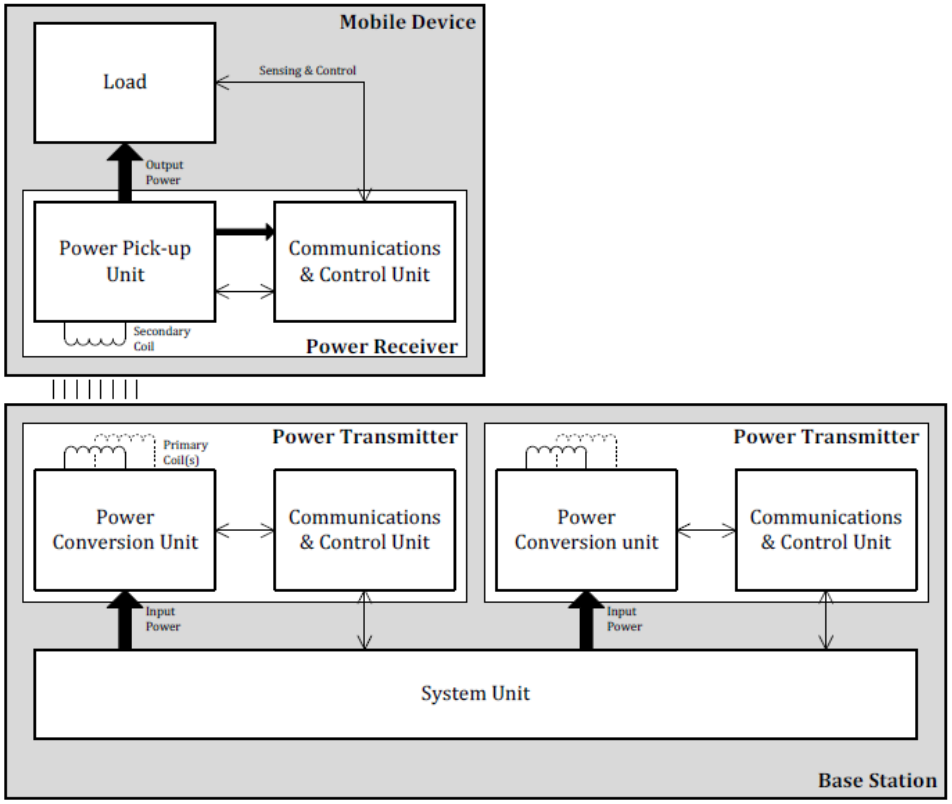
Claim Limitation	Exemplary Prior Art Disclosures
	within the battery of the donor electronic device 300. Accordingly, assuming a standardized wireless power interface, devices may be recharged or partially recharged almost everywhere from any wireless power device that can act as donor electronic device and that provides sufficient battery capacity. Cook, ¶¶48-49. FIG. 7 illustrates a block diagram of ***an electronic device configured for bidirectional wireless power transmission***, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, a bidirectional power conversion circuit 308 and ***a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324***. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane. Bidirectional power conversion circuit 308 further includes a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which ***the electronic device shares its power stored in battery 310 while in donor mode***. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶¶ 50-51. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a ***battery 462 (e.g. Li-Ion)***. Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶57. FIG. 10 illustrates a circuit diagram of a wireless power transmission system, in accordance with another exemplary embodiment. This exemplary embodiment enables exchange of energy from one battery operated device to another battery operated device equally in both directions. A

Claim Limitation	Exemplary Prior Art Disclosures
	wireless power transmission system 500 includes a bidirectional wireless power transceiver 318T (where "T" indicates a ***Transmitter configuration or transmit mode***) and a bidirectional wireless power transceiver 318R (where "R" indicates a ***Receiver configuration or receive mode***). Cook, ¶58. FIG. 11 illustrates a flowchart of a method for transceiving wireless power, in accordance with an exemplary embodiment. Method 600 for transceiving wireless power is supported by the various structures and circuits described herein. Method 600 includes step 602 for receiving an induced current from an antenna resonating in response to a magnetic near-field and rectifying the induced current into DC power through a bidirectional power conversion circuit when the bidirectional power conversion circuit is configured in ***receive mode***. Method 600 further includes step 604 for generating an induced current at a resonant frequency into the antenna from stored DC power through the bidirectional power conversion circuit and generating a magnetic near-field from the antenna when the bidirectional power conversion circuit is configured in ***transmit mode***. Cook, ¶64. *See generally* Cook, Figs. 1-10. Cook discloses a communication channel between a transmitter and receiver, and a frequency generation control circuit operates to control a bidirectional wireless power transceiver to operate in a transmit mode. For example: ***A communication channel 119 may also exist between the transmitter 104 and the receiver 108***. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel 119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32. Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and***

Claim Limitation	Exemplary Prior Art Disclosures
	control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59.

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	In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63.
[1a] one of coil and capacitor electrodes;	On information and belief, the Fulton Solution includes a coil such as a "primary coil" and "secondary coil" for inductive power transfer disclosed in the WPT standard. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 **Figure 2-1: Basic system overview** WPT, 8.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	On information and belief, the Fulton Solution comprises "a first circuitry comprising: an impedance network" which provides changeable impedance, such as an "impedance matching circuit" that provides different impedance when switch S is turned on/off, disclosed in the WPT standard. For example:

Claim Limitation	Exemplary Prior Art Disclosures

As shown in Figure 3-12, Power Transmitter design B1 uses a half-bridge inverter to drive the Primary Coil array. In addition, Power Transmitter design B1 uses a multiplexer to select the position of the Active Area. The multiplexer shall configure the Primary Coil array in such a way that one, two, or three Primary Coils are connected—in parallel—to the driving circuit. The connected Primary Coils together constitute a Primary Cell. As an additional constraint, the multiplexer shall select the Primary Coils such that each selected Primary Coil has an overlap with every other selected Primary Coil; see Figure 3-10(c) for an example.

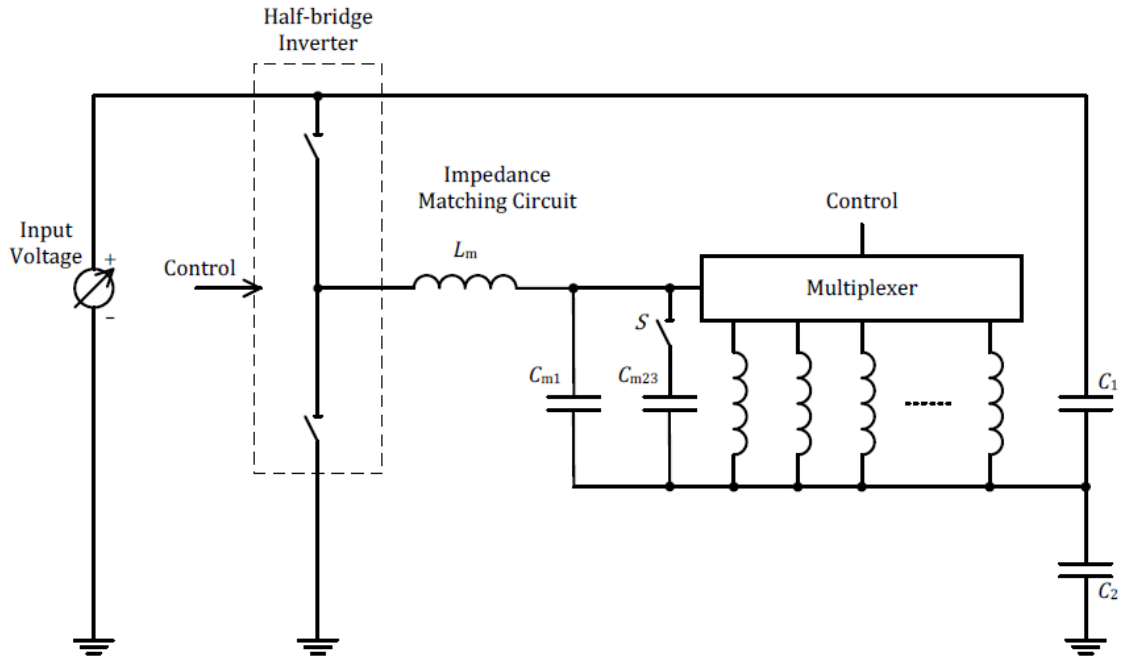
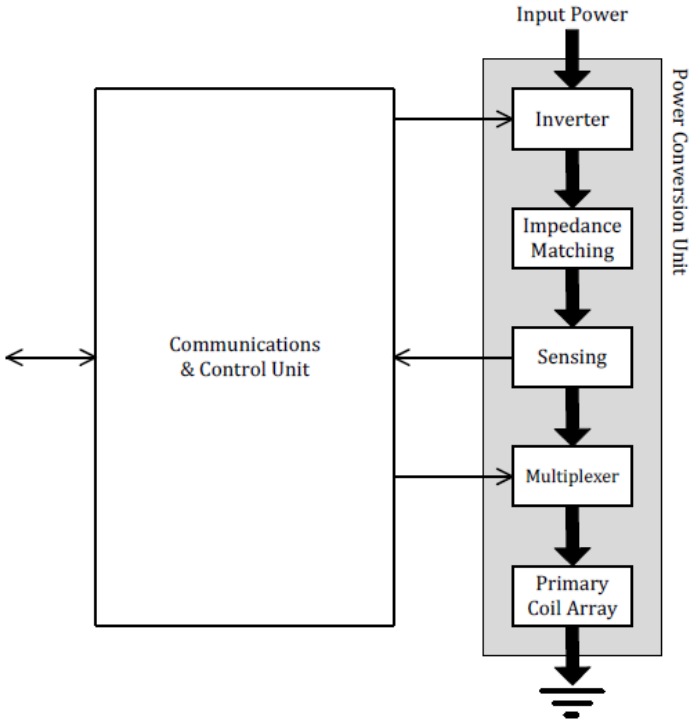
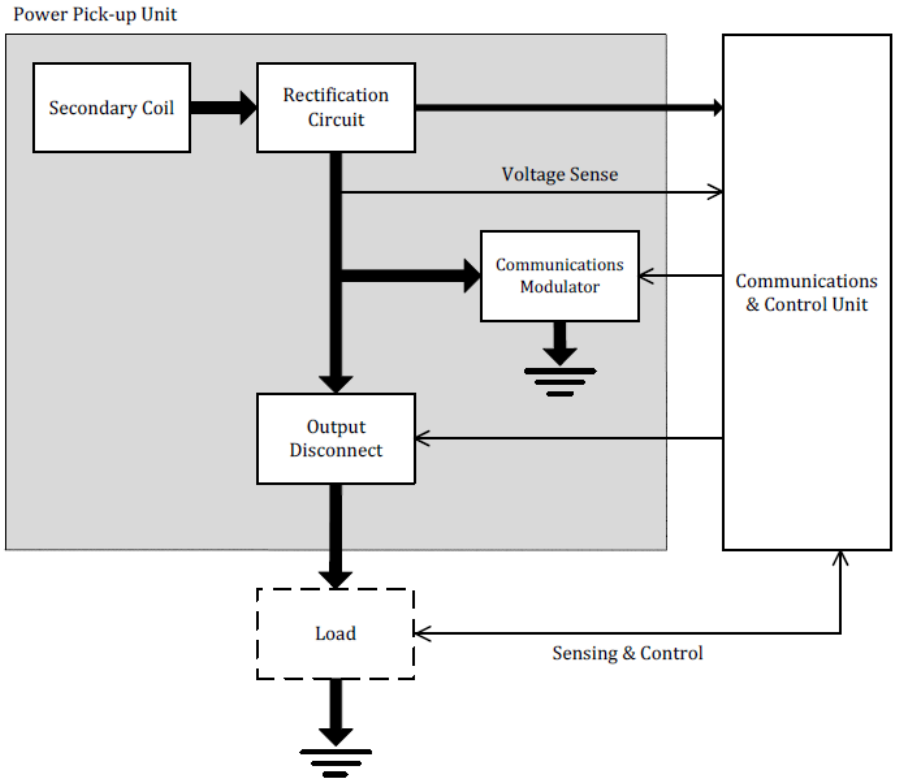


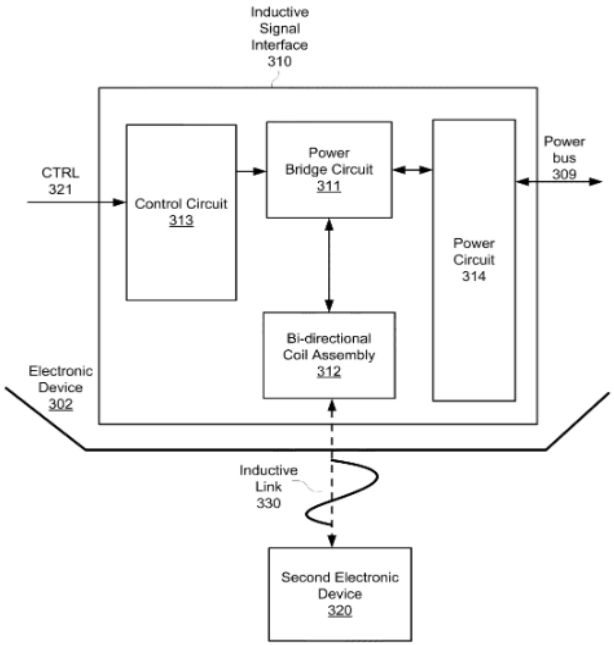
Figure 3-12: Electrical diagram (outline) of Power Transmitter design B1

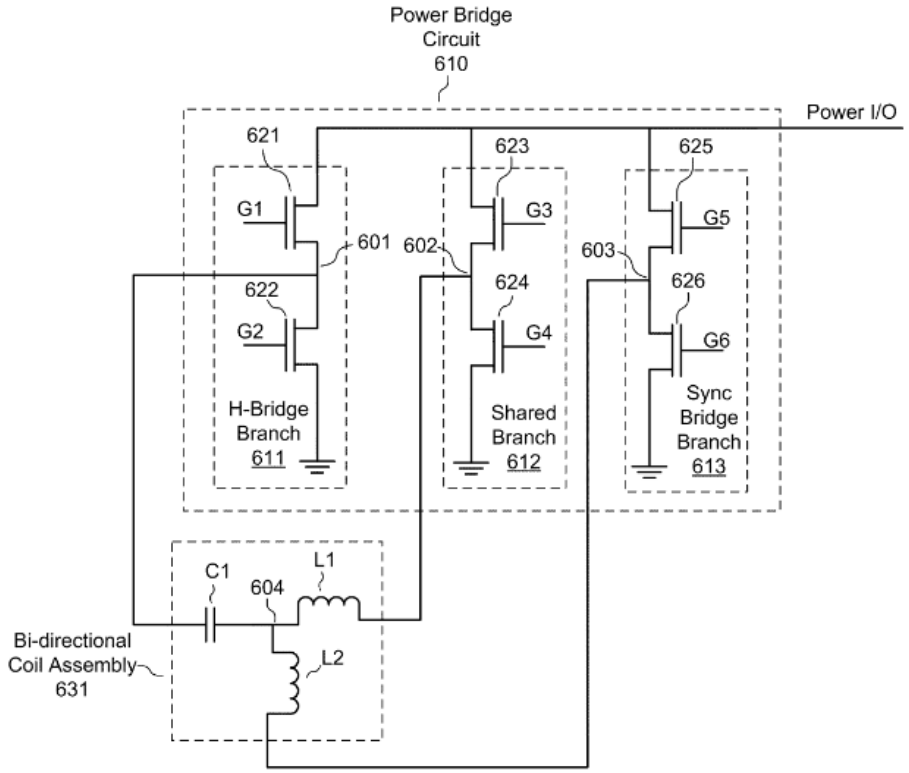
Claim Limitation	Exemplary Prior Art Disclosures
	Within the Operating Frequency range $f_{op} = 105 \ldots 113$ kHz, the assembly of Primary Coil array and Shielding has an inductance of $8.1^{\pm 1}$ µH for each individual Primary Coil in layer 1 (closest to the Interface Surface), $8.7^{\pm 1}$ µH for each individual Primary Coil in layer 2, and $9.6^{\pm 1}$ µH for each individual Primary Coil in layer 3. The capacitances and inductance in the impedance matching circuit are, respectively, $C_{m1} = 300^{\pm 5\%}$ nF, $C_{m23} = 200^{\pm 5\%}$ nF,and $L_m = 3.8^{\pm 5\%}$ µH. The capacitances C_1 and C_2 in the half-bridge inverter both are 68 µF. The switch S is open if the Primary Cell consists of a single Primary Coil; otherwise, the swich S is closed. (Informative) *The voltage across the capacitance C_m can reach levels exceeding 36 V pk-pk.* WPT, 23. On information and belief, the Fulton Solution comprises "a first circuitry comprising: . . . a switch network," such an inverter and a rectifier that each function under different modes, i.e. for transmitting power and for receiving power, respectively, disclosed in the WPT standard. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 **Figure 3-9: Functional block diagram of Power Transmitter design B1** WPT, 20.

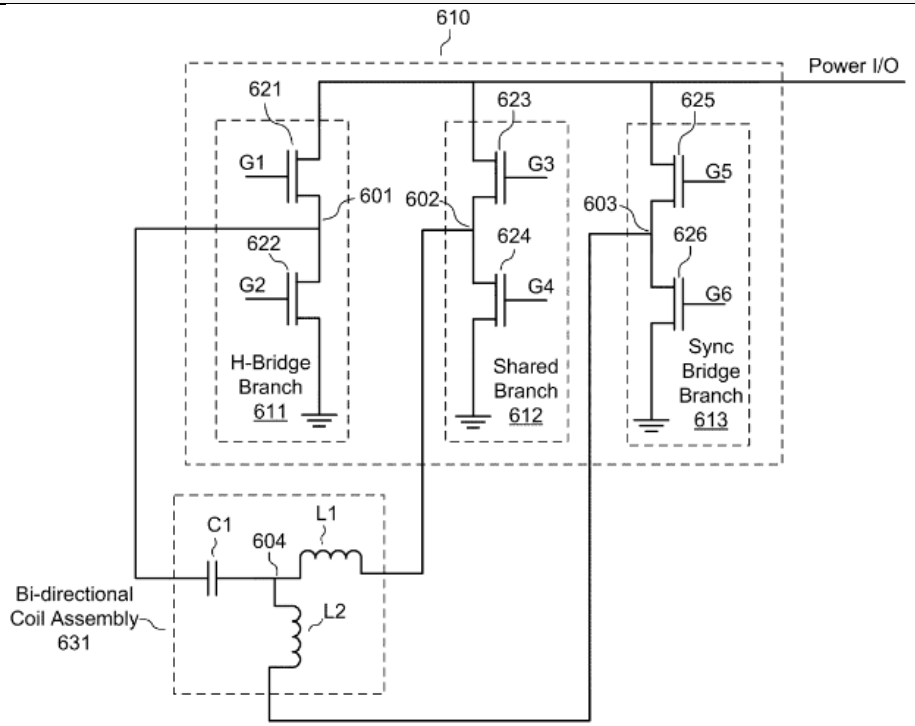
Claim Limitation	Exemplary Prior Art Disclosures
	 **Figure 4-1: Example functional block diagram of a Power Receiver** WPT, 29. On information and belief, the Fulton Solution comprises "a first circuitry comprising . . . a filter capacitor," such as a "low-pass filtering capacitance" disclosed in the WPT standard. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	A.1.2 Electrical details At the secondary resonance frequency $f_S = 100$ kHz, the assembly of Secondary Coil, Shielding and magnet has inductance values $L_s = 15.3^{\pm 1}$ µH and $L'_s = 18.4^{\pm 1}$ µH. The capacitance values in the dual resonant circuit are $C_S = 137^{\pm 1\%}$ nF and $C_d = 1.6^{\pm 5\%}$ nF. As shown in Figure A-3, the rectification circuit consists of four diodes in a full bridge configuration and a low-pass filtering capacitance $C = 20$ µF. WPT, 62. To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** First, Chatterjee discloses and/or renders obvious "a first circuitry comprising: an impedance network." Chatterjee discloses a bi-directional coil assembly whose impedance is changeable. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 **FIG. 3** Chatterjee, Fig. 3; *see also id.* Fig. 4. By selectively turning off the H-bridge branch 611 or the sync bridge branch 613, the power bridge circuit 610 is configurable to ***selectively turn off current paths in the bi-directional coil assembly 631 to change the impedance of the bi-directional coil assembly 631 based on the mode of operation of the inductive signal interface***. For example, in the power receive mode of the inductive signal interface, the current paths through the bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the capacitor C1 and the inductive coil L1. In the power transmit mode, the current path through bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the inductive coils L1 and L2. Chatterjee, ¶ 66.

Claim Limitation	Exemplary Prior Art Disclosures
	 Chatterjee, Figs. 6A; *see also id*. Figs. 6B-6D, ¶¶ 61-73. *See generally* Chatterjee, Figs. 7, 9, 10. Second, Chatterjee discloses and/or renders obvious "a first circuitry comprising: . . . a switch network." Chatterjee discloses a power bridge circuit that form different circuits depending on the mode of operation. For example: > According to embodiments described herein, the power bridge circuit **311** corresponds to a circuit element that is used by the inductive signal interface **310** when in both power transmit and power

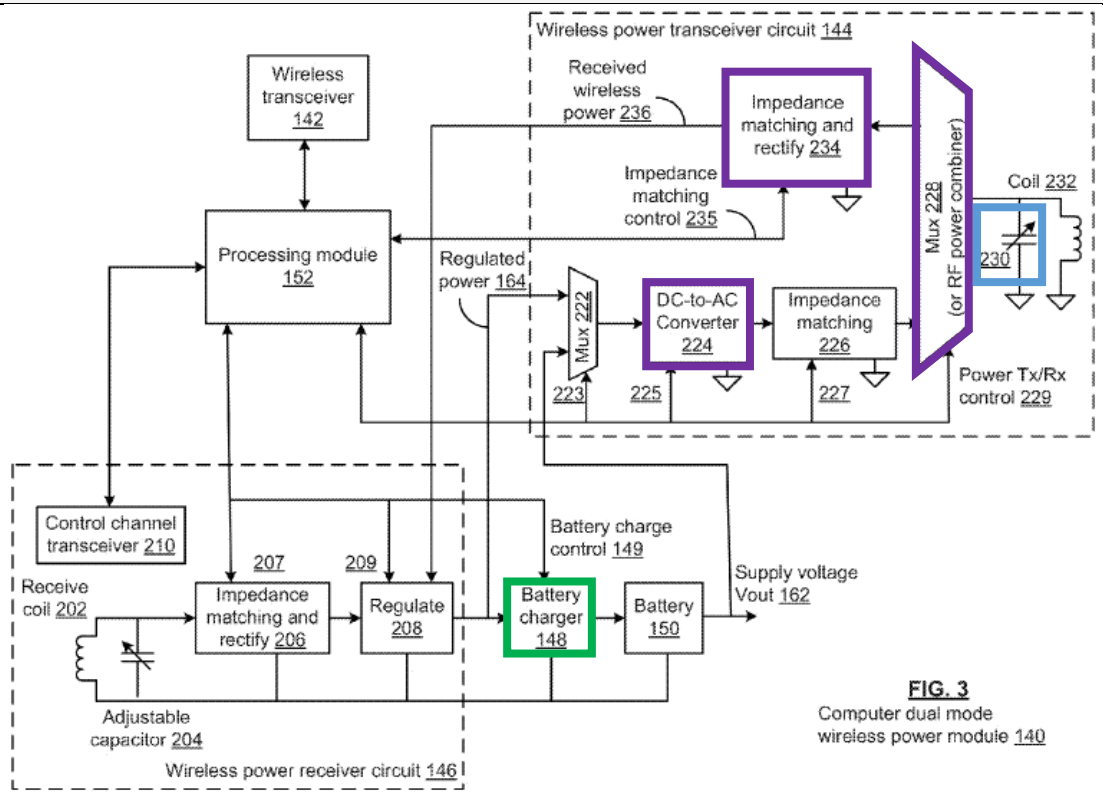
Claim Limitation	Exemplary Prior Art Disclosures
	receive modes. ***More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode***. FIG. 6A illustrates a circuit level embodiment of the power bridge circuit **311**, **411**, **511** and the bi-directional coil assembly **312**, **412**, **512** of FIGS. 3, **4**, and **5**, respectively. An embodiment depicted shows the ***power bridge circuit 610 as being "3-legged", meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for use with either the H-bridge or the synchronous bridge rectifier branch***. Chatterjee, ¶¶ 38, 61. In the power transmit mode of the inductive signal interface, the power I/O transmits an input DC current to the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the input DC current can be a regulated current transmitted by the power circuit **314** or **414**. ***In the power transmit mode, G5 and G6 are de-asserted by the control logic so that the switches 625 and 626 in the sync bridge branch 613 are in an off (i.e. open) state. Thus, the sync bridge branch 613 is off while the H-bridge branch 611 and the shared branch 612 are active***. Accordingly, current flow through the inductor L**2** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of capacitor C**1** and inductive coil L**1**. In the power receive mode of the inductive signal interface, the power I/O transmits an output DC current from the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the output DC current may be transmitted via the power bus to the power circuit **314** or **414** which performs voltage and current regulation on the output DC current in order to output a regulated current. ***In this mode of operation of the inductive signal interface, the signals G1 and G2 de-asserted such that the switches 621 and 622 of the H-bridge branch 611 are in the off state. Thus, the H-bridge branch 611 is off while the sync bridge branch 613 and the shared branch 612 are active***. By turning off the H-bridge branch **611**, current flow through capacitor C**1** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of inductive coils L**1** and L**2**. Chatterjee, ¶¶ 64–65.

Claim Limitation	Exemplary Prior Art Disclosures
	 Chatterjee, Fig. 6A; *see also id.* Fig. 6B–6D, ¶¶ 61-73. ***FIG. 1 illustrates an H-bridge inverter circuit 110 for transferring power from a DC supply 120 to an AC load 115***. The H-bridge inverter circuit **110** includes four switches **111**-**114** each controlled by a respective one of control signals H**1**-H**4**. During the operation of the H-bridge inverter **110**, the switches **111**-**114** turn on and off in pairs to deliver an AC current to the AC load **115**. For example, at one instance, the signals H**1** and H**4** are asserted to turn on switches **111** and **114**, while the signals H**2** and H**3** are de-asserted to turn off the switches **112** and **113**. Current flows from DC power supply **120** through switch **111**, to the AC load **115**, through the switch **114**, and to a ground voltage or a negative supply voltage. At another instance, the signals H**1** and H**4** are de-asserted to turn off switches **111** and **114**, while the signals H**2** and H**3** are asserted to turn on the switches **112** and **113**. During this instance, the current flows

Claim Limitation	Exemplary Prior Art Disclosures
	from the DC supply **120** through the switch **113**, to the AC load **115**, through the switch **112**, and to the ground voltage or the negative supply voltage. By altering the direction of the current flow, the H-bridge inverter is configured to deliver an AC current from the DC supply **120** to the AC load **115**. ***FIG. 2 illustrates a sync bridge circuit 210 for transferring power from an AC supply 215 to a DC load 220***. The sync bridge circuit **210** includes four switches **211**-**214** each controlled by a respective one of control signals S**1**-S**4**. The sync bridge circuit **210** receives an AC current from the AC supply **215**, and the switches **211**-**214** of the sync bridge circuit **210** turn on and off in pairs to deliver a DC current to the DC load. Chatterjee, ¶¶ 3–4; *see also id.* Figs. 1–2. 3. The inductive signal interface of claim 2, wherein two of the three branches operate to form an H-bridge circuit while the inductive signal interface operates in the power transmit mode. 4. The inductive signal interface of claim 2, wherein two of the three branches operate to form a synchronous bridge rectifier circuit while the inductive signal interface operates in the power receive mode. Chatterjee, cls. 3, 4. *See generally* Chatterjee, Figs. 7-11. Third, Chatterjee discloses and/or renders obvious a "a first circuitry comprising: . . . a filter capacitor." For example: The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. ***The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode)***. The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 37. > The power circuit 414 operates in a similar fashion as the power circuit 314 of FIG. 3 to handle current received in either the power transfer mode or the power receive mode. The power bridge circuit 411 operates in a similar fashion as the power bridge circuit 311 of FIG. 3. Chatterjee, ¶ 44. > FIG. 10 illustrates a power bridge circuit and a bi-directional coil assembly, together **1010**, coupled to current conditioning circuitry, under an embodiment. The power bridge circuit and bi-directional coil assembly combination **1010**, which may be any of the above described embodiments, is coupled via a signal line Power I/O to a decoupling circuit 1020. ***The decoupling circuit 1020 operates to act as a filter for certain signal frequencies and prevents those signals from passing through.*** Chatterjee, ¶¶ 89; *see also id.* Fig. 10. **Van Der Lee** First, Van Der Lee discloses and/or renders obvious "a first circuitry comprising: an impedance network." Van Der Lee discloses and/or renders obvious a capacitor and/or a coil whose impedance is adjustable. For example:

Claim Limitation	Exemplary Prior Art Disclosures



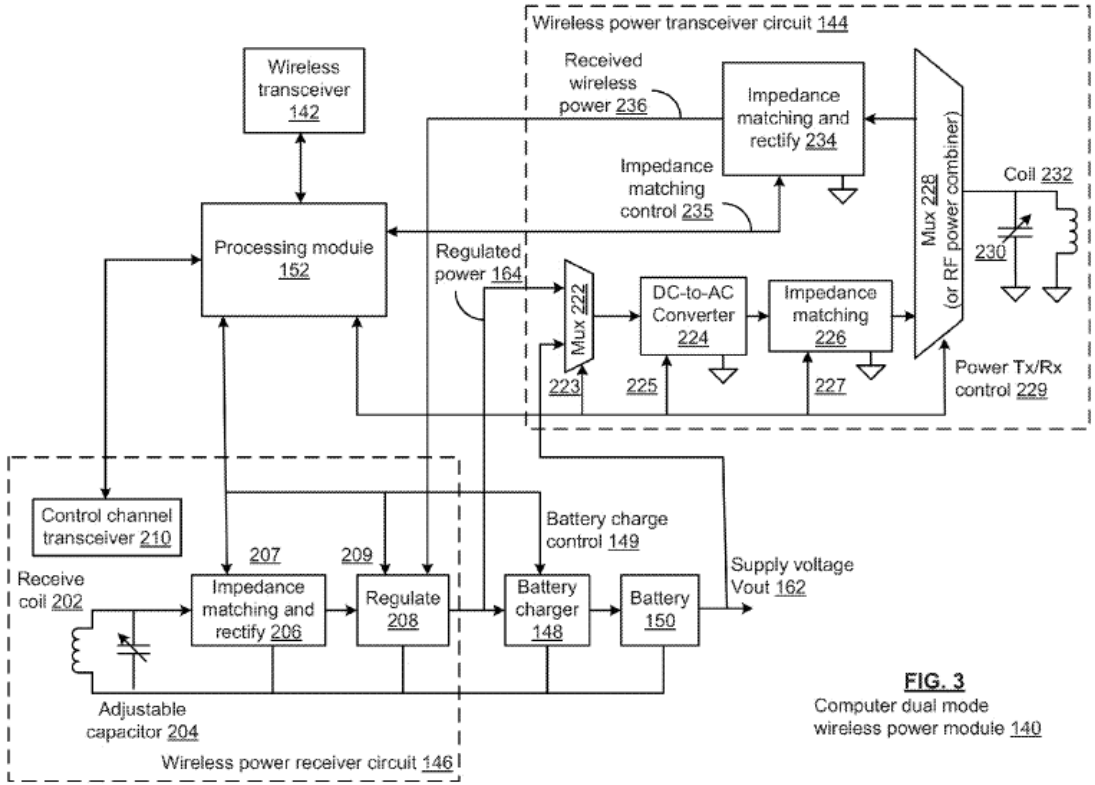
Van Der Lee, Fig. 3.

> The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, a DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, ***an adjustable capacitor 230***, and a coil 232.

Van Der Lee, ¶ 51.

Claim Limitation	Exemplary Prior Art Disclosures
	In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. ***As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit***. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54, Fig. 3; *see also id.* ¶¶ 62, 73, Fig. 4. Van Der Lee discloses and/or renders obvious "a first circuitry comprising: . . . switch network". Van Der Lee discloses a rectifier, an inverter, and/ a multiplexer that chooses between the two modes of operation. For example:

Claim Limitation	Exemplary Prior Art Disclosures



Van Der Lee, Fig. 3.

> The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, ***a DC-to-AC converter 224***, an impedance matching circuit 226, an impedance matching and ***rectify circuit 234***, an adjustable capacitor 230, and a coil 232.

Van Der Lee, ¶ 51.

Claim Limitation	Exemplary Prior Art Disclosures
	Note that the processing module 152 may be fabricated on a single integrated circuit or on a multiple integrated circuit with one or more of the components of the regulator 208, ***the rectifier portion of the impedance matching and rectify circuit 206 and 234***, battery charger 148, and/or a battery current sense. Van Der Lee, ¶ 59. In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. ***The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232***. ***The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224*** at a desired frequency. In an alternate embodiment, ***the DC-to-AC converter 224 may include a half bridge inverter topology***. The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232 to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54. ***The processing module 142 provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit or a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 56; *see also id.* ¶¶ 62, 72-73, Fig. 4. ***The terms "circuit" and "circuitry" as used herein may refer to an independent circuit or to a portion of a multifunctional circuit that performs multiple underlying functions.*** For example, depending on the embodiment, processing circuitry may be implemented as a single chip processor or as a plurality of processing chips. Likewise, ***a first circuit and a second circuit may be combined in one embodiment into a single circuit*** or, in another embodiment, operate independently perhaps in separate chips. The term "chip," as used herein, refers to an integrated

Claim Limitation	Exemplary Prior Art Disclosures
	circuit. Circuits and circuitry may comprise general or specific purpose hardware, or may comprise such hardware and associated software such as firmware or object code. Van Der Lee, ¶ 88. Third, Van Der Lee discloses "a first circuitry comprising: . . . filter capacitor." The primary device and/or the peripheral device may include an integrated circuit (IC) to support the above-described functions. For example, an IC may include at least a portion of the wireless power transceiver circuit (for example, one or more of the coil, capacitor, and diodes of the rectifying circuit may be off-chip), ***at least a portion of the battery charger (for example***, one or more of the switching transistors, ***the output filter capacitor***, the inductor may be off-chip), the transceiver, and the processing module. Van Der Lee, ¶ 36. **Shinoda** First, Shinoda discloses and/or renders obvious "a first circuitry comprising: an impedance network." Shinoda discloses a resonant capacitor that can be connected or bypassed in different modes. For example: The wireless power transfer terminal 11 includes the FETs 2A to 2D, coil L, control circuit 3, a switch SW, and a resonant capacitor C. The resonant capacitor C is provided between the node N4 and the coil L, and the switch SW is provided in parallel with the resonant capacitor C. ***The capacitance of the resonant capacitor C is set such that it is connected to the coil L and resonates in series therewith***. ***For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved.

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda, 5:52-6:2.

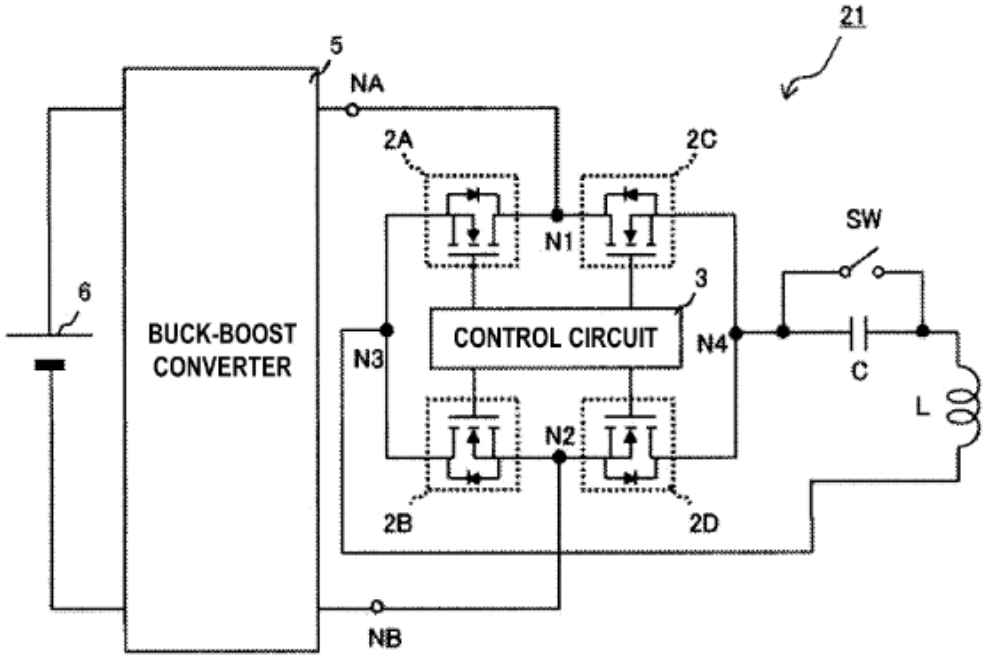


FIG.5

Shinoda, Fig. 5; *see also id.* Figs. 4, 7.

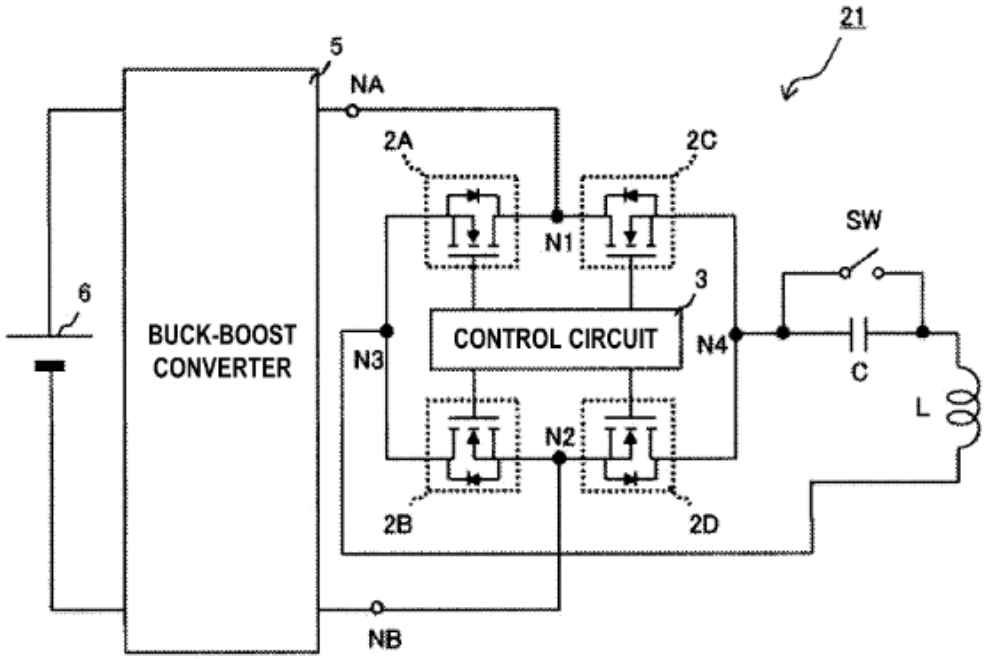
Second, Shinoda discloses and/or renders "a first circuitry comprising: . . . a switch network". Shinoda discloses switching elements (FETs 2A to 2D) that operate as different circuits depending on the mode of operation.

For example:

> FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via ***a respective power transmission circuit 103 and a power***

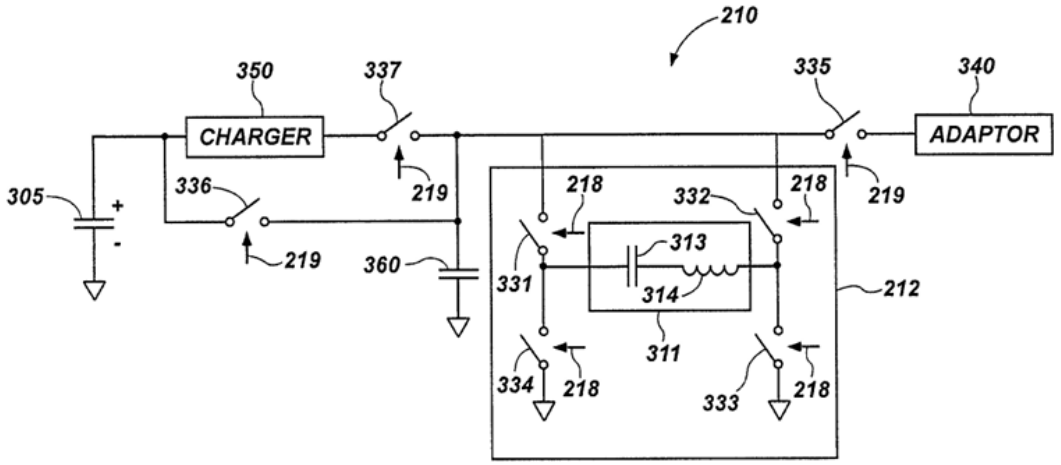
Claim Limitation	Exemplary Prior Art Disclosures
	reception circuit 104. ***The power transmission circuit 103 includes an inverter*** for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit*** for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 1:31-46. ***For a power transmission mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the ***FETs 2A to 2D function as a full-bridge inverter circuit***. Shinoda, 3:52-62. ***For a power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the ***FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. The above described parallel circuit including ***first to fourth semiconductor switching elements (i.e., FETs 2A to 2D) operating as a full-bridge inverter circuit*** can apply an alternating-current output to the coil, thus enabling the wireless power transfer terminal to transmit power. Also, the parallel circuit including the ***first to fourth semiconductor switching elements operating as a***

Claim Limitation	Exemplary Prior Art Disclosures
	rectifier circuit can rectify an alternating-current input applied from the coil, thus enabling the wireless power transfer terminal to receive power. In this way, the use of the parallel circuit including the first to fourth semiconductor switching elements as a full-bridge inverter circuit or a full-wave rectifier circuit can reduce the total number of the semiconductor switching elements, increase space savings of the circuit configuration of the wireless power transfer terminal 1, and reduce cost of manufacturing. For the present embodiment, an FET element is used as a semiconductor switching element. With this, the parallel circuit can operate as a full-wave rectifier circuit using a parasitic diode between the drain and the source of the FET element. However, embodiments consistent with the disclosure can also be suitably carried out using other semiconductor switching elements. For example, a combination of a bipolar transistor and a diode can also be used as substantially the same circuit configuration as that of the present embodiment, and with other embodiments consistent with this disclosure. Shinoda, 5:17-43.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** For instance, Singh-203 describes first circuitry that includes a coil 314 and/or capacitor 313 which are an impedance network, switches 331, 332, 333, and 334 which form a switch network, and capacitor 360 is a filter capacitor. For example: The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional

Claim Limitation	Exemplary Prior Art Disclosures
	capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. The plurality of switches 331, 332, 333, 334 may be configured as a full-bridge circuit, such that the resonant tank 311 is coupled on one end at a node between the first switch 331 and the fourth switch 334, and at a node between the second switch 332 and the third switch 333 on the other end. In other words, the first switch 331 and the fourth switch 334 may be serially coupled having a first node therebetween, and the second switch 332 and the third switch 333 may be serially coupled having a second node therebetween. The resonant tank 311 may be coupled between the first node and the second node. Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary

Claim Limitation	Exemplary Prior Art Disclosures
	switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. Singh-203, 7:10-8:12. The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively. Singh-203, 9:9-25; *see also* FIGS. 3A-3D.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3A **Singh-167** Singh-167 teaches an impedance adjuster 400 that provides variable impedance.

Claim Limitation	Exemplary Prior Art Disclosures

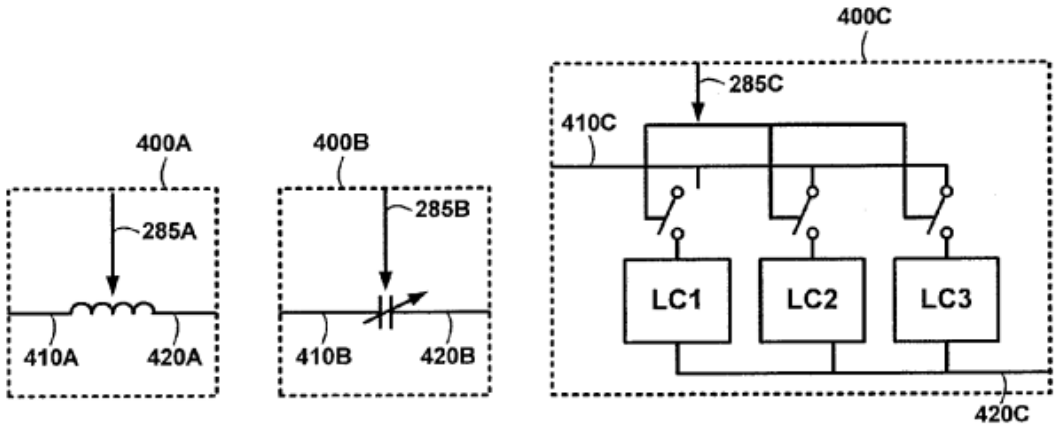


FIG. 4A FIG. 4B FIG. 4C

Singh-167 at Figs. 4A-4C; *see also* Singh-167, Figs. 2-3.

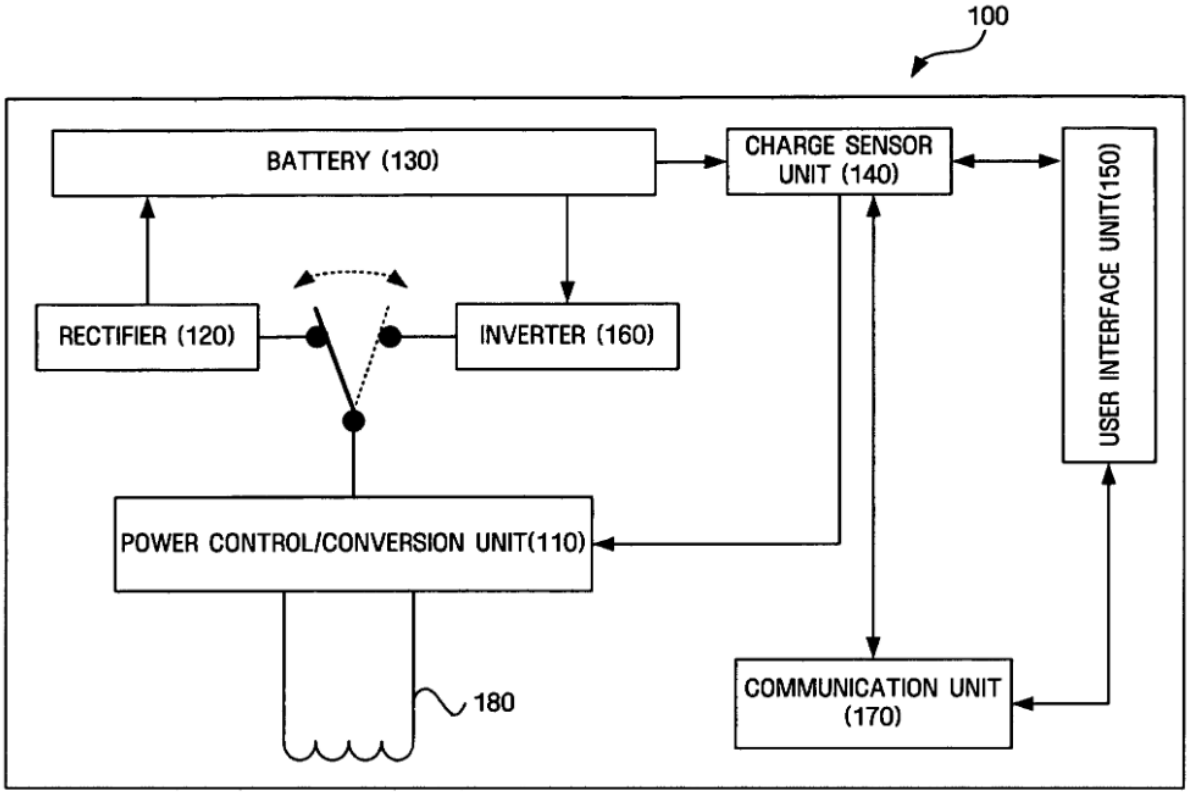
> Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN.
>
> Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above.

Singh-167, ¶¶ 48-49.

Claim Limitation	Exemplary Prior Art Disclosures
	FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. **Sagoo** First, Sagoo discloses a power control/conversion unit coupled to the coil. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode

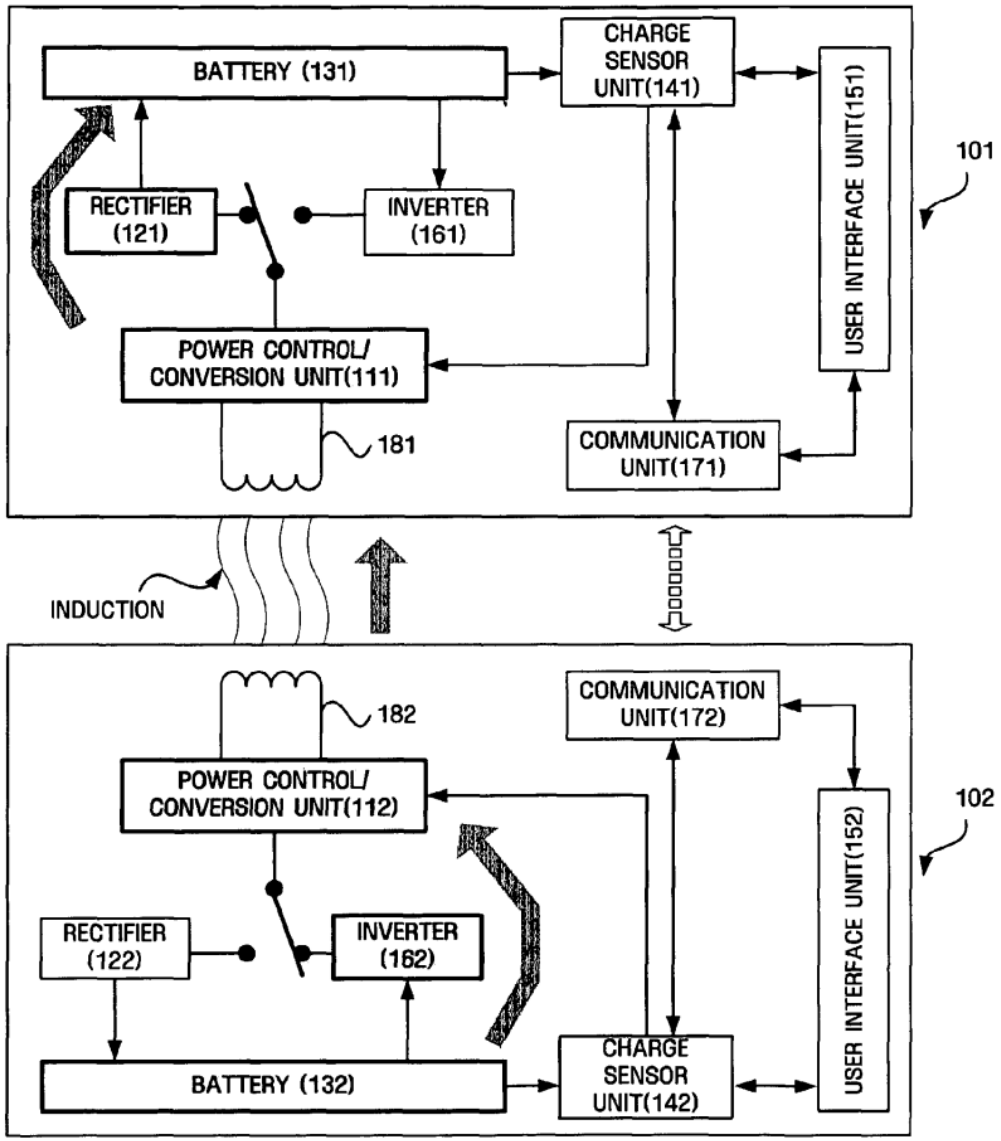
Claim Limitation	Exemplary Prior Art Disclosures
	by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; setting ***an inductive coil coupled with the power control/conversion unit*** as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device; setting an ***inductive coil coupled with the power control/conversion unit*** as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:35-55; *see also id.* Figs. 3-5. In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. ***An inductive coil 181 coupled with the power control/conversion unit 111*** serves as a secondary coil of a transformer. The first device is switched to the load mode. Sagoo, 6:26-32. Second, Sagoo discloses and/or renders "a first circuitry comprising: . . . a switch network". Sagoo discloses a rectifier and an inverter, and that the power control/conversion unit is selectively coupled to one of the rectifier and the inverter. For example: An apparatus and method of wirelessly sharing power by an inductive method are provided. The apparatus includes a first battery supplying power; a ***rectifier*** supplied with an AC voltage, converts the AC voltage into a DC voltage, and outputs the DC voltage; an ***inverter*** supplied with the DC voltage, converts the DC voltage into the AC voltage, and outputs the AC voltage; ***a power control/conversion unit connected to the rectifier or the inverter*** and supplying power to charge

Claim Limitation	Exemplary Prior Art Disclosures
	the first battery or a second battery that is provided in an external device as a power supply for the first battery; and a communication unit communicating with the external device. Sagoo, Abstract. ***The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage***. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage***. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160*** so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. Sagoo, 4:40-64.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 3  Sagoo, Fig. 3. A power control/conversion unit 111 of the first device 101 is connected to a rectifier 121, and the rectifier 121 converts an AC voltage into a DC voltage and provides the DC voltage to a battery 131 to charge the battery 131. A power control/conversion unit 112 of the second device 102 is connected to an inverter 162. When the inverter 162 converts a DC voltage charged in a battery 132 into an AC voltage and

Claim Limitation	Exemplary Prior Art Disclosures
	supplies the AC voltage to the power control/conversion unit 112, the power control/conversion unit 112 provides energy to the first device 101. Sagoo, 5:45-55.

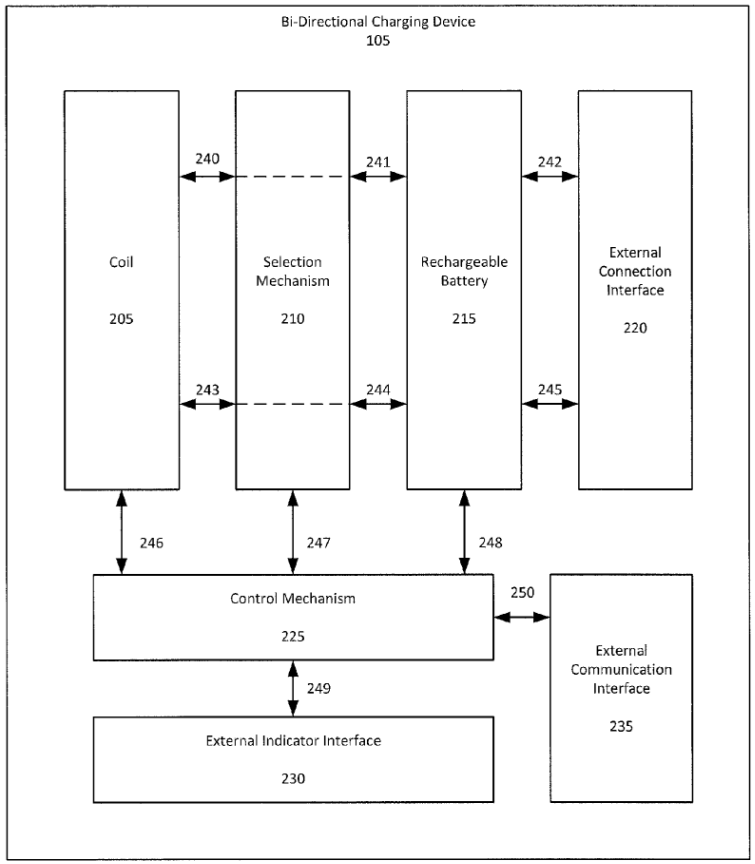
FIG. 4



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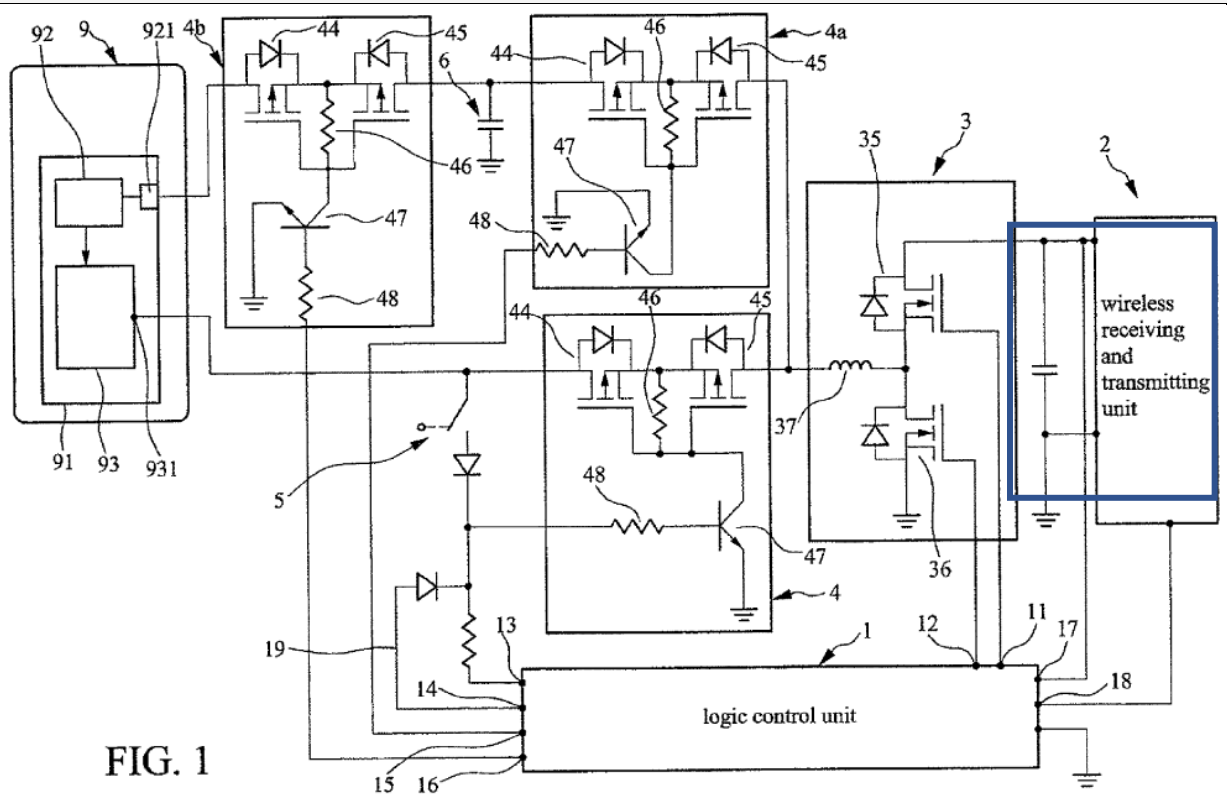
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Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Fig. 4; *see also* Figs. 5-7. In order to charge the battery 131 by receiving energy from the selected second device 102, the ***power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131***. An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode. The second device 102 is in the source mode and the ***power control/conversion unit 112 is connected to the inverter 16***2. DC energy of the battery 132 is converted into an alternating current by the inverter 162, and the alternating current is supplied to the first device 101 through the inductive coil 182 serving as a primary coil of a transformer. The charge sensor unit 142 checks the amount of charge in the battery 132 and provides information on the charge of the battery to the power control/conversion unit 112 to prevent excessive charging of the battery. Sagoo, 6:26-42. **Schuessler** First, Schuessler discloses and/or renders obvious "a first circuitry comprising: an impedance network." Schuessler discloses circuits such as a resonant circuit, a switched power amplification circuit, and/or circuits that may include the capability for tuning the energy deliver or receipt frequency. For example: Coil 205 generally is coupled to circuitry, not shown in FIG. 2, for the transfer of energy through coil 205. For example, ***coil 205 may be included in a resonant circuit for energy transfer through resonance. As another example, coil 205 may be included in a switched power amplification circuit. Coil 205 may be included in a wide variety of other circuits for delivering or receiving power. Circuits including coil 205 may include the capability for tuning the energy delivery or receipt frequency***. Schuessler, 4:19-27. ***Control mechanism 225 may provide adjustment to coil 205, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable***

Claim Limitation	Exemplary Prior Art Disclosures
	electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery. Schuessler, 5:57-62.  *Fig. 2* Schuessler, Fig. 2.

Claim Limitation	Exemplary Prior Art Disclosures
	Second, Schuessler discloses and/or renders "a first circuitry comprising: . . . a switch network". Schuessler discloses a selection mechanism that includes switching circuitry including power FETs. For example: Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Selection mechanism 210 may include electrical and/or mechanical selection. For example, a ***selection mechanism 210 may be a mechanical switch*** on the outside of a housing containing bi-directional charging device 105. As another example, ***selection mechanism 210 may be circuitry internal to bi-directional charging device 105, such as switching circuitry including power FETs (field effect transistors) or other electronic switches***. Selection mechanism 210 may be controlled by control mechanism 225, discussed below. Schuessler, 4:35-60. Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the ***FETs may be turned on and off by electrical signals from control mechanism 225***. Schuessler, 6:11-17. Bi-directional charging device 105 may include combinations of discrete and integrated components. For example, control mechanism 225 may include a processor implemented on a

Claim Limitation	Exemplary Prior Art Disclosures
	semiconductor device, and discrete input/output circuitry for the processor. Further, multiple functions or portions of functions may be integrated within one or more semiconductor devices. For example, portions of selection mechanism 210, external connection interface 220, control mechanism 225, external indicator interface 230, and external communication interface 235 may all be integrated within one semiconductor device. Schuessler, 7:20-30. Control mechanism 225 may be additional to an ***external selection option such as a switch*** accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 6:18-26. **Yeh** First, Yeh discloses a capacitor connected to a wireless receiving and transmitting unit.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1 Yeh, Fig. 1. Second, Yeh discloses and/or renders "a first circuitry comprising: . . . a switch network". Yeh discloses a step up/step down unit, a first reverse current protector, a second reverse current protector, and/or a third reverse current protector, that comprise switches that operate differently under different modes. For example: The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. The two control terminals 33, 34 are respectively and electrically connected to

Claim Limitation	Exemplary Prior Art Disclosures
	the first and second control pins 11, 12 of the logic control unit 1. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, ***the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification***. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. Yeh, 3:58-4:30. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1. Yeh, 4:40-47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The

Claim Limitation	Exemplary Prior Art Disclosures
	third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. Referring to FIGS. 1 and 2, ***each reverse current protector (4, 4a, 4b) comprises a first resistor 46 and serially-connected oppositely-directed first and second MOSFETs 44, 45***. Two ends of the two serially-connected MOSFETs are respectively the input terminal 41 and the output terminal 42 of the reverse current protector. The first and second MOSFETs 44, 45 each have a control terminal (not labeled), and the two control terminals are electrically connected to the control terminal 43 of the reverse current protector. The first resistor 46 has an end electrically connected between the first and second MOSFETs 44, 45 and an opposite end also electrically connected to the control terminal 43 of the reverse current protector. Further, each reverse current protector (4, 4a, 4b) further comprises a transistor 47 and a second resistor 48. The transistor 47 has a first terminal electrically connected to the control terminals (not labeled) of the first and second MOSFETs 44, 45, and a second terminal of the transistor 47 is grounded. The second resistor 48 is electrically connected between a third terminal of the transistor 47 and the control terminal 43 of the reverse current protector. Yeh, 5:17-36. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and

Claim Limitation	Exemplary Prior Art Disclosures
	discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. ***When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1***. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. Yeh, 5:44-63. if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. ***With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:12-29. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 6:38-44.

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Claim Limitation	Exemplary Prior Art Disclosures
	When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:51-7:18.

Claim Limitation	Exemplary Prior Art Disclosures

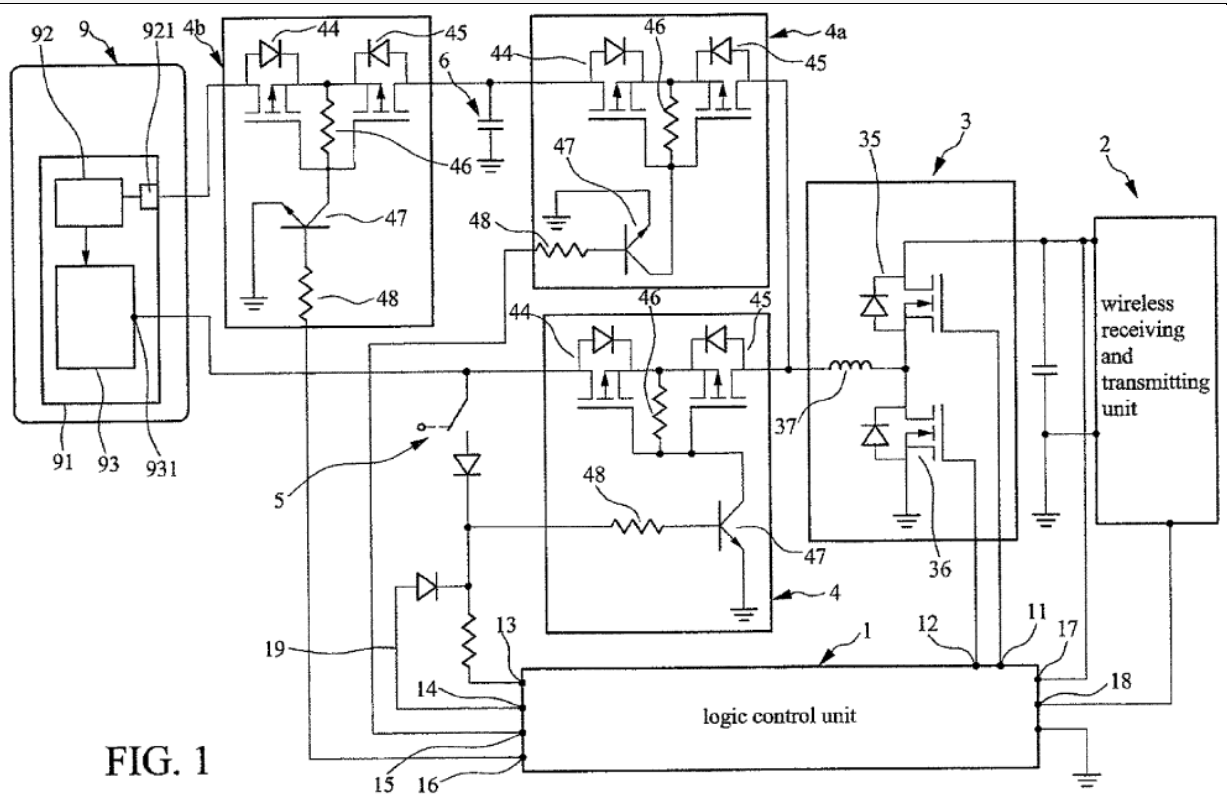


FIG. 1

Yeh, Fig. 1; *see also id.* Figs. 2-3.

In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery. ***The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with***

Claim Limitation	Exemplary Prior Art Disclosures
	synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. ***The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency***. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. Third, Yeh discloses and/or renders obvious "a first circuitry comprising . . . a filter capacitor." Yeh discloses a supercapacitor. For example: An objective of the present invention is to provide a bidirectional wireless charging and discharging device, which makes use of the arrangement of supercapacitors in specific locations and ***the supercapacitors having resistances lower than a battery to allow, in a charging operation, the supercapacitors to be charged first for blocking surges occurring in the charging operation*** and thus realizing protection against accumulated damage caused by charging of the battery; makes use of the function of preventing reverse current by first and second reverse current protectors to eliminate electrical leakage to thereby save power. Yeh, 2:52-62. To realize the above objectives, the present invention provides a bidirectional wireless charging and discharging device, which is applicable to a portable electronic device having a circuit device. The circuit device is electrically connected to a power receiving terminal and a battery. The bidirectional wireless charging and discharging device comprises a logic control unit, a wireless receiving and transmitting unit, a step-up/step-down unit, a first reverse current protector, a second reverse current protector, a control switch, and a first supercapacitor, wherein the logic control unit comprises a plurality of pins; the wireless receiving and transmitting unit has a transmission

Claim Limitation	Exemplary Prior Art Disclosures
	terminal and a test terminal, the test terminal being electrically connected to a detection pin of the logic control unit; the step-up/step-down unit has a first voltage regulation terminal, a second voltage regulation terminal, and two control terminals, the second voltage regulation terminal being electrically connected to the transmission terminal of the wireless receiving and transmitting unit, the two control terminals being respectively and electrically connected to first and second control pins of the logic control unit; a power pin of the logic control unit being electrically connected to the second voltage regulation terminal and the transmission terminal that are connected to each other; the first reverse current protector has an input terminal, an output terminal, and a control terminal, the input terminal and the output terminal being respectively and electrically connected to a discharging terminal of the battery and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a third control pin of the logic control unit; the control switch has an end electrically connected to the discharging terminal of the battery and an opposite end electrically connected to the control terminal of the first reverse current protector and the third control pin of the logic control unit; the second reverse current protector has an input terminal, an output terminal, and a control terminal, the output terminal and the input terminal being respectively and electrically connected to the power receiving terminal of the circuit device and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a fifth control pin of the logic control unit; and the ***first supercapacitor has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounde***d. As such, ***the supercapacitor may be used block surges occurring in each charging operation in order to protect a battery from accumulated damaged caused by charging***. Further, the first and second the reverse current protectors provide a function of preventing reverse current so as to eliminate electrical leakage and thus save power. Yeh, 2:20-3:3. ***The first supercapacitor 6 has an end electrically connected to connection between the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the output***

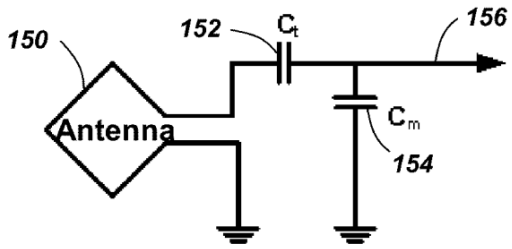
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Claim Limitation	Exemplary Prior Art Disclosures
	terminal 42 of the second reverse current protector 4a and forms a first node 61 there. Another end of the first supercapacitor 6 is grounded. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). ***The second supercapacitor is connected in parallel to the battery 93***. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. ***Since resistances of the first supercapacitor 6 and the second supercapacitor are lower than that of the battery 93, each time a charging operation is performed, the supercapacitors are charged first, whereby the supercapacitors may function to resist the surge occurring in the charging operation. Further, the supercapacitors can be easily charged in full and then immediately charge the battery 93***. Yeh, 4:48-5:15. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and ***the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b)*** to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the

Claim Limitation	Exemplary Prior Art Disclosures
	protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) Yeh, 6:59-7:10. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: ***Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a batter***y. The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. a first supercapacitor, which has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded. Yeh, cl. 1.

Claim Limitation	Exemplary Prior Art Disclosures
	2. The bidirectional wireless charging and discharging device as claimed in claim 1 further comprising a second supercapacitor, the second supercapacitor being connected in parallel with the battery. Yeh, cl. 2; *see also* Yeh, Figs. 1-3. **Cook** First, Cook discloses and/or renders obvious "a first circuitry comprising: an impedance network." Cook discloses and/or renders obvious a capacitor connected to the coil and has adjustable capacitance. For example: An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to charge a battery 136 as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. ***The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118***. Cook, ¶31. As stated, ***efficient transfer of energy between the transmitter 104 and receiver 108 occurs during matched or nearly matched resonance between the transmitter 104 and the receiver 108***. However, even when resonance between the transmitter 104 and receiver 108 are not matched, energy may be transferred at a lower efficiency. Transfer of energy occurs by coupling energy from the near-field of the transmitting antenna to the receiving antenna residing in the neighborhood where this near-field is established rather than propagating the energy from the transmitting antenna into free space. ***The resonant frequency of the loop antennas is based on the inductance and capacitance. Inductance in a loop antenna is generally the inductance created by the loop, whereas, capacitance is generally added to the loop antenna's inductance to create a resonant structure at a desired resonant frequency***. As a non-limiting example, ***capacitor 152 and capacitor 154 may be added to the antenna to create a resonant circuit that generates a sinusoidal or quasi-sinusoidal signal 156***. Accordingly, for larger diameter loop antennas, the size of capacitance needed to induce resonance decreases as the diameter or inductance of the loop increases.

Claim Limitation	Exemplary Prior Art Disclosures
	Furthermore, as the diameter of the loop antenna increases, the efficient energy transfer area of the near-field increases for "vicinity" coupled devices. Of course, other resonant circuits are possible. As another non-limiting example, a capacitor may be placed in parallel between the two terminals of the loop antenna. In addition, those of ordinary skill in the art will recognize that for transmit antennas the resonant signal 156 may be an input to the loop antenna 150. Cook, ¶¶ 34-35.  ***FIG. 3*** *see also* Cook, Figs. 2, 3. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208

Claim Limitation	Exemplary Prior Art Disclosures
	are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if ***both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0***. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41.

Claim Limitation	Exemplary Prior Art Disclosures

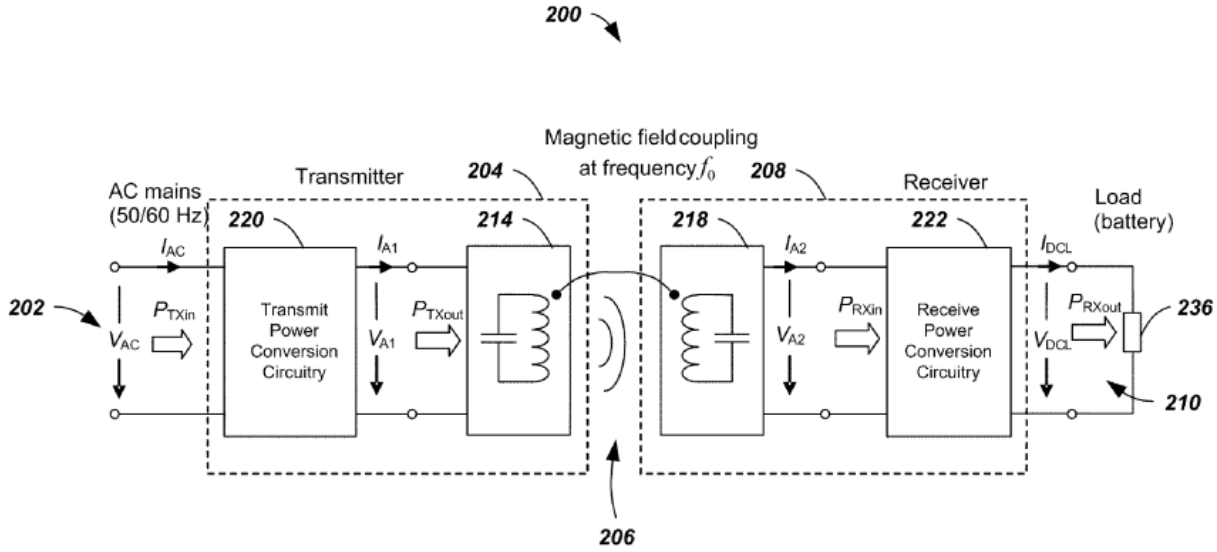


FIG. 4

Cook, Fig. 4

As described herein, wireless power transfer uses ***coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency***. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured

Claim Limitation	Exemplary Prior Art Disclosures
	electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of a half bridge rectifier topology 400 including ***a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna*** where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration. The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. ***The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency***. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.

Claim Limitation	Exemplary Prior Art Disclosures

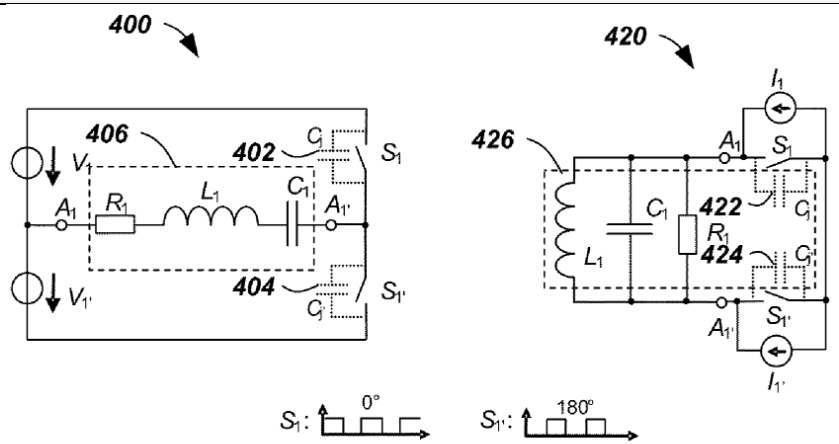


FIG. 8

Cook, Fig. 8

FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where "T" indicates a Transmitter configuration) with a half bridge active rectifier configured with the ***switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454***.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. ***Furthermore, low loss zero***

Claim Limitation	Exemplary Prior Art Disclosures
	voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). ***Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency***. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures

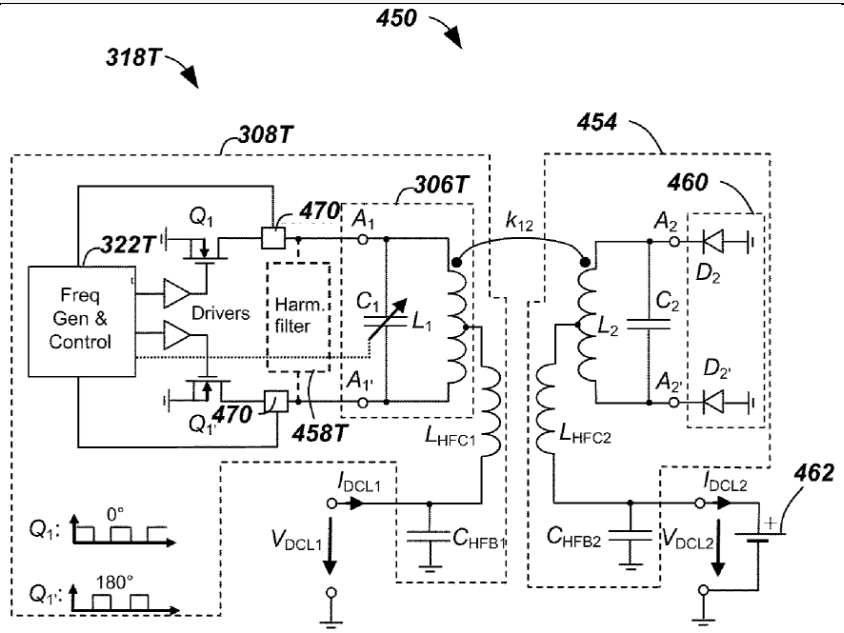


FIG. 9

Cook, Fig. 9.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, l***ow loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T,***

Claim Limitation	Exemplary Prior Art Disclosures
	L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶61. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all.*** Cook, ¶61.

Claim Limitation	Exemplary Prior Art Disclosures
	See also Cook, Figs 7-10. Cook discloses and/or renders obvious "a first circuitry comprising: . . . switch network". Cook discloses a power conversion circuit that comprises synchronous switches that operate differently under different modes. For example: FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes ***a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter***. Receiver 208 further includes ***a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter***. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various

Claim Limitation	Exemplary Prior Art Disclosures
	transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). ***Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable***. Accordingly, the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device. Cook, ¶42. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and ***a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow)***. The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. ***The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein***. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, ***a bidirectional power conversion circuit 308*** and a switch 326 for

Claim Limitation	Exemplary Prior Art Disclosures
	supplying power to the battery 310 or directly to the host device electronics 324. ***Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane***. Cook, ¶50. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of ***a half bridge rectifier topology 400*** including a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. ***A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration.*** The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.

Claim Limitation	Exemplary Prior Art Disclosures

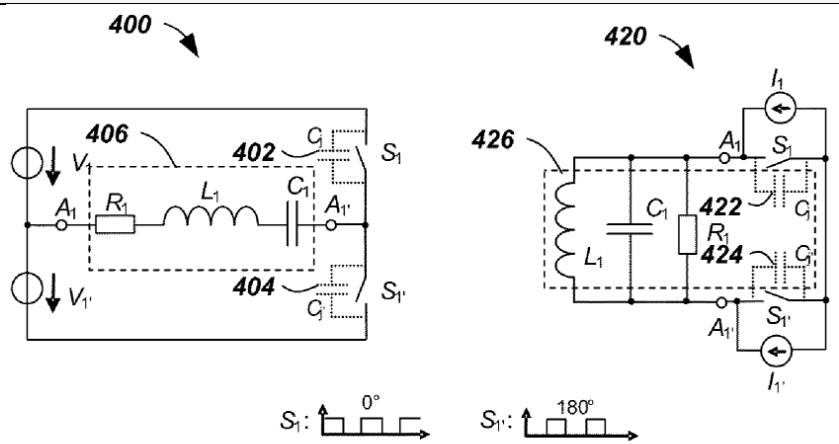


FIG. 8

Cook, Fig. 8

FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where "T" indicates a Transmitter configuration) with a ***half bridge active rectifier*** configured with the switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, ***a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low

Claim Limitation	Exemplary Prior Art Disclosures
	loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , ***a half bridge passive diode rectifier*** 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶¶54-57.

Claim Limitation	Exemplary Prior Art Disclosures

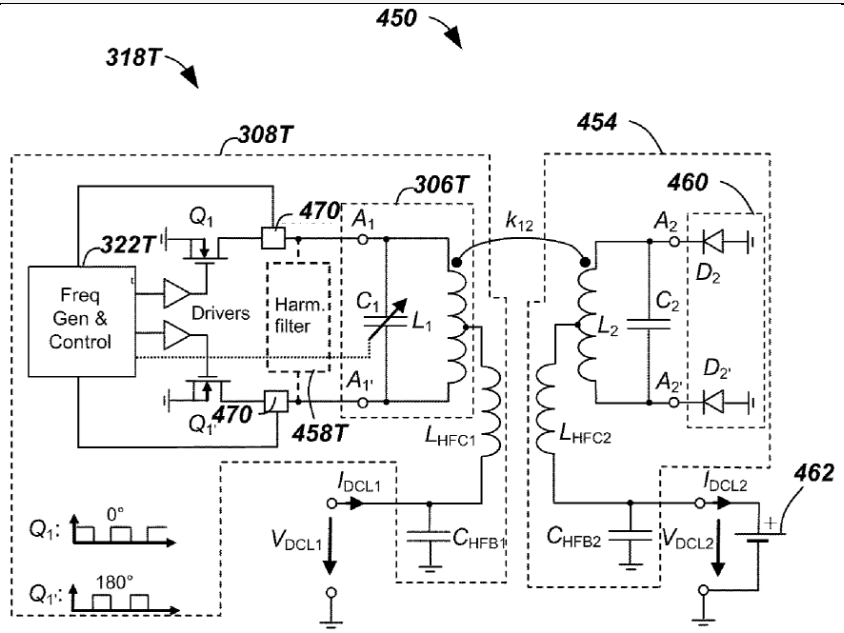


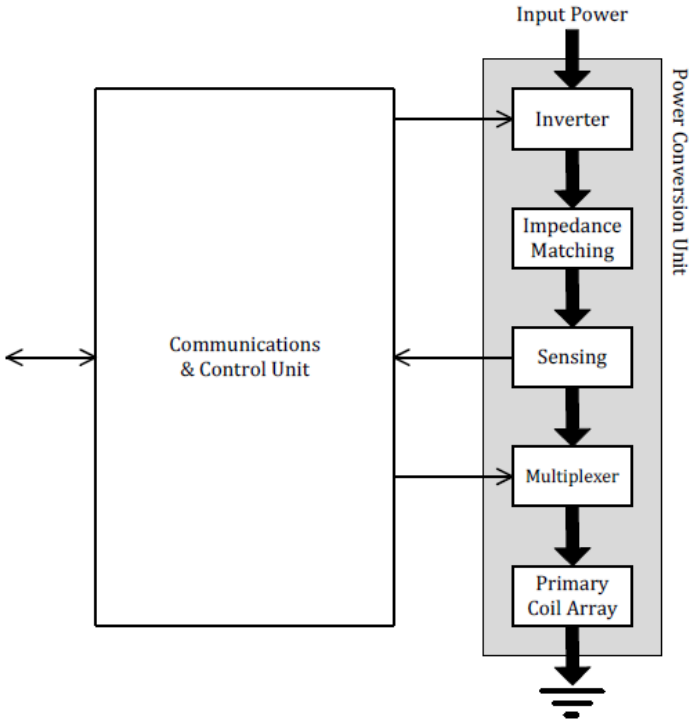
FIG. 9

Cook, Fig. 9.

Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional ***power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna

Claim Limitation	Exemplary Prior Art Disclosures
	306T, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, ***a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratin***gs. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. ***In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier*** and switches are controlled based on sensed voltage. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶63. Third, Cook discloses “a first circuitry comprising: . . . filter capacitor.” For example: FIG. 2 shows a simplified schematic diagram of a wireless power transmission system. The transmitter 104, driven by input power 102, includes an oscillator 122, a power amplifier or power stage 124 and a ***filter*** and matching circuit 126. The oscillator is configured to generate a desired

Claim Limitation	Exemplary Prior Art Disclosures
	frequency, which may be adjusted in response to adjustment signal 123. The oscillator signal may be amplified by the power amplifier 124 with a power output responsive to control signal 125. The filter and matching circuit 126 may be included to ***filter out harmonics or other unwanted frequencies*** and match the impedance of the transmitter 104 to the transmit antenna 114. Cook, ¶ 30. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd ***harmonics filtering in form of a series resonant L-C circuits*** e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶56. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), ***odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T***, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶60; *see also id.* ¶62.
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	On information and belief, the Fulton Solution comprises "a second circuitry comprising: a control logic circuit" such as a communications and control unit disclosed in the WPT standard. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 **Figure 3-9: Functional block diagram of Power Transmitter design B1** WPT, 20.

Claim Limitation	Exemplary Prior Art Disclosures

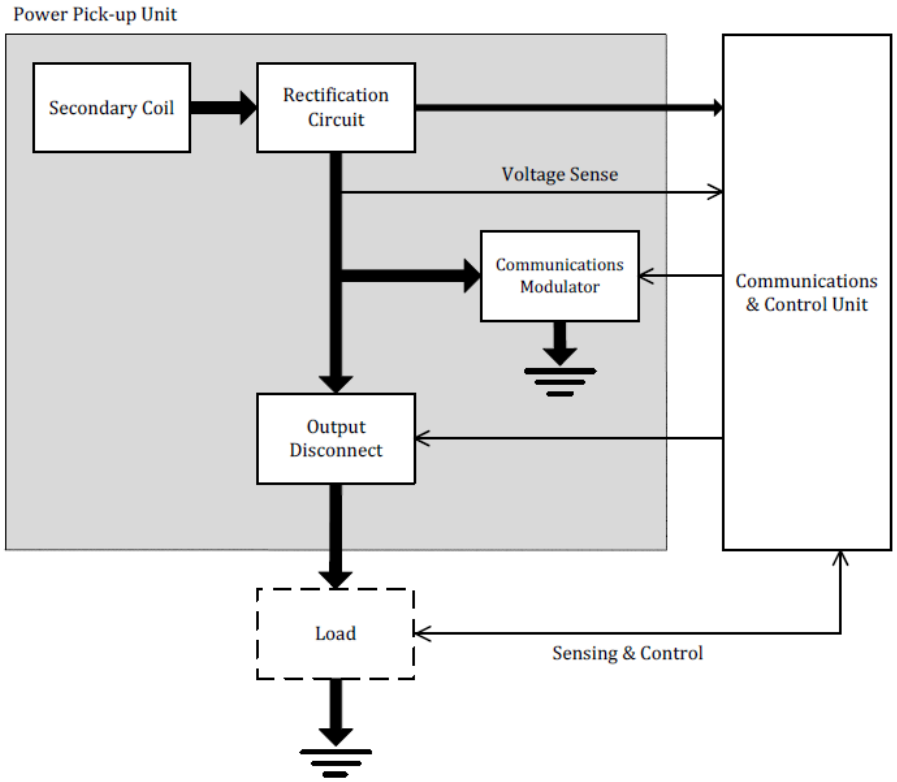


Figure 4-1: Example functional block diagram of a Power Receiver

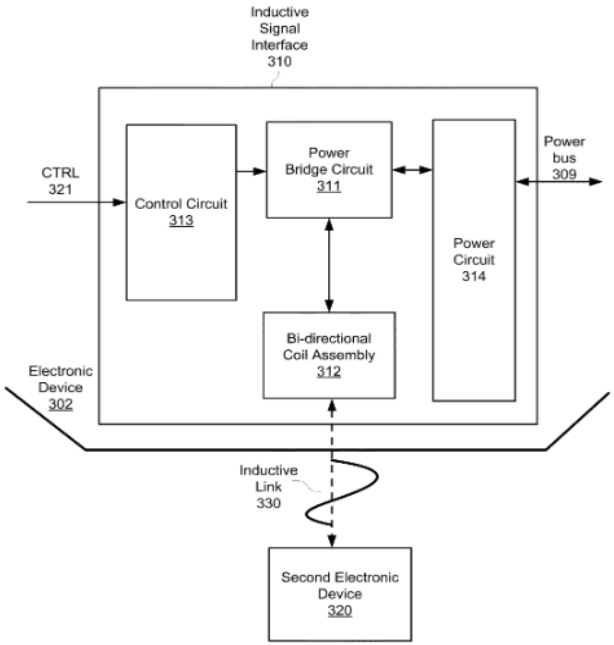
WPT, 29.

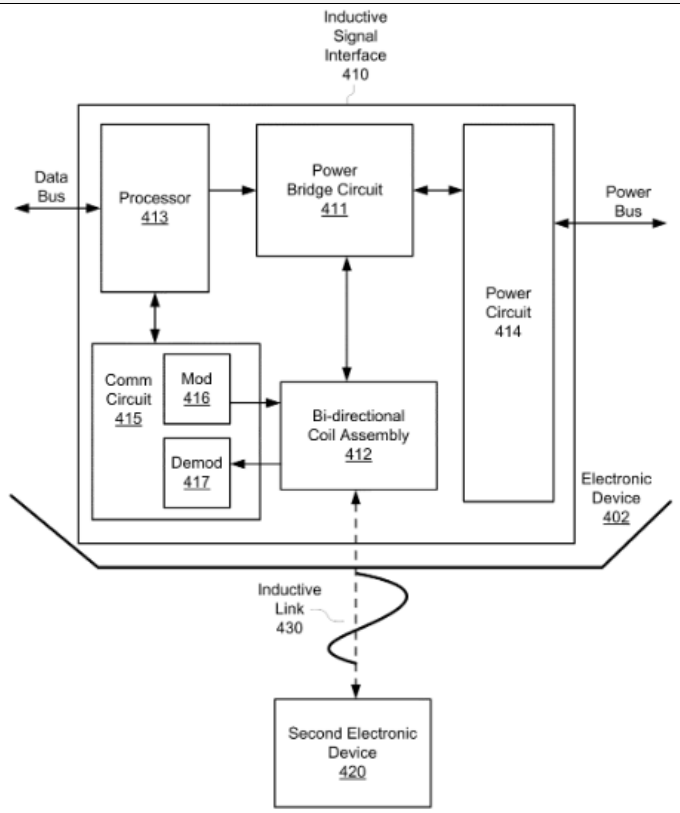
On information and belief, the Fulton Solution comprises "a second circuitry comprising: . . . a modulator/demodulator circuit" such as using modulation for data communication disclosed in the WPT standard.

For example:

> The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the***

Claim Limitation	Exemplary Prior Art Disclosures
	AC waveform to control the power transfer. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, ***the communications modulator typically consists of a capacitor in series with a switch*** (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme"). To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee Chatterjee discloses a control circuit including e.g. a processor and a communication circuit. For example:  FIG. 3

Claim Limitation	Exemplary Prior Art Disclosures
	 **FIG. 4** Chatterjee, Figs. 3, 4, 5. First, Chatterjee discloses or renders obvious "a second circuitry comprising: a control logic circuit." Chatterjee discloses a processor that controls the operation of the circuitry the inductive signal interface. For example: The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal***

Claim Limitation	Exemplary Prior Art Disclosures
	interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 51. The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. The power bridge circuit 610 is operable in both the power receive and transmit modes of an inductive signal interface, such as the inductive signal interface 410 of FIG. 4. ***The operation of the power bridge circuit 610 is controlled by the signals G1-G6, which are transmitted by control logic coupled the switches 621-626***. Referring back to FIGS. 3 and 4, for example, ***the control logic may be the control element 313 or processor 413***. Chatterjee, ¶ 63. In the power transmit mode, the sync bridge branch 613 is turned off and the current path through the bi-directional coil assembly 632 is the series combination of the capacitor C2 and the inductive coil L3. In the power receive mode, the H-bridge branch 611 is turned off and the current path through the bi-directional coil assembly 632 is the inductive coil L3. Chatterjee, ¶ 69. As shown by an embodiment of FIG. 11, the MCD 1110 has a housing shell 1112 having a thickness (t). The housing shell 1112 may be used to retain internal components of the MCD 1110,

Claim Limitation	Exemplary Prior Art Disclosures
	such as ***a circuit board, processor***, memory, or components of a display assembly. The MCD 1110 may be structured so that a primary facade 1115 (e.g. the back panel) of the housing shell 1112 rests on a receiving surface 1125 of the dock 1120. Chatterjee, ¶ 94. Second, Chatterjee discloses and/or renders obvious a "a second circuitry comprising: . . . modulator/demodulator circuit." For example: The communication circuit **415** is coupled to the bi-directional coil assembly **412** in order to transmit and receive data over the inductive link **430**. ***The communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. Chatterjee, ¶¶ 51-54.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee First, Van Der Lee discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Van Der Lee discloses a processing module. For example: > ***The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode based upon power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. > ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit or a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 56. > Moreover, the processing module **142 [sic]** provides a power selection signal **223** to the MUX **222** between the regulated power **164** and the supply voltage Vout **162** for wireless power transmission via the wireless power transceiver circuit **144**. Moreover, ***the processing module 132 implements a battery charge control 149, a regulate control 209, an impedance matching circuit control 207, 227, and 235, a DC-to-AC control 225***, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures

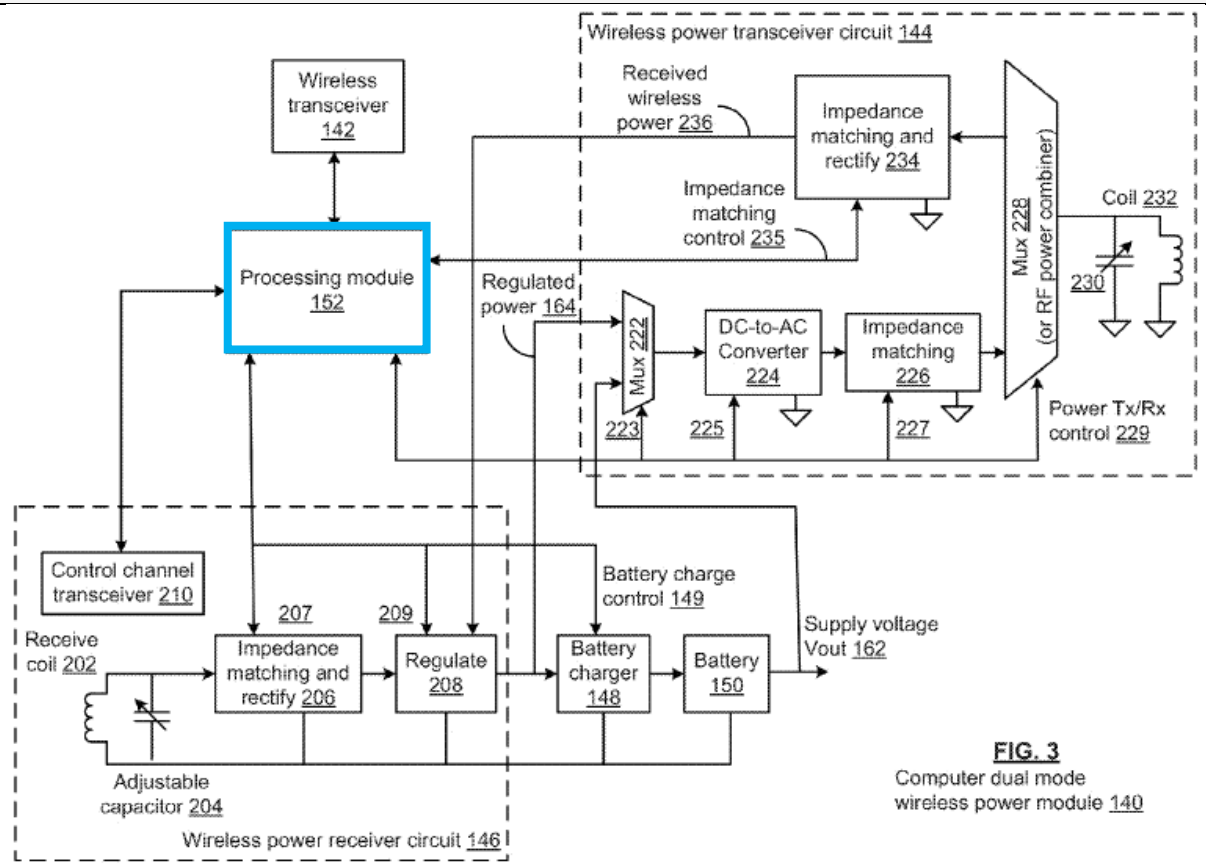


FIG. 3
Computer dual mode wireless power module 140

Van Der Lee, Fig. 3; *see also id.* ¶¶ 53, 55, 65, Fig. 4.

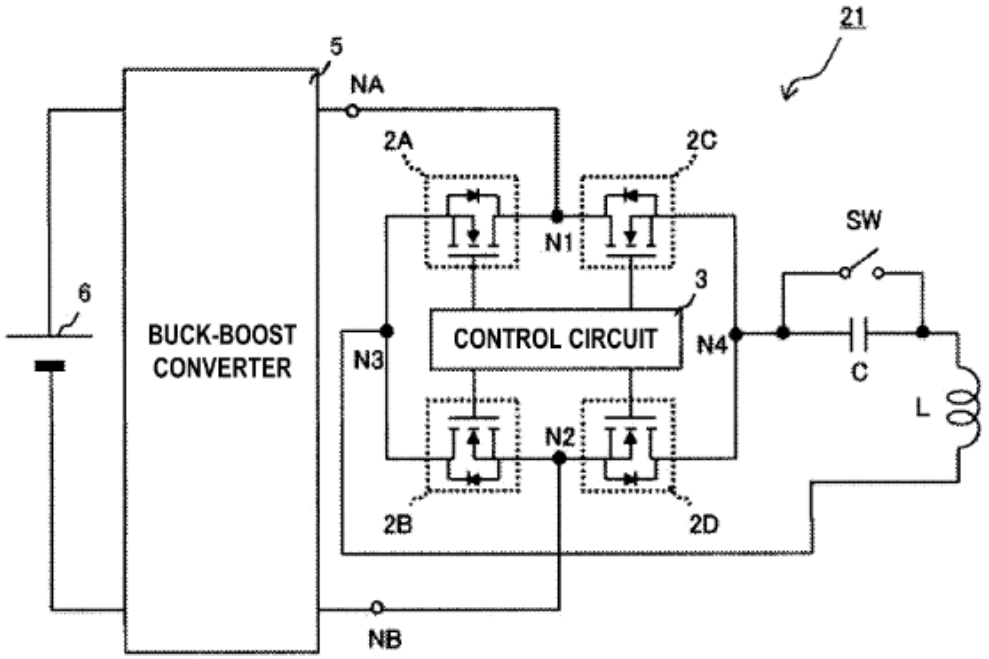
Second, Van Der Lee discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." Van Der Lee discloses that a wireless communication link and a wireless power link may be established over the same inductive link.

For example:

> ***The peripheral devices***, such as cell phone 104, smart phone 102, and personal A/V player 108 may be wirelessly powered concurrently from the computer 100 and/or sequentially. Each of the

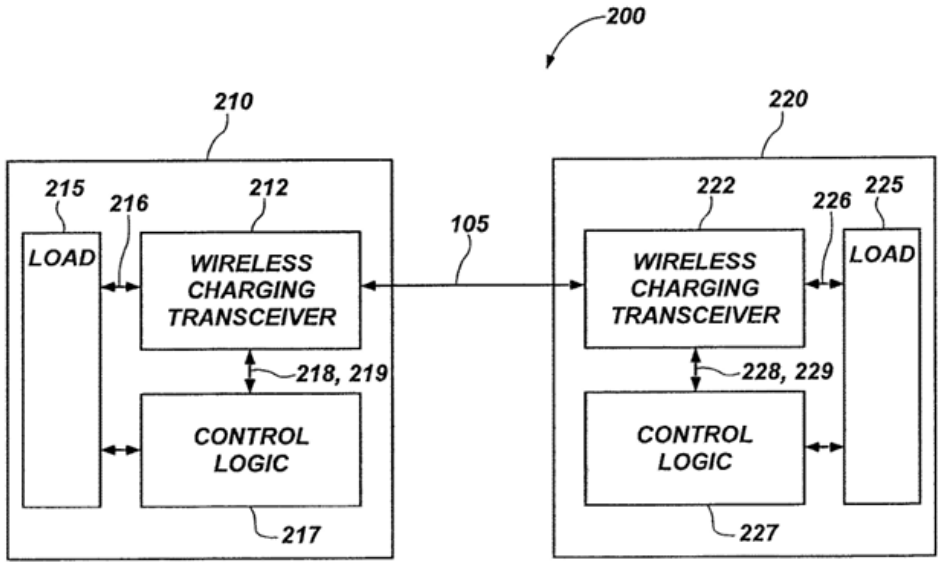
Claim Limitation	Exemplary Prior Art Disclosures
	peripheral devices 102, 104, and 108, ***wirelessly communicates via control and communication links with the computer 100 using*** conventional wireless communication protocols (such as Bluetooth) and or use ***a wireless power control channel***. The foregoing method may further include establishing the wireless power link. The wireless power link may be established based on inductive (or non-resonant) coupling or on resonant inductive coupling. ***The wireless communication link and the wireless power link may also be established via the same inductive link***. The foregoing method may further include monitoring an amount of power wirelessly transferred to the portable electronic device and charging a user of the portable electronic device based on the monitored amount. Van Der Lee, ¶¶ 25, 8; https://documentation.meraki.com/MR/Wi-Fi_Basics_and_Best_Practices/Wireless_Fundamentals%3A_Modulation. **Shinoda** First, Shinoda discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Shinoda discloses a control unit or control circuit. For example: In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power transmission mode of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and

Claim Limitation	Exemplary Prior Art Disclosures
	a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, ***the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods***. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the FETs 2A to 2D function as a full-bridge inverter circuit. Shinoda, 3:52-62. For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, ***the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the ***control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. Second, Shinoda discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." For example: For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the

Claim Limitation	Exemplary Prior Art Disclosures
	opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5. ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20. **Singh-203** Sing-203 describes second circuity in which control logic 217 is a control logic circuit and a modulator / demodulator circuit is included for communicating with other devices. FIG. 2 is a schematic block diagram of an inductive wireless power transfer system 200 according to an embodiment of the present disclosure. The inductive wireless power transfer system 200 includes a first wireless power enabled device 210 and a second wireless power enabled device 220. The first wireless power enabled device 210 may include a wireless charging transceiver 212, a load 215, and control logic 217. Similarly, the second wireless power enabled device 220 may include a wireless charging transceiver 222, a load 225, and control logic 227. Singh-203, 5:3-12. The control logic 217, 227 may be configured to determine which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. The control signals 218, 219, 228, 229 may be transmitted to the wireless charging transceivers 212, 222 to drive the desired operations.

Claim Limitation	Exemplary Prior Art Disclosures
	As an example, the control logic 217, 227 may include a processor (e.g., microcontroller) that is configured (e.g., programmed) to determine whether the respective wireless charging transceiver 212, 222 is to operate in transmit mode or receive mode. The control logic 217, 227 may further include computer-readable media (e.g., memory) storing computing instructions for execution by the processor related to performing processes of the embodiments of the present disclosure. Memory may include volatile and non-volatile memory. The loads 215, 225 may include energy storage devices (e.g., batteries), system components of the wireless power enabled devices 210, 220, or both. Thus, the output power signals 216, 226 may be a charging signal for an energy storage device, or a system power signal for the various system components. Singh-203, 5:31-51. In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. Singh-203, 6:5-24; *see also id.*, 7:7-9 ("The plurality of switches 335, 336, 337 may be controlled by control signals 219 from the control logic 217 (FIG. 2)."). The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, 7:23-31.  FIG. 2 Singh-203 also discloses a modulator / demodulator. For example, > The embodiments shown in FIG. 2, as well as in FIGS. 3A through 3D, are shown to demonstrate a wireless power enabled device being configured to operate in either a transmit mode or a receive mode, such as for wireless OTG charging. It should be recognized that the wireless power enabled device may include additional components to perform other features not specifically described herein. For example, the wireless power enabled device may include a modulator and/or a demodulator for communicating with other devices, foreign object detection modules, I/O modules for interfacing with a user, memory for storing instructions and data, various sensors, among other components. Singh-203, 9:26-37. **Singh-624**

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624 describes an analogous system and shows how the modulator/demodulator may be employed. For instance:

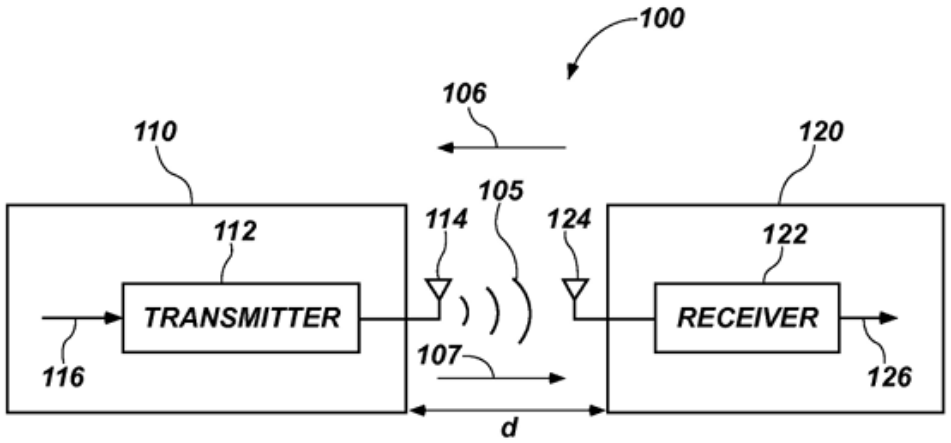
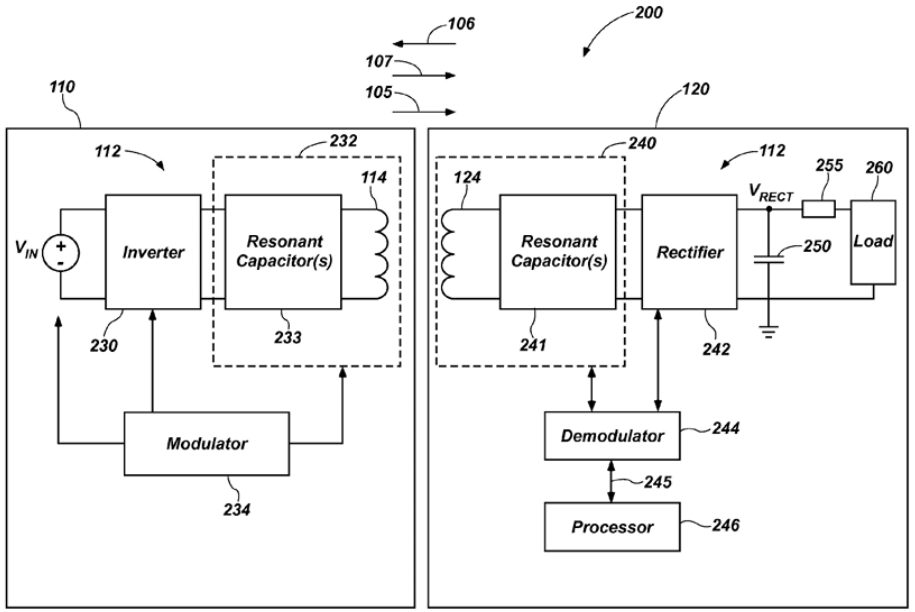


FIG. 1

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	 *FIG. 2* Singh-624, FIGS. 1-2; *see also id.*, FIG. 7. An inductive wireless power transfer device comprises a transmitter that comprises a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. An inductive wireless power receiving device comprises a receiver that comprises a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Related inductive wireless power transfer systems and methods for back-channel communication from the transmitter to the receiver of an inductive wireless power transfer system are disclosed.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, Abstract. During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Embodiments of the present disclosure include an inductive wireless power transfer device. The inductive wireless power transfer device comprises a transmitter that includes a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power receiving device. The inductive wireless power receiving device comprises a receiver having a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power transfer system. The inductive wireless power transfer system comprises a transmitter having a transmit coil configured to generate a modulated wireless power signal in a coupling region for wireless power transfer, and a receiver having a receive coil configured to couple with the transmit coil by receiving the modulated wireless power signal and to generate an output signal in response thereto to provide power to a load, wherein the modulated wireless power signal includes characters. Another embodiment of the present disclosure includes a method for communicating between a transmitter to a receiver in an inductive wireless power transfer system. The method comprises

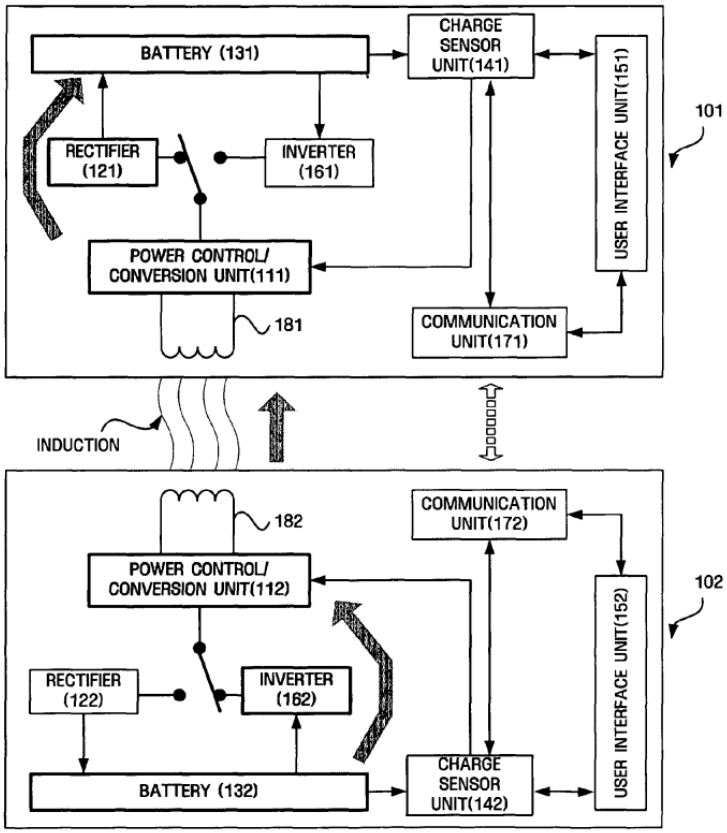
Claim Limitation	Exemplary Prior Art Disclosures
	generating a wireless power signal through a transmit coil of a transmitter to a receive coil of a receiver, and modulating the wireless power signal on the transmitter side for communicating data over the wireless power signal from the transmitter to the receiver. Singh-624, 1:56-2:25. Embodiments of the present disclosure include a back-channel communication link 107 to transmit data from the transmitter 112 to the receiver 122. The transmitter 112 may be configured to establish the back-channel communication link 107 by modulating the wireless power signal 105. In particular, the conversion gain of the wireless power signal 105 may be modulated, which may be detected responsive to the wireless power signal 105 being received and demodulated by the receiver 122. While the back-channel communication link 107 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105, it should be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils (through transmit coil 114 and receive coil 124). Thus, the wireless power signal 105 carries the communication data of the back-channel communication link 107 when the wireless power signal 105 is modulated as described herein. The arrow for the back-channel communication link 107 is merely shown separately for the purpose of indicating a direction of communication data flow. Similar to conventional wireless power transfer systems, embodiments of the present disclosure may further include a forward-channel communication link 106 for transmitting data from the receiver 122 to the transmitter 112, such as via backscatter modulation. As discussed above, conventional wireless power transfer systems may be limited to one-way communication from the receiver 122 to the transmitter 112, or else require separate RF coils for transmitting data separately from the transmit coil 114 and receive coil 124. Like the back-channel communication link 107, the forward-channel communication link 106 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105; however, it should also be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils. Thus, the wireless power signal 105 carries the communication data of the forward-channel communication link 106 when the wireless power signal 105 is modulated according to the conventional principles of back scatter modulation. The arrow for the forward-channel communication link 106 is also shown separately for the purpose of indicating a direction of communication data flow.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, 5:38-6:11. The transmitter 112 may further include an inverter 230, a resonant tank 232, and a modulator 234. The resonant tank 232 may include one or more capacitors (e.g., resonant capacitor(s) 233) coupled with an inductor (e.g., the transmit coil 114). The capacitors and inductors may be configured in an LC network, such as being coupled in series or parallel. The inverter 230 is coupled between the input voltage (VIN) and the resonant tank 232. The modulator 234 may be coupled with one or more of the inverter 230, the resonant tank 232, and the input voltage (VIN) in order to modulate the wireless power signal 105 such that communication may be achieved from the transmitter 112 to the receiver 122, as will be described in more detail below. The transmitter 112 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions such as power monitoring, foreign object detection, etc. It will also be appreciated that the transmitter 112 may include a demodulator for receiving and demodulating communication received from the receiver 122. The receiver 122 may further include a resonant tank 240, a rectifier 242, a demodulator 244, and a processor 246. The resonant tank 240 may include an inductor (e.g., receive coil 124) coupled with one or more capacitor (e.g., resonant capacitor(s) 241). The resonant tank 240 is coupled with the rectifier 242, which may further be coupled to the load 260. The demodulator 244 may be coupled with one or more of the resonant tank 240, the rectifier 242, and the processor 246 in order to demodulate the received wireless power signal 105 and transmit a demodulated signal 245 to the processor 246 for analysis or other processing. The receiver 122 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions, such as power monitoring, foreign object detection, etc. It will also be appreciated that the receiver 122 may include a modulator for modulating communication to the receiver 122. Singh-624, 6:55-7:22. **Sagoo** First, Sagoo discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Sagoo discloses a power control/conversion unit and/or a communication unit that controls, e.g. which mode the mobile device operates in and the input/output levels of AC and DC voltages. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside***; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device***; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:35-55. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted.

Claim Limitation	Exemplary Prior Art Disclosures
	The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:34-5:4. ***The communication unit 170*** performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and ***controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. Second, Sagoo discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." For example: ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile***

Claim Limitation	Exemplary Prior Art Disclosures
	devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. An example of a process in which the two mobile devices share energy in a non-contact manner will now be described. A user having the first device 101 is informed through a user interface unit 151 that the battery does not have enough charge. The charge sensor unit 141 measures the charge state of the battery and communicates with the communication unit about the charge state of the battery. Rechargeable batteries such as the battery 131 of the first device 101 can be installed in devices, such as a notebook computer, a PDA, an MP3 player, and a game console, and have different voltages, currents, and capacities. The battery can be formed of, for example, a nickel metal hydride (NiMH) battery or a lithium-ion battery. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device and outputs the received information to the user interface unit 151***. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:4-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, the communication units can perform authentication with respect to each other such that charging is performed between authenticated devices. Sagoo, 6:43-48.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 4  Sagoo, Fig. 4; *see also id.* Figs. 3-7. **Schuessler**

Claim Limitation	Exemplary Prior Art Disclosures
	First, Schuessler discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Schuessler discloses a control mechanism that determines the mode for the bi-directional charging device and provides adjustment. For example: ***Control mechanism 225 represents the control hardware, firmware, and/or software that determines the mode for the bi-directional charging device 105, for example, a power receiving mode or a power delivering mode***. As discussed above, there may be multiple concurrent modes. ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown) to receive information or to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and ***control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer***. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215.

Claim Limitation	Exemplary Prior Art Disclosures
	Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. Bi-directional charging device 105 may include combinations of discrete and integrated components. For example, ***control mechanism 225 may include a processor implemented on a***

Claim Limitation	Exemplary Prior Art Disclosures
	semiconductor device, and discrete input/output circuitry for the processor. Further, multiple functions or portions of functions may be integrated within one or more semiconductor devices. For example, portions of selection mechanism 210, external connection interface 220, control mechanism 225, external indicator interface 230, and external communication interface 235 may all be integrated within one semiconductor device. Schuessler, 7:20-30. Second, Schuessler discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." For example: The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Schuessler, 5:5-21. One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 3:1-11. wherein the wireless communication mechanism is selected from Bluetooth, WiFi, other public or proprietary wireless protocols, ***modulation on the energy transfer itself, modulating a low frequency protocol on a high frequency energy transfer, by modulating a high frequency protocol on a low frequency energy transfer or an infrared interface***; Schuessler, cl. 1. **Yeh** Yeh discloses a logic control unit that controls the operation of a bi-directional wireless charging and discharging device. For example: The logic control unit 1 comprises first to sixth control pins 11-16, a power pin 17, and a detection pin 18. The remaining pin that is not labeled is a grounding pin. The wireless receiving and transmitting unit 2 comprises a transmission terminal 21 and a test terminal 22. ***The test terminal 22 is electrically connected to the detection pin 18 of the logic control unit 1***. The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. ***The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1***. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. ***The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the***

Claim Limitation	Exemplary Prior Art Disclosures
	step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1***. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. ***The control switch 5 has an end electrically connected to the discharging terminal 931 of the battery 93 and an opposite end electrically connected to the control terminal 43 of the first reverse current protector 4 and the third control pin 13 of the logic control unit 1***, wherein the connection of said opposite end of the control switch 5 with the control terminal 43 of the first reverse current protector 4 forms a second node 431. Preferably, the control switch 5 is an automatic returning switch. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1***. Yeh, 3:51-4:47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. ***The control terminal 43 is electrically connected to the sixth***

Claim Limitation	Exemplary Prior Art Disclosures
	control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. The transmission mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to the transmission mode, the control switch 5 is actuated to effect switching. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. ***Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode***. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. ***When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the***

Claim Limitation	Exemplary Prior Art Disclosures
	third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition. ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2***: if there is no load: the transmission is stopped; if there is a load: ***the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3***. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 5:37-6:44.

Claim Limitation	Exemplary Prior Art Disclosures
	The receiving mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18. In the bidirectional wireless charging and discharging device according to the second embodiment of the present invention, ***the second node 431 of the first reverse current protector 4 is electrically connected to the signal output terminal 911 in order to receive the control signal***

Claim Limitation	Exemplary Prior Art Disclosures
	supplied from the signal output terminal 911 to switch the logic control unit 1 (via the third control pin 13) to the transmission mode. Yeh, 7:38-44. Yeh also discloses a wireless receiving and transmitting unit that may comprise a built-in antenna that can detect whether a second electronic device to be charged exist on the opposite side of the wireless charging and transmitting unit. For example: ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna***. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: Yeh, 6:4-10; *see also id.* Figs. 1-3. **Cook** First, Cook discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Cook discloses a frequency generation and control circuit that controls the operation of the bidirectional wireless power transceiver. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable.

Claim Limitation	Exemplary Prior Art Disclosures
	Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored***

Claim Limitation	Exemplary Prior Art Disclosures
	by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. Second, Cook discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." Cook discloses a communication channel that is combined with magnetic field between the transmitter and receiver. For example: A communication channel 119 may also exist between the transmitter 104 and the receiver 108. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel 119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32; https://documentation.meraki.com/MR/Wi-Fi_Basics_and_Best_Practices/Wireless_Fundamentals%3A_Modulation. **Corbridge**

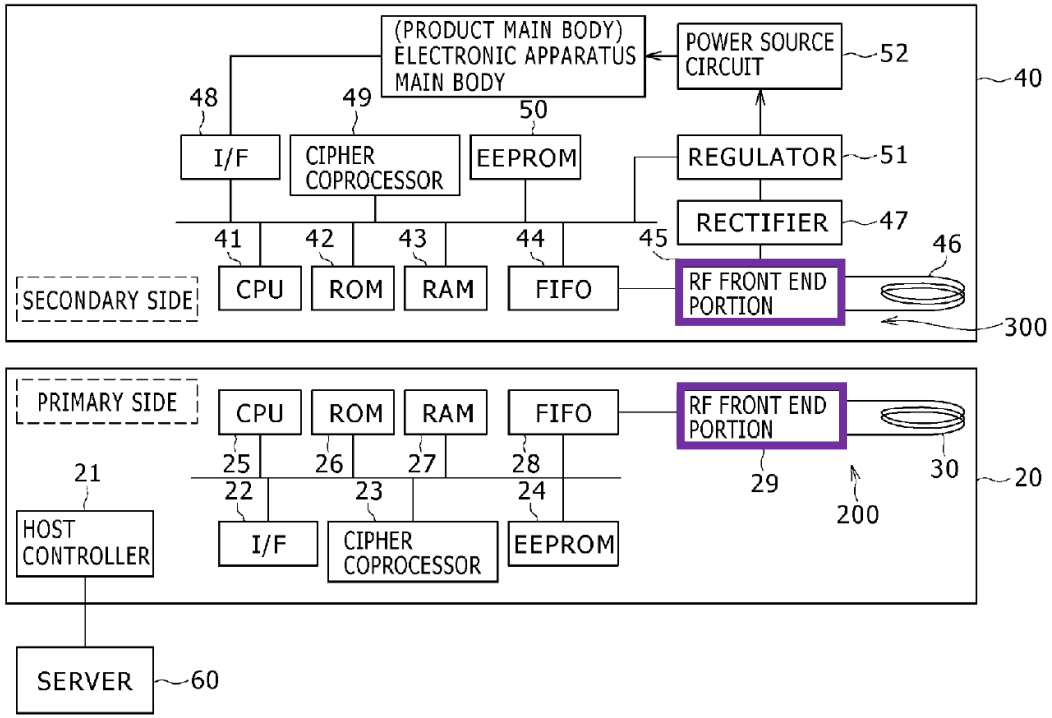
Claim Limitation	Exemplary Prior Art Disclosures
	For example: On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. Corbridge, ¶55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For***

Claim Limitation	Exemplary Prior Art Disclosures
	example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410. Corbridge, ¶57. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a***

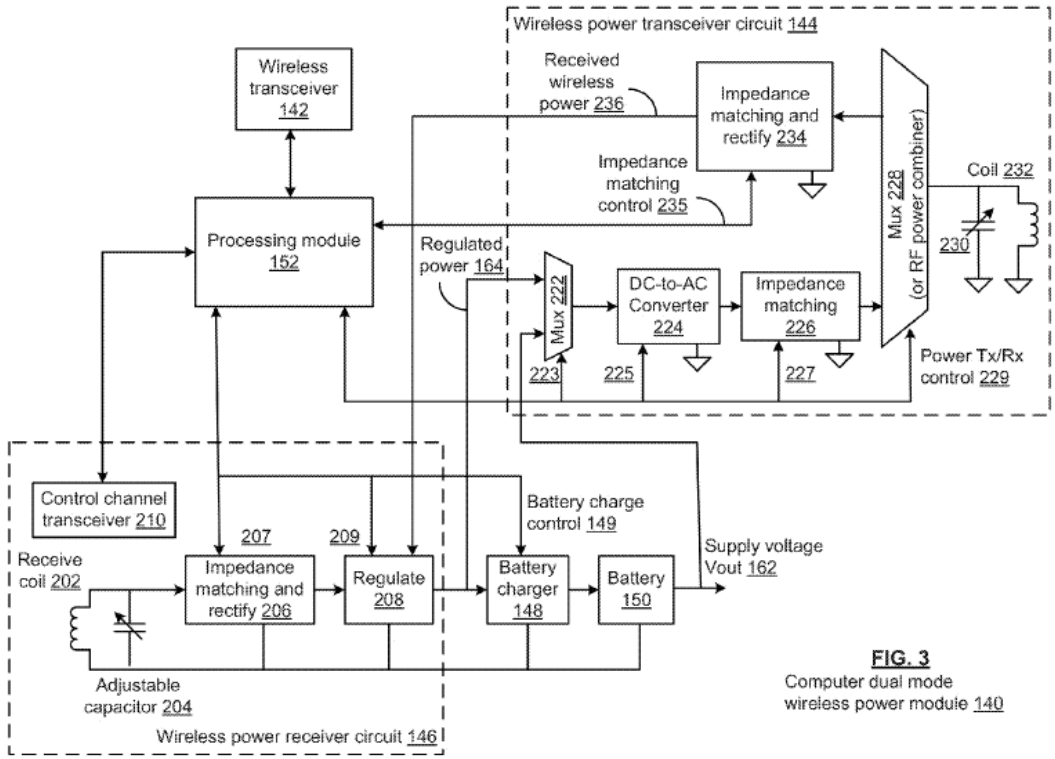
Claim Limitation	Exemplary Prior Art Disclosures
	communication protocol such as described with one or more embodiments described herein. The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0" values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95. **Teramoto** For example, Teramoto discloses:

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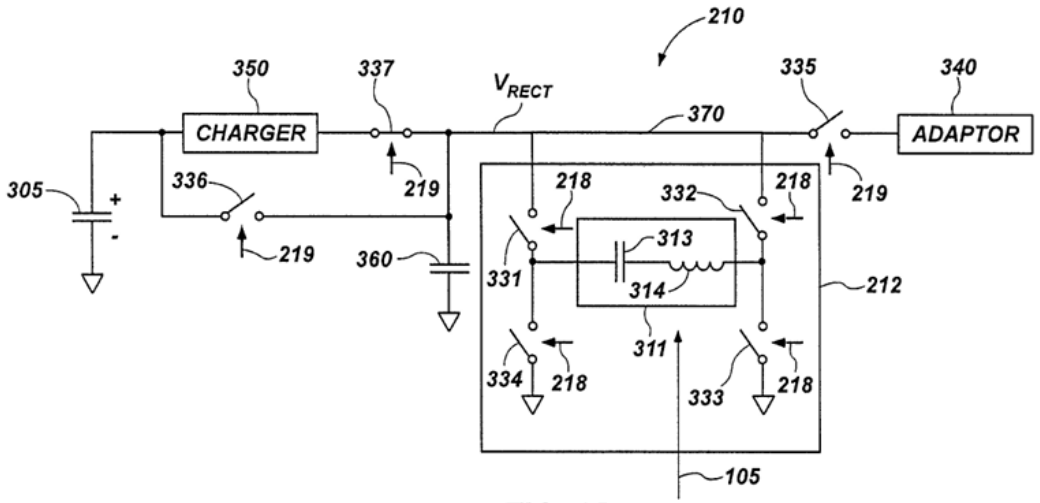
Claim Limitation	Exemplary Prior Art Disclosures
	Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶ 52.  Teramoto, Fig. 1; *see also id.* ¶ 55. In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.

Claim Limitation	Exemplary Prior Art Disclosures
	The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	On information and belief, the Fulton Solution comprises "said first circuitry configured to receive said power from a wireless power transmitter." The Fulton Solution can be charged by a charging dock, and the impedance network and the rectifier function to transmit and modify the power received via the coil to charge the battery in the Fulton Solution, which is implemented on a Galaxy tablet. To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses a power receive mode. For example: ***During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420. The power signal is transmitted in modulated form over the power bridge circuit 411, which performs rectification to output a DC current to the power circuit 414***. The power circuit 414 is configured to clamp current levels, regulate voltage levels, and perform other functions to transmit an outgoing power signal in the power receive mode. According to embodiments, ***the resulting power signal is a DC signal and is routed to: (i) charge a rechargeable battery within the electronic device 402, and/or (ii) provide power to circuit elements within the electronic device***.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee Van Der Lee discloses a wireless power receive mode. For example: > ***When in a wireless power receive mode, the wireless power transceiver circuit 144 receives an electromagnetic field*** that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122. ***The wireless power transceiver circuit 144 converts the wireless power link into a voltage delivered to the battery charger 148, which in turn charges the battery 150***. Van Der Lee, ¶ 46.  **FIG. 3** Computer dual mode wireless power module 140

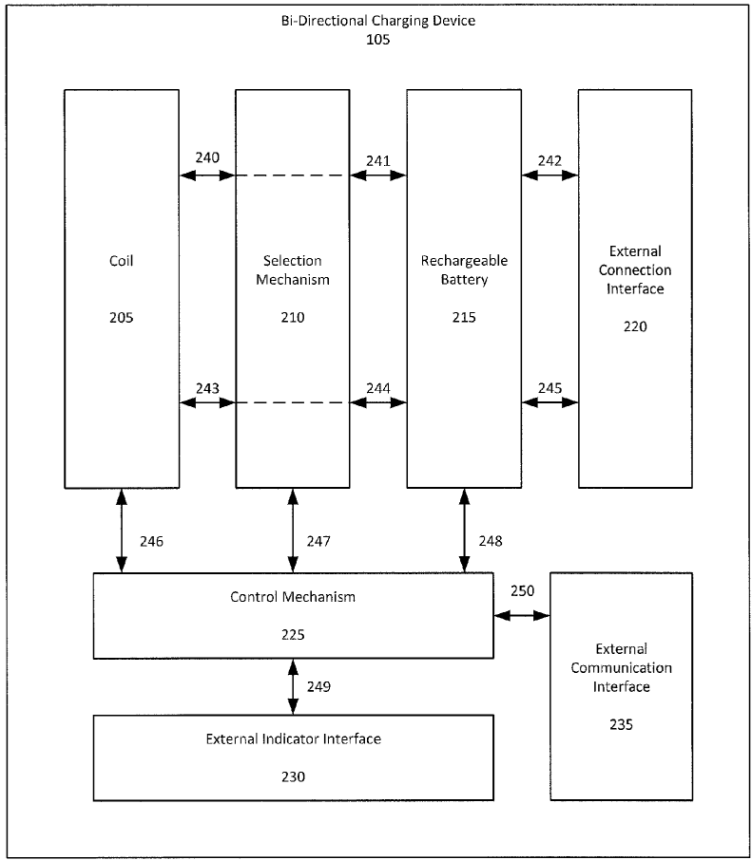
Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee, Fig. 3; *see also id.* ¶ 43, Fig. 4. **Shinoda** Shinoda discloses a power reception mode for the wireless power transfer terminal. For example: FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. The power transmission circuit 103 includes an inverter for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage***. Shinoda, 1:31-46. FIG. 3A illustrates a state in which a positive voltage is excited at one end of the coil L that is connected to the node N3 and a negative voltage is excited at another end of the coil L that is connected to the node N4 in a half period of an alternating-current input. ***In this state, a current from one end of the coil L at which the positive voltage is excited passes through the node N3, FET 2A, node N1, and input/output node NA and enters a power reception load. The current flowing from the power reception load passes through the input/output node NB, node N2, FET 2D, and node N4 and returns to one end of the coil L at which the negative voltage is excited***. Therefore, the positive voltage from the input/output node NA and the negative voltage from the input/output node NB are applied to the power reception load. Shinoda, 4:34-47. FIG. 3B illustrates a state in which a negative voltage is excited at one end of the coil L that is connected to the node N3 and a positive voltage is excited at another end of the coil L that is

Claim Limitation	Exemplary Prior Art Disclosures
	connected to the node N4 in a half period of an alternating-current input. ***In this state, a current from one end of the coil L at which the positive voltage is excited passes through the node N4, FET 2C, node N1, and input/output node NA and enters the power reception load. The current flowing from the power reception load passes through the input/output node NB, node N2, FET 2B, and node N3 and returns to one end of the coil L at which the negative voltage is excited***. Therefore, the positive voltage from the input/output node NA and the negative voltage from the input/output node NB are applied to the power reception load. Shinoda, 4:52-65. For a ***power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. **Singh-203** Singh-203 discloses and renders obvious this limitation. For instance, the first circuitry 210 operates in receive mode to receive power signal 105 from a wireless transmitter. For example: Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality

Claim Limitation	Exemplary Prior Art Disclosures
	of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof.  FIG. 3D Singh-203, 8:51-9:5, FIG. 3D. **Sagoo** Sagoo discloses that the mobile device receives power wirelessly in a load mode. For example: The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that ***the mobile device 100 can be supplied with energy from another device (the load mode)*** or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion

Claim Limitation	Exemplary Prior Art Disclosures
	unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. Sagoo, 4:56-64. The ***inductive coil 180 performs the function of the secondary coil when the mobile device is in the load mode***, and performs the function of the primary coil when the mobile device is in the source mode. Sagoo, 5:27-30. In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. ***An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode***. Sagoo, 6:26-32; *see also* Sagoo, Figs. 2-5. When the selected mobile device (hereinafter, referred to as a source device) can operate in the source mode, the mobile device to be charged is switched to the load mode (S270). ***When the mobile device to be charged is switched to the load mode, the rectifier is connected to the battery and the power control/conversion unit such that energy can be received from the outside. Further, the inductive coil is set as the secondary coil (S280). Energy is received from the secondary coil and the primary coil of the source device (S290).*** The charge state of the battery can be checked while the energy is being received such that the battery is prevented from being excessively charged. Sagoo, 7:34-45; *see also id.* Figs. 6, 8. **Schuessler** Schuessler discloses that a bi-directional wireless charger receives power wirelessly in, for example, a power-receiving mode. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively causes power to be delivered from the coil to the battery and selectively causes power to be delivered from the battery to the coil, and a control mechanism. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the coil to the battery***, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the battery to the coil. Schuessler, Abstract. ***A bi-directional charging device may wirelessly receive power*** and wirelessly deliver power. When the bi-directional charging device is in the vicinity of a charging bay it may receive power from the charging bay to recharge an internal battery. When the bi-directional charging device is in the vicinity of a rechargeable electronic device it may deliver power to the electronic device for recharging an internal battery of the electronic device. Thus, the bi-directional charging device may be kept near rechargeable electronic devices to recharge batteries in the electronic devices, for example throughout the day. The bi-directional charging device may itself be recharged when it is placed in the vicinity of a charging bay, for example overnight. Schuessler, 1:41-53. ***Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode*** or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 4:35-60.  *Fig. 2* Schuessler, Fig. 2 **Yeh**

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh discloses that a bi-directional wireless charging and discharging device receives power wirelessly in a load mode. For example: The ***receiving mode*** of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, ***the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to ***set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93*** of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; ***when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18; *see also* Yeh, Figs. 1-3.

Claim Limitation	Exemplary Prior Art Disclosures
	Cook Cook discloses that a bi-directional wireless power transceiver receives power wirelessly in a power receive mode. For example: FIG. 5A and FIG. 5B illustrate a bidirectional wireless power device, in accordance with an exemplary embodiment. Bidirectional wireless powering and charging of electronic devices (e.g. mobile phones, head sets, MP3 players, etc.) is disclosed in which ***electrical energy can be wirelessly transferred, as illustrated in FIG. 5A, from a power conversion circuit 220 and transmit antenna 214 of a power base 302 (e.g. charging pad) to a bidirectional wireless power transceiver 318 including a transceiver antenna 306 and a bidirectional power conversion circuit 308 of an electronic device 300 as illustrated in FIG. 5B. Then, as illustrated with reference to FIG. 5B, the wirelessly transmitted power is stored in a load illustrated as battery 310.*** The stored power in battery 310 is then donated through the bidirectional power conversion circuit 308 and transceiver antenna 306 of electronic device 300 to a receive antenna 312 and a power conversion circuit 314 of another electronic device 304 for consumption or storage in load or battery 316. Cook, ¶ 44. FIG. 7 illustrates a block diagram of ***an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, a bidirectional power conversion circuit 308 and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324***. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane. Cook, ¶ 50. FIG. 10 illustrates a circuit diagram of a wireless power transmission system, in accordance with another exemplary embodiment. This exemplary embodiment enables exchange of energy from one battery operated device to another battery operated device equally in both directions. A wireless power transmission system 500 includes a bidirectional wireless power transceiver 318T

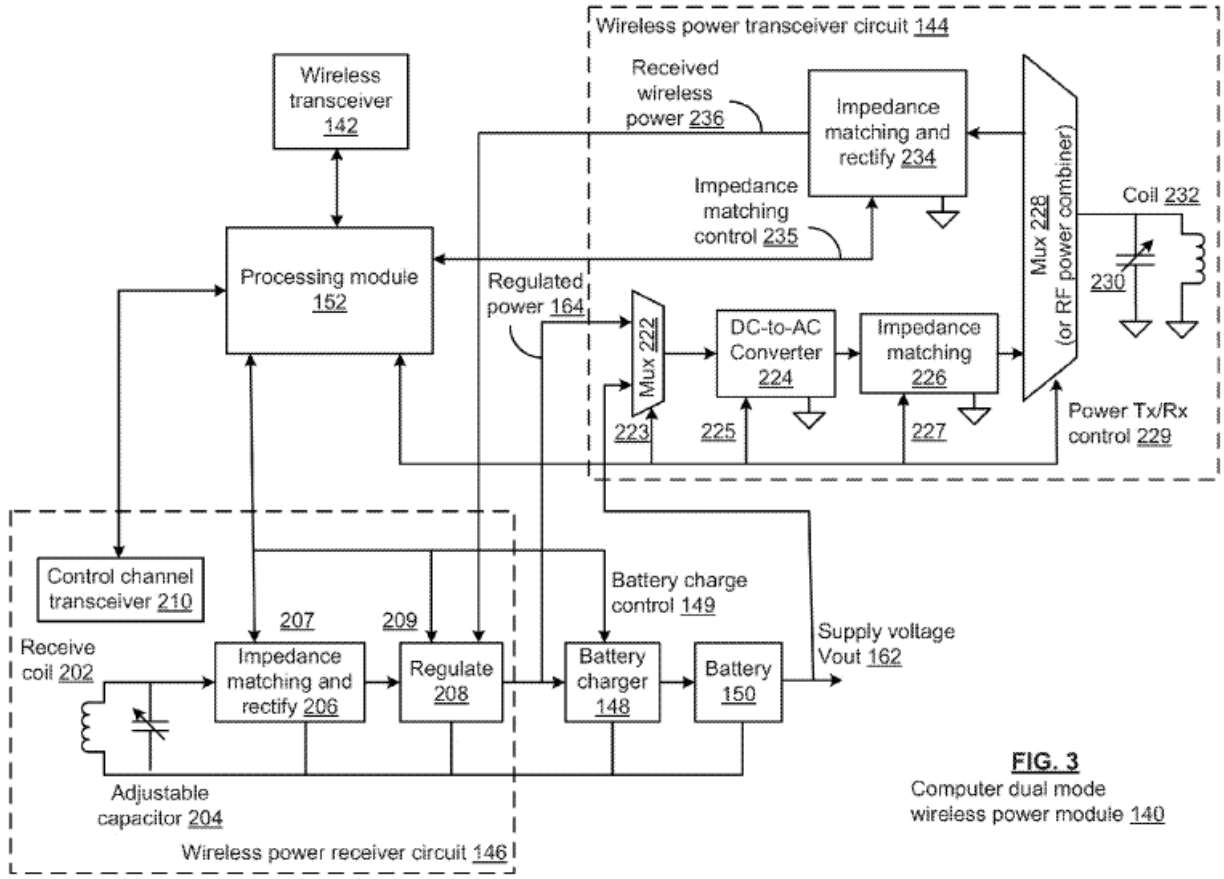
Claim Limitation	Exemplary Prior Art Disclosures
	(where "T" indicates a Transmitter configuration or transmit mode) and a bidirectional wireless power transceiver 318R (where "R" indicates a ***Receiver configuration or receive mode***). Cook, ¶58. FIG. 11 illustrates a flowchart of a method for transceiving wireless power, in accordance with an exemplary embodiment. Method 600 for transceiving wireless power is supported by the various structures and circuits described herein. Method 600 includes step 602 for ***receiving an induced current from an antenna resonating in response to a magnetic near-field and rectifying the induced current into DC power through a bidirectional power conversion circuit when the bidirectional power conversion circuit is configured in receive mode***. Method 600 further includes step 604 for generating an induced current at a resonant frequency into the antenna from stored DC power through the bidirectional power conversion circuit and generating a magnetic near-field from the antenna when the bidirectional power conversion circuit is configured in transmit mode. Cook, ¶64. *See also* Figs. 1-10. *See generally* Limitation [1b] and [1p].
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load	As explained above in claim limitation [1b], on information and belief, the Fulton Solution comprises "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network." On information and belief, in the Fulton Solution, changing "impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device" is "based on an input from said control logic circuit." The operation of the first circuitry needs to be controlled by a controller or a processor, such as the communications and control unit disclosed in the WPT standard which comprises "digital logic" and "executes the relevant power control algorithms and protocols," among others. For example:

Claim Limitation	Exemplary Prior Art Disclosures
device;	The Communications and Control Unit on the left-hand side of Figure 3-9 comprises the digital logic part of the design. This unit receives and decodes messages from the Power Receiver, configures the multiplexer to connect the appropriate parts of the Primary Coil array, executes the relevant power control algorithms and protocols, and drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver. The Communications and Control Unit also interfaces with the other subsystems of the Base Station, e.g. for user interface purposes. WPT, 20. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30. To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses a processor that controls the electronic device to operate in a power receive mode. For example: The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. The processor **413** may be configured to process identification and status information transmitted over the inductive signal interface **430** to determine a mode of operation of the inductive signal interface **410**. ***The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor **413** may also be

Claim Limitation	Exemplary Prior Art Disclosures
	configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH) Chatterjee, ¶ 55. The same power bridge circuit **311** may be used for implementations in which first device **302** can only receive power over the inductive link **330**. ***The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in*** both power receive and ***power transmit modes***, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may (i) ***link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode***; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In usages when inductive signal interface **310** is in a power receive mode, the power signal is received from the second electronic device **320** over the inductive link **330**. The inductive signal interface **310** may be coupled to a power storage element, such as a rechargeable battery. The inductive signal interface **310** may be configured to charge the power storage element or to provide power to other circuitry within the first electronic device through the voltage supply line. The power circuit **314** receives current transmitted from the power bridge circuit **311** and is configurable to perform voltage and current regulation in order to charge the power storage element or provide power to other circuitry. The bi-directional coil assembly **312** receives power inductively from the second electronic device **320**, ***the power bridge circuit 311 converts AC current received inductively at the bi-directional coil assembly 312 to DC current*** to be transferred to the power circuit via the power bus. Chatterjee, ¶ 40. During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420. Chatterjee, ¶ 46; *see also id.* Figs. 3-10. **Van Der Lee**

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee discloses that the processing module controls the wireless power module to operate in a power receive mode. For example: ***The processing module 152 places the wireless power transceiver circuit 144 in either of*** a wireless power transmit mode or ***a wireless power receive mode*** based upon power information from the dual mode wireless power module 122, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. When in a wireless power receive mode, such as when the computer dual mode wireless power module 140 does not receive wireless power via the wireless power receiver circuit 146, as indicated through the power Tx/Rx control 229 from the processing module 152, the coil 232 of the wireless power transceiver circuit 144 receives a wireless power signal transmitted by the coil another device having a peripheral device dual mode wireless power module. In this mode, ***the impedance matching and rectify circuit 234 converts the AC voltage into a received wireless power 236, which is rectified to a DC voltage***. ***The DC voltage is regulated via the regulate circuit 208 for the battery charger 148, which in turn charges the battery 150***. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in*** either of a wireless power transmit or ***a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶¶ 55–56. Moreover, the processing module 142 [sic] provides a power selection signal 223 to the MUX 222 between the regulated power 164 and the supply voltage Vout 162 for wireless power transmission via the wireless power transceiver circuit 144. Moreover, the processing module 132 implements a battery charge control 149, a regulate control 209, an impedance matching circuit control 207, 227, and 235, a DC-to-AC control 225, and provide for RF/MMW and/or NFC baseband processing.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee, ¶ 58.

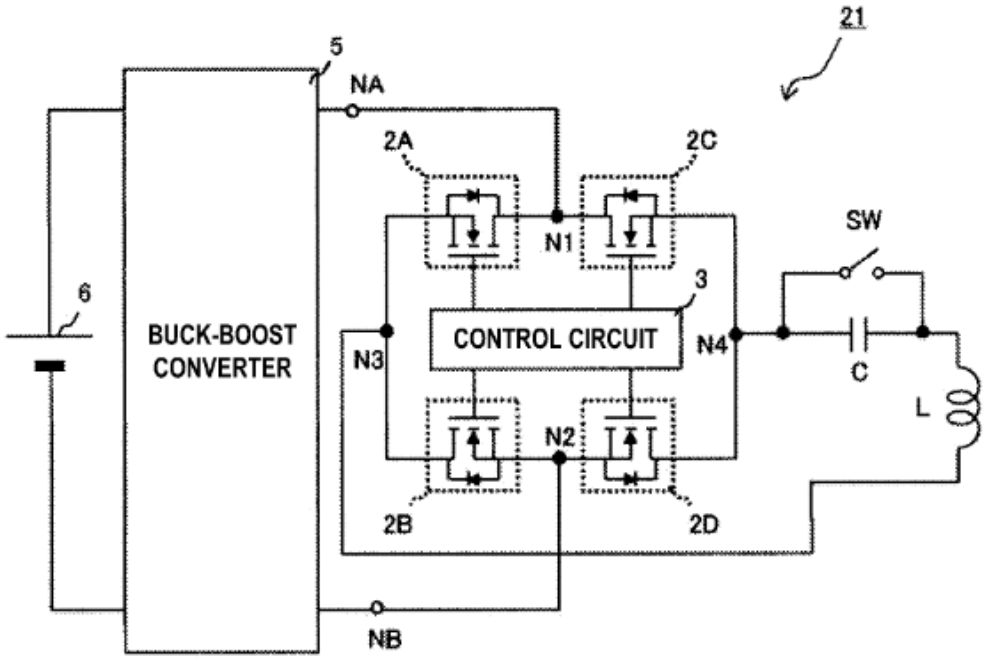


Van Der Lee, Fig. 3; *see also id.* Fig. 4.

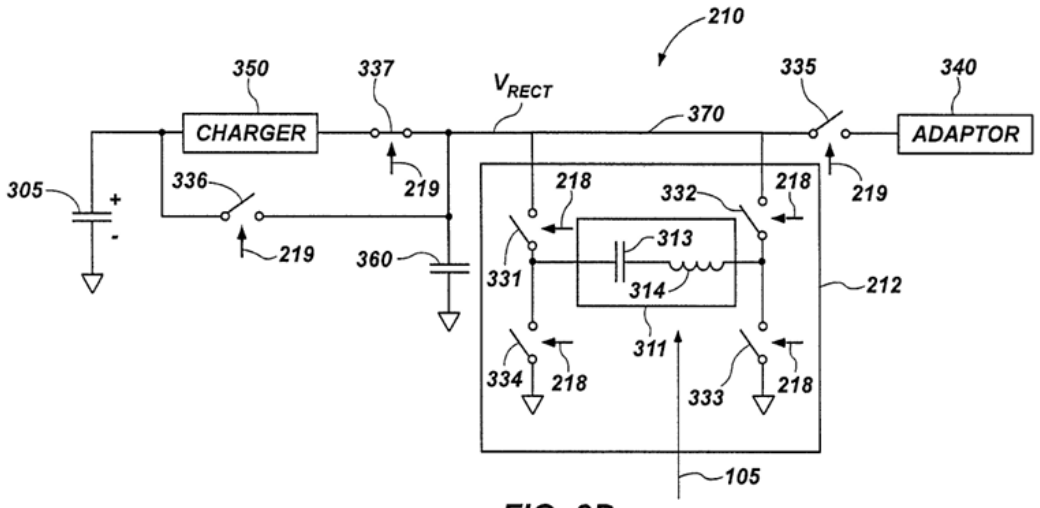
Shinoda

Shinoda discloses a control unit or control circuit that controls the switches to operate in a power reception mode.

Claim Limitation	Exemplary Prior Art Disclosures
	For example: In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, ***the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; ***for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** Singh-203 explains that control logic 217 generates control signal 218 to configure switches 331-334 as a full-bridge rectifier. The voltage at the output of the rectifier is a rectified DC voltage that is provided to a load device 215 (e.g., battery 305). For example: Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling

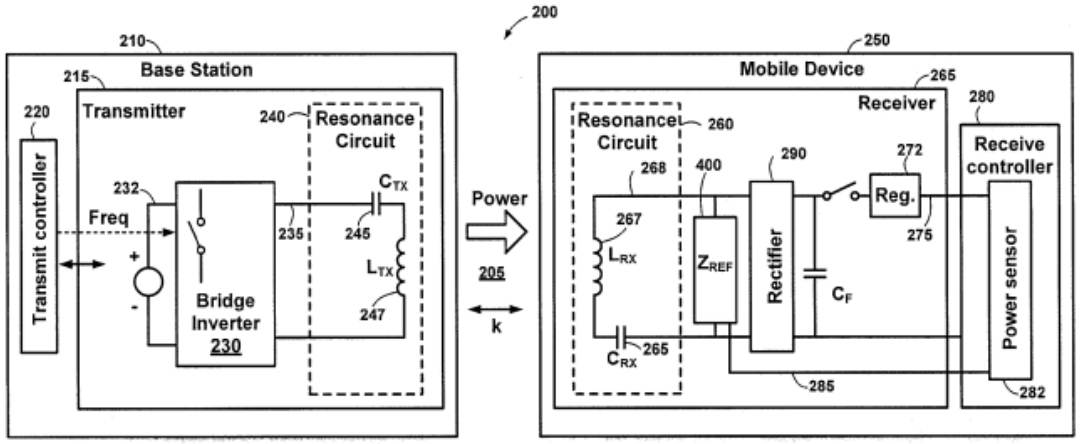
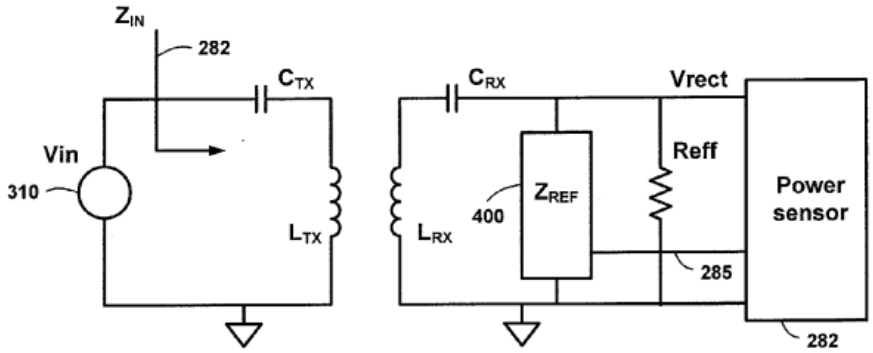
Claim Limitation	Exemplary Prior Art Disclosures
	region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof. Singh-203, 8:51-9:5. If the receive mode is determined to be the desired mode of operation, the wireless power enabled operates in the receive mode at operation 430. While in receive mode, control logic may transmit control signals to the wireless charging transceiver. The control signals may control operation of the full-bridge circuit coupled with the resonant tank of the wireless charging transceiver to operate as a full-bridge rectifier. The wireless charging transceiver may receive an incoming wireless power signal and generate an AC current through the resonant tank through inductive coupling. The incoming wireless power signal may be generated by a wireless power transmitting apparatus, such as a wireless power charger. In some embodiments, the wireless power transmitting apparatus may likewise be a wireless power enabled device having multiple modes of operation. The wireless charging transceiver operating as a full-bridge rectifier receives the AC current generated by the resonant tank generates a DC current to be output to a load. Therefore, at operation 435, power may be generated from the energy transfer to provide power to a load. For example, the load may include an energy storage device (e.g., battery), system components of the wireless power enabled device, or other power consuming devices. Singh-203, 10:13-36.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3D **Singh-624** Singh-624 discloses "backscatter modulation in which the load is modulated on the receiver side," which WiPQTUS contends meets the limitation of "change impedance of said impedance network." For example: > During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. **Singh-167**

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-167 teaches a receive impedance adjuster 400 that is configured to adjust a resonant frequency of the receive resonance circuit "by selectively modifying an impedance of the receive impedance adjuster." For example: The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a

Claim Limitation	Exemplary Prior Art Disclosures
	coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32.

Claim Limitation	Exemplary Prior Art Disclosures
	The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.

Claim Limitation	Exemplary Prior Art Disclosures
	 *FIG. 2* Singh-167, Fig. 2.  *FIG. 3* Singh-167, Fig. 3.

Claim Limitation	Exemplary Prior Art Disclosures
	Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN. Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above. Singh-167, ¶¶ 48-49. FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below.

Claim Limitation	Exemplary Prior Art Disclosures
	In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line 520. This larger impedance will result in less power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240,

Claim Limitation	Exemplary Prior Art Disclosures
	which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7. **Sagoo** Sagoo discloses a power control/conversion unit that is selectively coupled to a rectifier and controls the input/output levels of the AC and DC voltages. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside***; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. Sagoo, 2:35-45. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power

Claim Limitation	Exemplary Prior Art Disclosures
	control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:40-5:4. **Schuessler** Schuessler discloses that a control mechanism controls the coil circuitry and selection mechanism to direct power from a coil to a rechargeable battery. For example: ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown)*** to receive information or ***to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and control mechanism 225 may use the information received to determine

Claim Limitation	Exemplary Prior Art Disclosures
	whether conditions are appropriate to begin or continue energy transfer. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then ***tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225***. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26.

Claim Limitation	Exemplary Prior Art Disclosures
	External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. ***Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode*** or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. **Yeh**

Claim Limitation	Exemplary Prior Art Disclosures
	Yeh discloses a logic control unit that controls the operation of a bidirectional wireless charging and discharging device in a power receive mode to charge the battery. For example: Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby ***a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not***. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. The receiving mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, ***the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current***

Claim Limitation	Exemplary Prior Art Disclosures
	protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; ***when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18. **Cook** Cook discloses that a frequency generation and control circuit controls a bidirectional wireless circuit to operate in a power receive mode. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51.

Claim Limitation	Exemplary Prior Art Disclosures
	Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. *See also* Limitations [1b], [1c].
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch network and said impedance of said impedance	As explained above in claim limitation [1b], on information and belief, the Fulton Solution comprises "said first circuitry … configured to change the impedance of said impedance network and the topology of said switch network." On information and belief, in the Fulton Solution, changing "said topology of said switch network and said impedance of impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver" is "based on an input from said control logic circuit." The operation of the first circuitry needs to be controlled by a controller or a processor, such as the communications and control unit disclosed in the WPT standard which comprises "digital logic,"

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network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	"executes the relevant power control algorithms and protocols," "drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver," among other functionalities. For example: The Communications and Control Unit on the left-hand side of Figure 3-9 comprises the digital logic part of the design. This unit receives and decodes messages from the Power Receiver, configures the multiplexer to connect the appropriate parts of the Primary Coil array, executes the relevant power control algorithms and protocols, and drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver. The Communications and Control Unit also interfaces with the other subsystems of the Base Station, e.g. for user interface purposes. WPT, 20. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30. To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses a processor that controls the electronic device to operate in a power transmit mode. For example: The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. The processor **413** may be configured to process identification and status information transmitted over the inductive signal

Claim Limitation	Exemplary Prior Art Disclosures
	interface **430** to determine a mode of operation of the inductive signal interface **410**. ***The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH) Chatterjee, ¶ 55. The same power bridge circuit **311** may be used for implementations in which first device **302** can only receive power over the inductive link **330**. ***The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive*** and power transmit modes, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may ***(i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode***; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power

Claim Limitation	Exemplary Prior Art Disclosures
	signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. ***The power bridge circuit 311 is coupled to the power circuit 314 to (i) convert signals from DC to high-frequency form over inductive link 330 when the inductive signal interface 310 is in the power transmit mode***, or (ii) from high-frequency form to DC when the inductive signal interface 310 is in the power receive mode. According to embodiments described herein, the power bridge circuit 311 corresponds to a circuit element that is used by the inductive signal interface 310 when in both power transmit and power receive modes. More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode. In particular, the circuit elements include some circuit elements that are shared and used in both modes, and other circuit elements that are dedicated for a particular one of the two modes. In some embodiments, the circuit elements are provided as branches, where two branches combine to route incoming and outgoing current over the inductive link 330. In one embodiment, the power bridge circuit 311 has a three-legged formation, which provides a shared branch that combines with (i) a second branch in order to transmit power over the inductive link 330, and (ii) a third branch in order to receive power over the inductive link 330. As described below, the three branches combine to effectively form an H-bridge and synchronous bridge rectifier combination for use with the inductive link 330. Chatterjee, ¶ 37; *see also id.* Figs. 3-10. **Van Der Lee** Van Der Lee discloses a processing module that controls the electronic device to operate in a power transmit mode. For example: ***When in a wireless power transmit mode, as dictated by the power Tx/Rx control 229 from the processing module 152, the wireless power transceiver circuit 144 is powered*** by two possible sources, the first being the regulated power 164 (that is, a regulated rail voltage) when receiving wireless power from wireless power receiver circuit 146, and the second being ***the battery 150 via***

Claim Limitation	Exemplary Prior Art Disclosures
	the supply voltage Vout 162 when the computer is in a battery operated mode (further presuming the battery 150 has sufficient energy to charge other devices, as is discussed later in further detail with respect to FIGS. 5 and 6). In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. ***The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224*** at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. ***The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module.*** Van Der Lee, ¶¶ 53, 54. Moreover, the processing module 142 [sic] provides a power selection signal 223 to the MUX 222 between the regulated power 164 and the supply voltage Vout 162 for wireless power transmission via the wireless power transceiver circuit 144. Moreover, the processing module 132 implements a battery charge control 149, a regulate control 209, ***an impedance matching circuit control*** 207, ***227***, and 235, ***a DC-to-AC control 225***, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 56. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit*** or a wireless power receive ***mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures

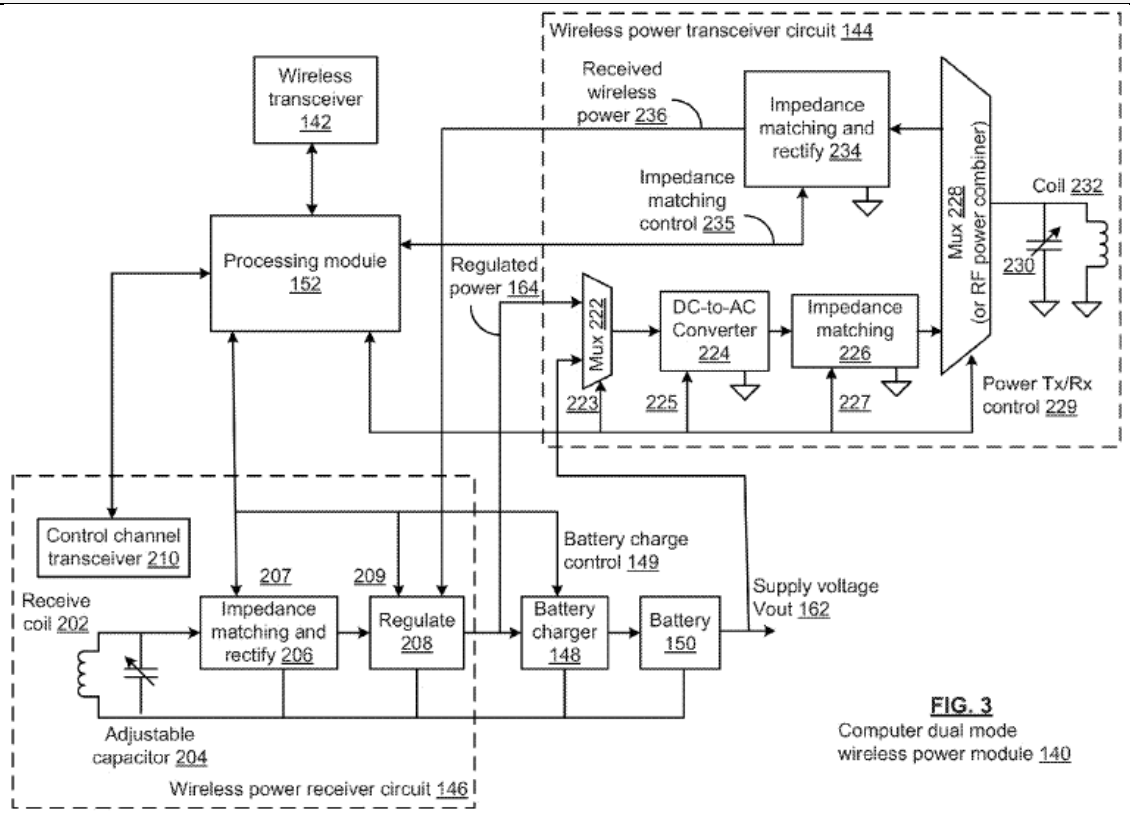


FIG. 3
Computer dual mode wireless power module 140

Van Der Lee, Fig. 3.

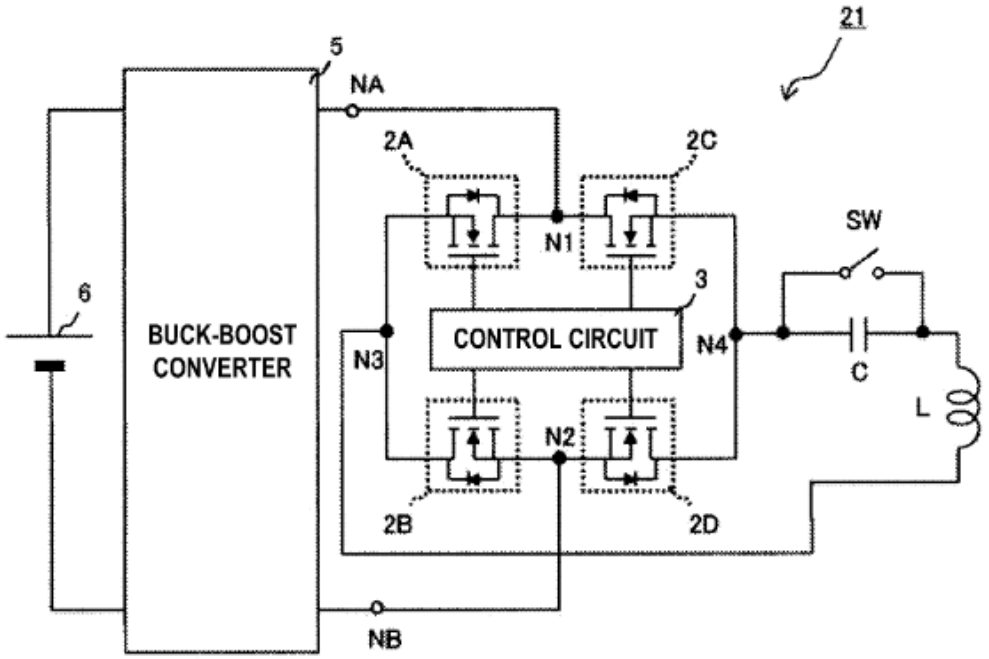
Shinoda

Shinoda discloses a processor that controls the switches to operate in a power transmission mode.

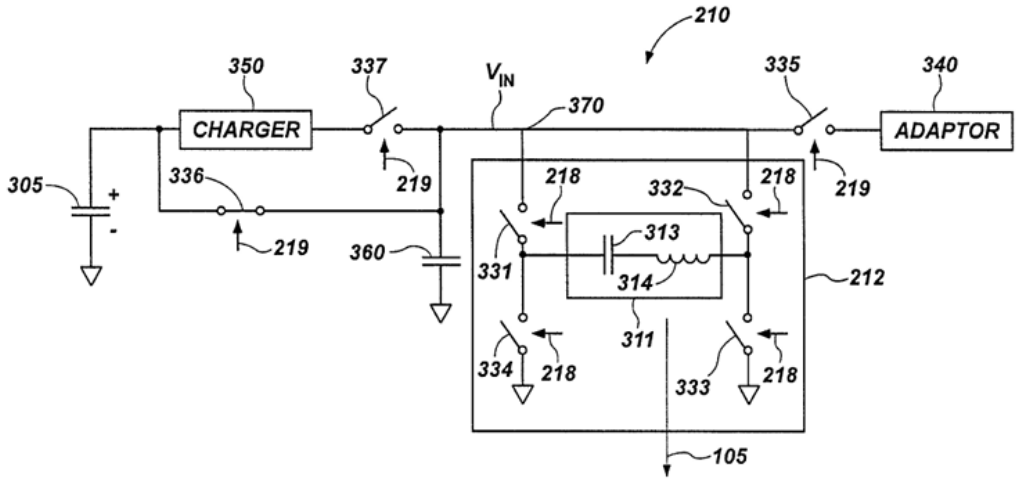
For example:

> In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit

Claim Limitation	Exemplary Prior Art Disclosures
	includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power transmission mode of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, ***the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods***. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the FETs 2A to 2D function as a full-bridge inverter circuit. Shinoda, 3:52-62. For ***a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series***; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** Singh-203 explains that control logic 217 generates control signal 218 to configure switches 331-334 as a full-bridge inverter and may vary switching frequency, duty cycle of the switching, and phase of the switching, etc. The switch network thus generates an AC current through tank 331 to transmit power from battery 305 to power up device 220. For example: Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to

Claim Limitation	Exemplary Prior Art Disclosures
	transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. In this example, the power used to generate the wireless charging signal can be provided by the energy storage device 305 rather than through the adaptor 340. Thus, the fifth switch 335 may be open to disconnect the wireless charging transceiver 212 from the adaptor 340, and the sixth switch 336 may be closed to connect the energy storage device 305 to the wireless charging transceiver 212. In addition, the seventh switch 337 may be opened so that current may not flow through the charger 350 to the energy storage device 305. As a result, the voltage at node 370 may be the input signal (VIN) to the wireless charging transceiver 212 for enabling current flow through the resonant tank 311 to generate the wireless power signal 105. Capacitor 360 may be coupled to node 370 may act as an input capacitor during transmit mode. Singh-203, 7:51-8:27. If the transmit mode is determined to be the desired mode of operation, the wireless power enabled operates in the transmit mode at operation 420. While in transmit mode, control logic may transmit control signals to a wireless charging transceiver. The control signals may control operation of a full-bridge circuit coupled with a resonant tank of the wireless charging transceiver to operate as a

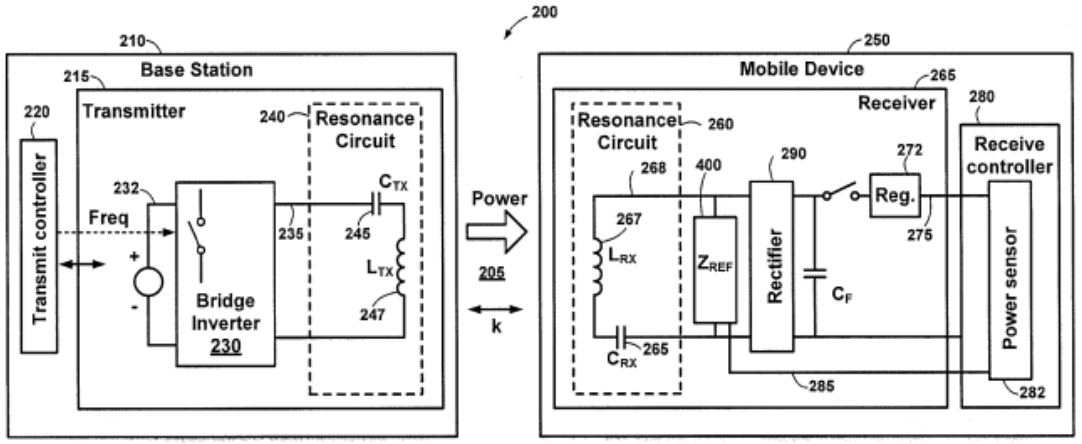
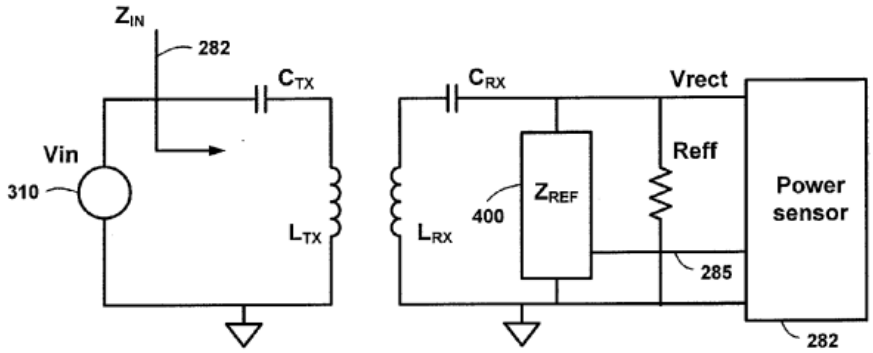
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	full-bridge inverter. The wireless charging transceiver operating as a full-bridge inverter receives a DC input signal and generates an AC current through the resonant tank. Therefore, at operation 425, the wireless power signal may be generated for energy transfer to a wireless power receiving device. The wireless power receiving apparatus may be an electronic device that is configured to receive the wireless power signal. In some embodiments, the wireless power receiving apparatus may likewise be a wireless power enabled device having multiple modes of operation. Singh-203, 9:63-10:12.  FIG. 3B **Singh-167** Singh-167 teaches adjusting "the resonant frequencies of the transmit resonance circuit 240." For example: The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The

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	signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7.

Claim Limitation	Exemplary Prior Art Disclosures
	The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4.

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	Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.

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	 *FIG. 2* Singh-167, Fig. 2.  *FIG. 3* Singh-167, Fig. 3.

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	Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN. Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above. Singh-167, ¶¶ 48-49. FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below.

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	In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line 520. This larger impedance will result in less power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240,

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	which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7. **Sagoo** Sagoo discloses a power control/conversion unit that is selectively coupled to an inverter and controls the input/output levels of the AC and DC voltages. For example: According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device***; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:46-55. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power

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	control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:34-5:4. *See also* Limitations [1b], [1c]. **Schuessler** Schuessler discloses that a control mechanism controls the coil circuitry and selection mechanism to direct power from a coil to a rechargeable battery. For example: ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown)*** to receive information or ***to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry

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	around coil 205, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then ***tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225***. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26.

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	External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. ***Selection mechanism 210 selects the direction of energy transfer,*** either directing power to rechargeable battery 215 in a power receiving mode or ***directing power from rechargeable battery 215 in a power delivering mode***. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively*** causes power to be delivered from

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	the coil to the battery and selectively ***causes power to be delivered from the battery to the coil, and a control mechanism***. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the coil to the battery, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the battery to the coi***l. Schuessler, Abstract. **Yeh** Yeh discloses a logic control unit that controls the operation of a bidirectional wireless charging and discharging device in a power transmission mode to transmit power from the battery to the wireless receiving and transmission unit to charge another device. For example: The transmission mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to the transmission mode, the control switch 5 is actuated to effect switching. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the

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	second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. ***When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition***. The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. ***If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2:*** ***if there is no load: the transmission is stopped;*** ***if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3***. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. ***When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current***.

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	During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 5:37-6:44. ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition***; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition. Yeh, 7:11-18. **Cook** Cook discloses that a frequency generation and control circuit controls the bidirectional wireless circuit to operate in a power transmit mode. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode.*** Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs)

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	with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. *See also* Limitations [1b], [1c].

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[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver;	On information and belief, the Fulton Solution discloses "said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless power receiver and identify a wireless power protocol of said secondary wireless power receiver" such as the power transmitter's communications and control unit receiving and processing information from the power receiver via load modulation, such as information in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet disclosed in the WPT standard. For example: Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and

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	monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme") From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are

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	contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36. **6.3.1 Signal Strength Packet (0x01)** Table 6-4 defines the format of the message contained in a Signal Strength Packet **Table 6-4: Signal Strength** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 Signal Strength Value **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** b_7 b_6 b_5 b_4 b_3 b_2 b_1 b_0 B_0 End Power Transfer Code

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6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two's complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

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6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

6.3.7 Configuration Packet (0x51)

Table 6-11 defines the format of the message contained in a Configuration Packet.

Table 6-11: Configuration

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Power Class			Maximum Power				
B_1	Reserved							
B_2	Prop	Reserved				Count		
B_3	Reserved							
B_4	Reserved							

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Table 6-12: Identification

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Major Version				Minor Version			
B_1	(msb) Manufacturer Code							
B_2								(lsb)
B_3	Ext	(msb) Basic Device Identifier						
⋮								
B_6								(lsb)

WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages).

To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination.

Chatterjee

Chatterjee discloses that the processor receives and process data from the second electronic device, including a type identification and communication protocol of the second electronic device.

For example:

> The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device.

Chatterjee, ¶ 31.

Claim Limitation	Exemplary Prior Art Disclosures
	The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a***

Claim Limitation	Exemplary Prior Art Disclosures
	power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the

Claim Limitation	Exemplary Prior Art Disclosures
	electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***. Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or

Claim Limitation	Exemplary Prior Art Disclosures
	alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430***. The communication circuit includes a modulator **416** and a demodulator **417**. The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. Chatterjee, ¶ 51. The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Chatterjee, ¶ 53. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. Chatterjee discloses and/or renders obvious that identifying "a type of said secondary wireless power receiver" and "wireless protocol of said secondary wireless power receiver" happens "on power-up of said secondary

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	wireless power receiver" because a POSA would have understood or found it obvious that data is communicated over the power link by modulating the wirelessly transmitted power (*see e.g.* claim limitation [1c]), and thus can only happen when the power link exists. **Van Der Lee** Van Der Lee discloses that the processing module receives information including, for example, the identifier, the power capability, and the power priority, as well as the communication protocol, from another wireless power module. For example: A dual mode wireless power module for a device includes a wireless transceiver and a wireless power transceiver circuit. ***The wireless transceiver circuit is operable to communicate peripheral power information indicating a wireless power configuration***. The wireless power transceiver circuit is operable to determine, based upon the power information, a power status of another device identified by the peripheral power information. When the power status of the another device is favorable, the wireless power transceiver circuit is placed in a wireless power receive mode in which the wireless power transceiver circuit converts wireless power into a voltage. When the power status of the another device is unfavorable, the wireless power transceiver circuit is placed in a wireless power transmit mode in which the wireless power transceiver circuit converts a power source of the device into the wireless power. Van Der Lee, Abstract. The determination a power status of one of the devices, such as the smart phone 102, the cell phone 104, the personal A/V player 108, may be with regard to power information communicated via the control and communication link between the device. For example, ***the power information may include power source identifier for the peripheral device, a wireless power capability of the device, whether dual mode wireless power is enabled for the device, wireless power transmit capability, or wireless power receive capability. Moreover, the power information may include a device power priority giving precedence over lower prioritized devices for limited or discrete power resources in a battery-based system (that is, a system in which a power transmitter circuit 110 is unavailable to provide virtually bottomless power resources).*** For example, a device may be designated in a factory setting as having priority for finite power resources (such as a cell phone

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	104) in the need to communicate in emergencies, or lower based upon purely entertainment function (such as the personal A/V player 108). In other contexts, a user may configure the device power priority based upon their individual preferences, such as via a user interface for the device. ***The power information may further include at least one of a communication protocol, input data, input command, output data, and output command***. For example, with interaction with a user input device (such as a touch or tactile screen, keypad, mouse, keyboard, et cetera), the user input device may generate data and/or a command for execution by the display device, such as a display screen on the personal A/V player 108. As another example, if the device setup includes a memory device such as a wireless disk drive or flash drive, and the peripheral device is a user output device such as the display screen and speakers of the personal A/V player 108, the memory device provides data to the user output device for display of audible and/or visual data. Van Der Lee, ¶¶30-31. The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode based upon ***power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. The power information indicates a wireless power configuration, including one or more of full battery capacity, charging history (e.g., times, durations, charge voltage, charge current, trickle charge reached, etc.), current battery life, current loading, loading history, etc. Moreover, the ***power information includes a power source identifier identifying the device or devices, wireless power capability (for example, whether dual mode capable, transmit capable, or receive capable)***; device power priority (indicating the power reception priority for conveying or receiving wireless power); and ***at least one of a communication protocol***, input data, input command, output data; and output command. Van Der Lee, ¶ 76. The foregoing method may further include establishing the wireless power link. The wireless power link may be established based on inductive (or non-resonant) coupling or on resonant

Claim Limitation	Exemplary Prior Art Disclosures
	inductive coupling. ***The wireless communication link and the wireless power link may also be established via the same inductive link***. The foregoing method may further include monitoring an amount of power wirelessly transferred to the portable electronic device and charging a user of the portable electronic device based on the monitored amount. Van Der Lee, ¶ 8. Van Der Lee discloses and/or renders obvious that identifying "a type of said secondary wireless power receiver" and "wireless protocol of said secondary wireless power receiver" happens "on power-up of said secondary wireless power receiver." Van der Lee discloses and/or renders obvious transmitting data over the same wireless power link as explained above in claim limitation [1c]. **Shinoda** Shinoda discloses the control unit or control circuit receiving and detecting code from the partner device, such as identification code, device code, and code specifying power specification, and that such code is sent from the partner device via load modulation. For example: In another more specific embodiment, ***the control unit may be configured to carry out mutual device authentication communication with a partner device*** coupled to the coil ***and variably control transmitting power or received power according to the partner device***. Shinoda, 2:52-56. FIG. 6 is a diagram that illustrates an operational flow for power transmission of the wireless power transfer terminal 21. For a power transmission mode of the wireless power transfer terminal 21, ***authentication communication is carried out and a response from a partner device is awaited (step S1)***. This authentication communication can be carried out by, for example, amplitude-modulating voltage in power transmission with constant periods using, for example, ***identification code or device code*** and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example.

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	Next, the power specification of the partner device is determined (steps S2 and S3). This determination is made by, for example, ***demodulating the response from the partner device and detecting code specifying the power specification***. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Next, the output of the buck-boost converter is set such that it is voltage in power transmission corresponding to the power specification of the partner device, and power transmission is started under this setting (steps S4 and S5). The wireless power transfer terminal 21 transmits power according to the above-described operational flow. With this operation, even if there are a plurality of specifications for voltage in power transmission, power transmission supporting such various specifications can be achieved. Hence, the wireless power transfer terminal 21 can transmit and receive power to and from a plurality of partner devices having different specifications of power used in power transmission and power used in power reception. Shinoda, 6:52-7:5.

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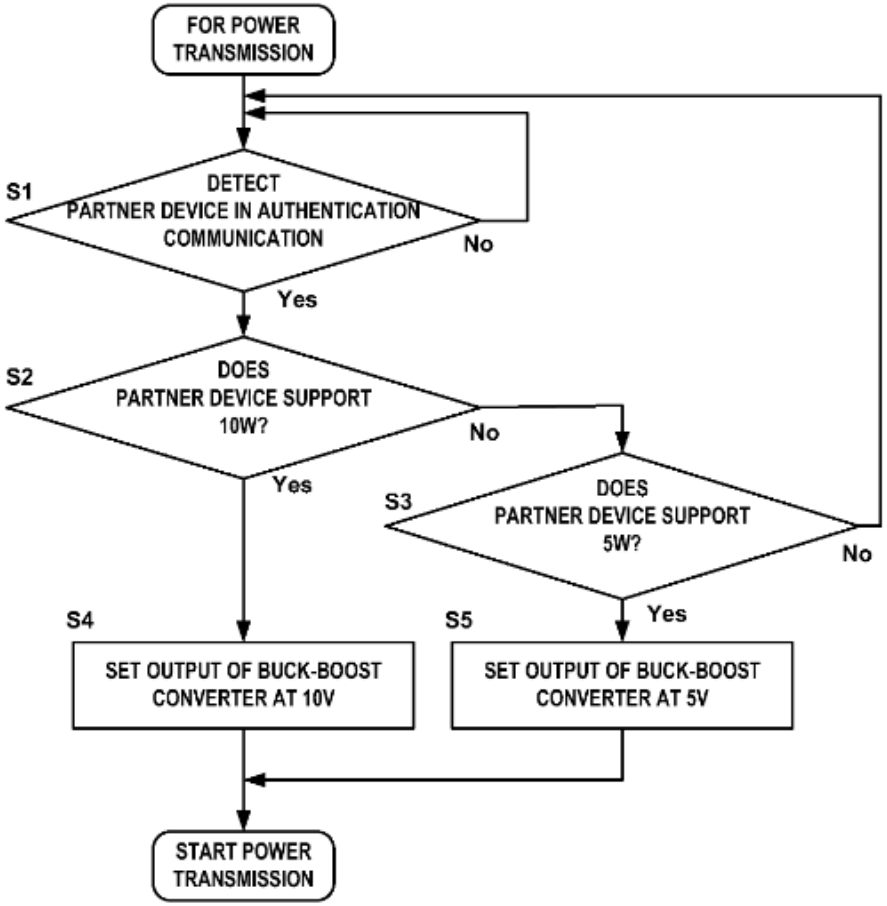


FIG.6

Shinoda, Fig. 6.

The partner device may preferably respond by the ***load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21

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	and using various kinds of code set in the partner device. Therefore, the wireless power transfer terminal 21 may preferably be provided with a load modulating unit in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-26. **Singh-203** Singh-203 discloses and renders obvious this limitation. On power-up of the secondary wireless power receiver, control logic 217 of device 210 determines the mode of operation according to a wireless power protocol, establishing a communication link. The protocol identifies the device type. For example, Singh-203 discloses: In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and

Claim Limitation	Exemplary Prior Art Disclosures
	protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated. Singh-203, 6:5-38. Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. In this example, the power used to generate the wireless charging signal can be provided by the energy storage device 305 rather than through the adaptor 340. Thus, the fifth switch 335 may be open to disconnect the wireless charging transceiver 212 from the adaptor 340, and the sixth switch 336 may be closed to connect the energy storage device 305 to the wireless charging transceiver 212. In addition, the seventh switch 337 may be opened so that current may not flow through the charger 350 to the energy storage device 305. As a result, the voltage at node 370 may be the input signal (VIN) to the wireless charging transceiver 212 for enabling current flow through the resonant tank 311 to generate the wireless power signal 105. Capacitor 360 may be coupled to node 370 may act as an input capacitor during transmit mode.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, 7:51-8:27. **Singh-167** Singh-624 discloses identification of a device type and it would have been obvious to have Singh-203's circuitry identify the device type on power-up. For example, Singh-624 teaches: > Having two-way communication enables the transmitter 112 and the receiver 122 to establish a secure communication for a variety of different purposes, such as the transmitter 112 authenticating the type of receiver 122 that the transmitter 112 is talking to, or to authenticate a particular battery type to know that the battery of the receiver 122 is legitimate prior to generating the wireless power signal 105. Other data may be shared between the transmitter 112 and receiver 122 regarding the performance of the inductive wireless power transfer system 100, to assist with foreign object detection, among other reasons. Singh-624, 6:12-22. **Sagoo** Sagoo teaches that the communication unit receives information on the states of other mobile devices, authentication information, information on whether charging can be performed on a neighboring device, For example: > ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices***, and controls whether the mobile device can be charged by any one of the other mobile devices. When ***the communication unit is made to further perform an authentication process***, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied.

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, 5:5-21. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device*** and outputs the received information to the user interface unit 151. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:17-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, ***the communication units can perform authentication with respect to each other*** such that charging is performed between authenticated devices. Sagoo, 6:43-48. **Schuessler** Schuessler teaches receiving communication from the second electronic device such as charging needs, status, handshaking, power deliver request, charging completion, and that such communication can be modulated on the energy transfer itself. For example: One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding ***charging needs and status***. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. If communication capability is included in both bi-directional charging device 105 and rechargeable electronic device 115 as described above, then the devices may communicate with

Claim Limitation	Exemplary Prior Art Disclosures
	each other to coordinate energy transfer. ***Coordination of energy transfer may include beginning and ending energy transfer and status communication during energy transfer***. Schuessler, 3:56-61. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform ***handshaking*** with an external device, and then inform control mechanism 225 of ***an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. External communication interface 235 may be used by bi-directional charging device 105 to make requests to external devices for charging. For example, upon recognizing that a charging bay 110 is in the vicinity, bi-directional charging device 105 may request the charging bay 110 to begin delivering power. External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies. An external device may notify bi-directional charging device 105 that charging is complete, and control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215. Schuessler, 6:62-7:19. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. ***A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge***.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 8:7-21. Multiple bi-directional charging devices 105 may be within charging distance of each other. In such cases, one of the bi-directional charging devices 105 may charge another bi-directional charging device 105. A protocol may be implemented for determining which of multiple devices 105 is to provide charge and which is to receive charge. For example, a protocol may include a determination within one or more bi-directional charging devices 105 as to battery state of charge and expected battery life at the present rate of use and a further determination of whether a device 105 has reached a critical battery state of charge. A protocol may include a heuristic to automatically determine whether a device 105 should be used to charge another device 105. A protocol may include a user notification on a first device 105 that a second device 105 in the vicinity needs to be charged, and that the expected battery life of the first device 105 will be reduced by an amount if the first device 105 is used to charge the second device 105. A user interface on the first devices 105 may allow a user to direct that charge be provided to the second device 105, or direct that no charge be provided to the second device 105. Many other protocols may be implemented to address the situation in which multiple bi-directional recharging devices 105 are within charging distance of each other wherein each device 105 may have a different level of battery charge. Schuessler, 8:53-9:10. **Corbridge** Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. For example: FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication

Claim Limitation	Exemplary Prior Art Disclosures
	subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path). Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates

Claim Limitation	Exemplary Prior Art Disclosures
	current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii)

Claim Limitation	Exemplary Prior Art Disclosures
	provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0" values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal.

Claim Limitation	Exemplary Prior Art Disclosures
	Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***, according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step 1120)***. Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The

Claim Limitation	Exemplary Prior Art Disclosures
	enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

Claim Limitation	Exemplary Prior Art Disclosures

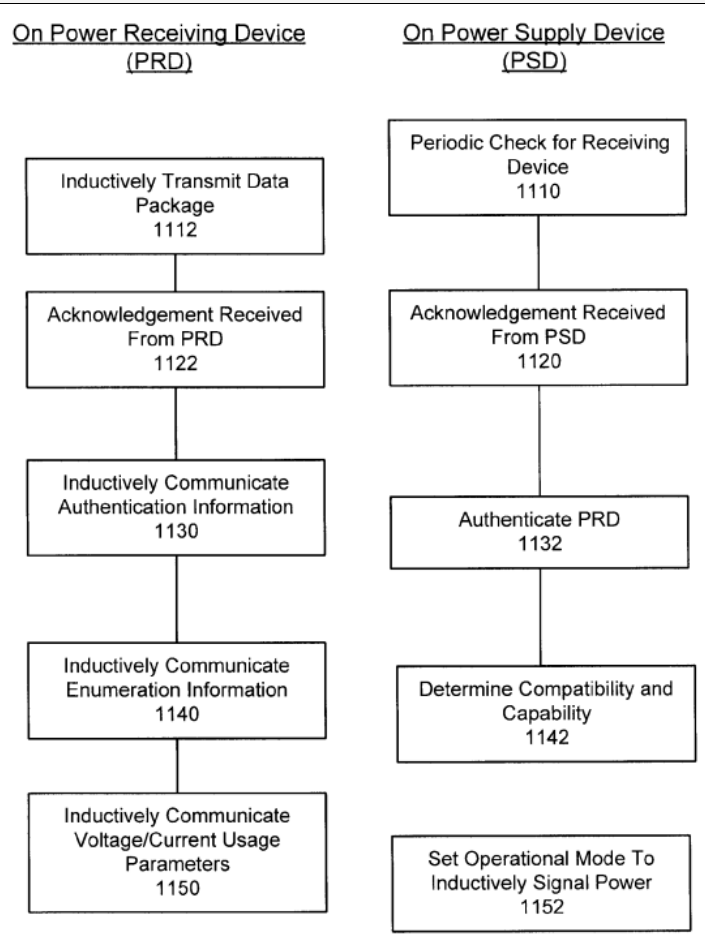


FIG. 11

Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

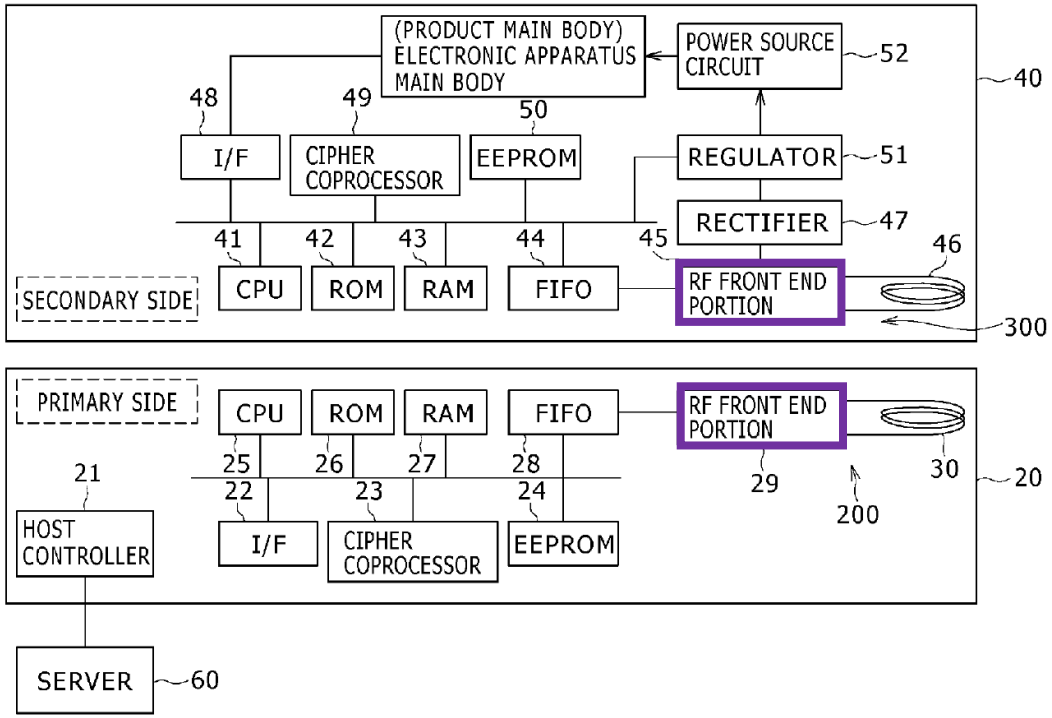
Teramoto

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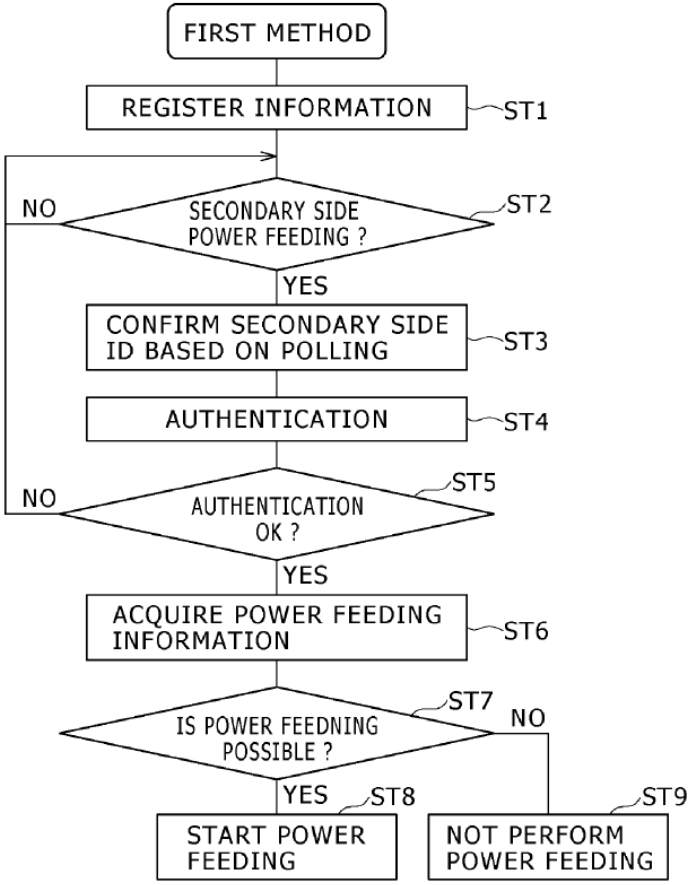
Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. For example: The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight

Claim Limitation	Exemplary Prior Art Disclosures
	saving of an electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said	On information and belief, the Fulton Solution comprises "said second circuitry, configured to receive and interpret data from said secondary wireless power receiver in said identified wireless power protocol." As explained in limitation [1g], the WPT standard, with which the Fulton Solution complies, discloses the power transmitter's communications and control unit receiving and processing information from the power receiver

<table>
<tr><th>Claim Limitation</th><th>Exemplary Prior Art Disclosures</th></tr>
<tr><td>secondary wireless power receiver in said identified wireless power protocol;</td><td>via load modulation, such as information in the identification packet, configuration packet, signal strength packet, rectified power packet, charge status packet, error control packet, or end power transfer packet, in accordance with the wireless power protocol.

To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more references cited in limitations [1c] and [1g]. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination.

See also supra Limitations [1c], [1g].</td></tr>
<tr><td>[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.</td><td>On information and belief, the Fulton Solution comprises “said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry,” such as to end power transfer when receiving an “End Power Transfer message,” “drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver,” or “adjust its Primary Cell current in response to control data that it receives from the Power Receiver” as disclosed in the WPT standard.

For example:

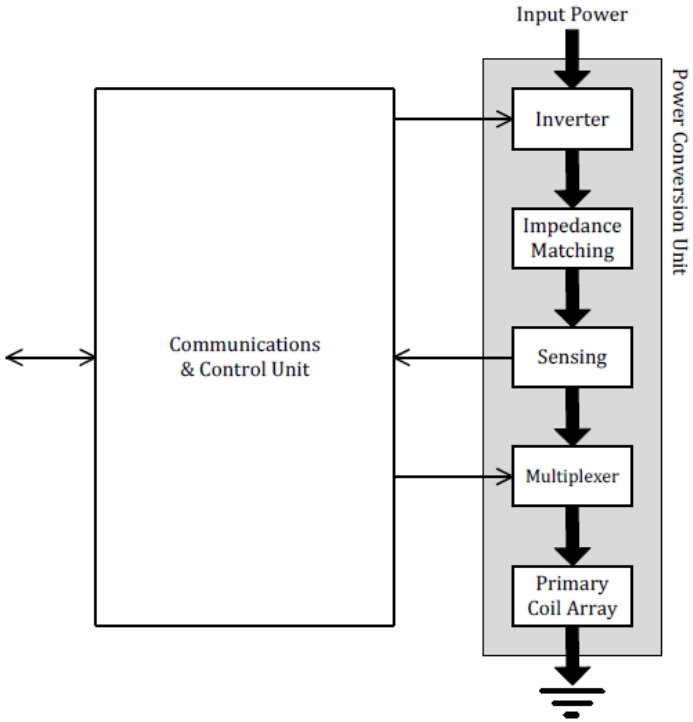
6.3.2 End Power Transfer Packet (0x02)
Table 6-3 defines the format of the message contained in an End Power Transfer Packet.

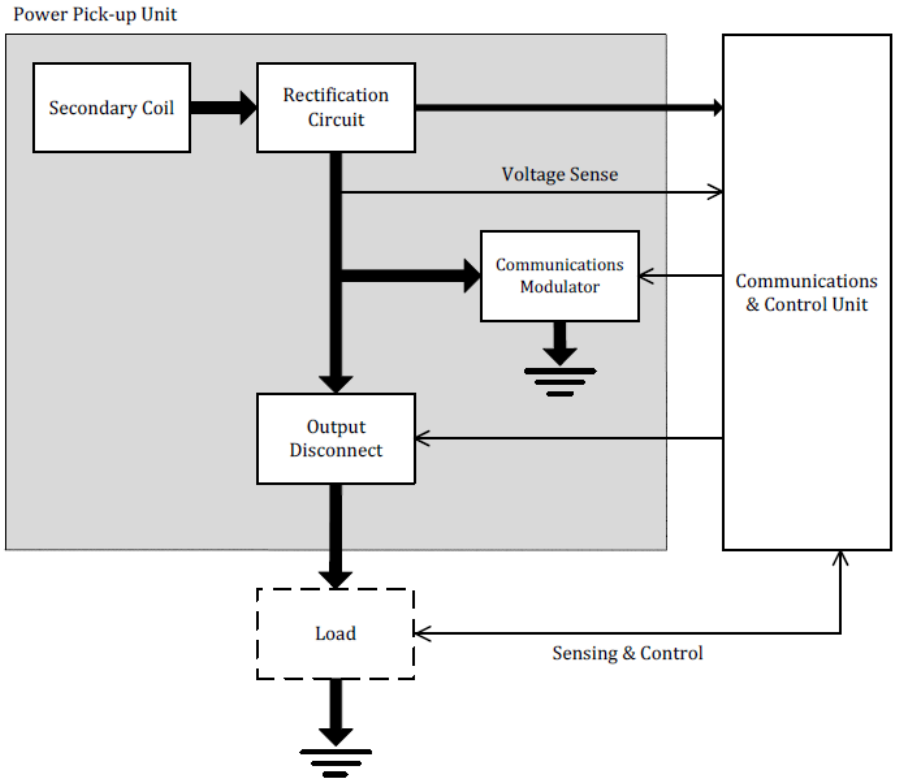
Table 6-5: End Power Transfer
<table><tr><td></td><td>b7</td><td>b6</td><td>b5</td><td>b4</td><td>b3</td><td>b2</td><td>b1</td><td>b0</td></tr><tr><td>B0</td><td colspan="8">End Power Transfer Code</td></tr></table>
WPT, 56.</td></tr>
</table>

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Claim Limitation	Exemplary Prior Art Disclosures
	The Communications and Control Unit on the left-hand side of Figure 3-9 comprises the digital logic part of the design. This unit receives and decodes messages from the Power Receiver, configures the multiplexer to connect the appropriate parts of the Primary Coil array, executes the relevant power control algorithms and protocols, and drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver. The Communications and Control Unit also interfaces with the other subsystems of the Base Station, e.g. for user interface purposes. WPT, 20. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to control data that it receives from the Power Receiver. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the *selection* phase. Finally, the system may also leave the *power transfer* phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the *selection* phase, or request to renegotiate the Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the *identification & configuration* phase. WPT, 36. To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more references cited in limitations [1c] and [1g]. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of those references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. *See also supra* Limitations [1g], [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured	On information and belief, the Fulton Solution comprises "said switch network of said first circuitry is configured as one of an inverter and a rectifier." As explained in limitation [1b], on information and belief, the Fulton Solution comprises an inverter and a rectifier that each function under different modes, i.e. for transmitting power and for receiving power, respectively, as disclosed in the WPT standard. For example:

Claim Limitation	Exemplary Prior Art Disclosures
as one of an inverter and a rectifier.	 **Figure 3-9: Functional block diagram of Power Transmitter design B1** WPT, 20.

Claim Limitation	Exemplary Prior Art Disclosures
	 **Figure 4-1: Example functional block diagram of a Power Receiver** WPT, 29. To the extent the Fulton Solution does not disclose this limitation, it would have been obvious in view of one or more references cited in limitations [1b]. On information and belief, a POSA would have been motivated to combine the Fulton Solution with WPT and/or one or more of those references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. *See also supra* claim limitation [1b].

Winstream Bidirectional Wireless Charging Solution ("Winstream Solution")

On information and belief, the asserted claims of U.S. No. 10,038,339 (the "'339 patent") are anticipated and/or rendered obvious by Winstream Bidirectional Wireless Charging Solution ("Winstream Solution") either alone or in combination with the knowledge of a person of ordinary skill in the art ("POSA"), and/or in combination with one or more of the references disclosed in Samsung's invalidity contentions, including in other exhibits of the invalidity contentions.

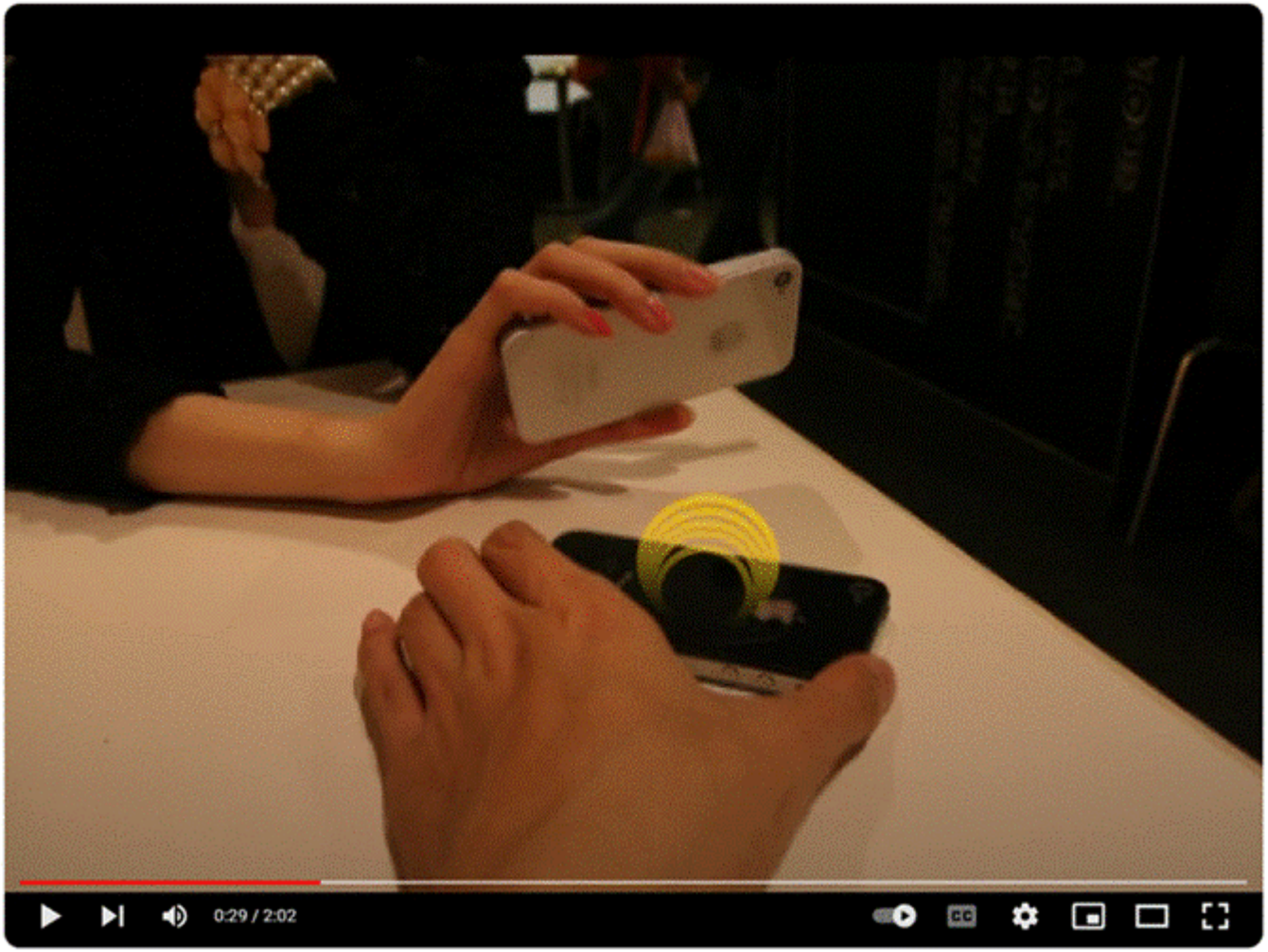
The Winstream Solution, by Winstream Technology Co., Ltd., was made public at least by June 12, 2012 at Computex Taipei 2012 in Taipei and thus qualifies as prior art under § 102(a)(1). The Winstream Solution is described at least in part in the following materials:

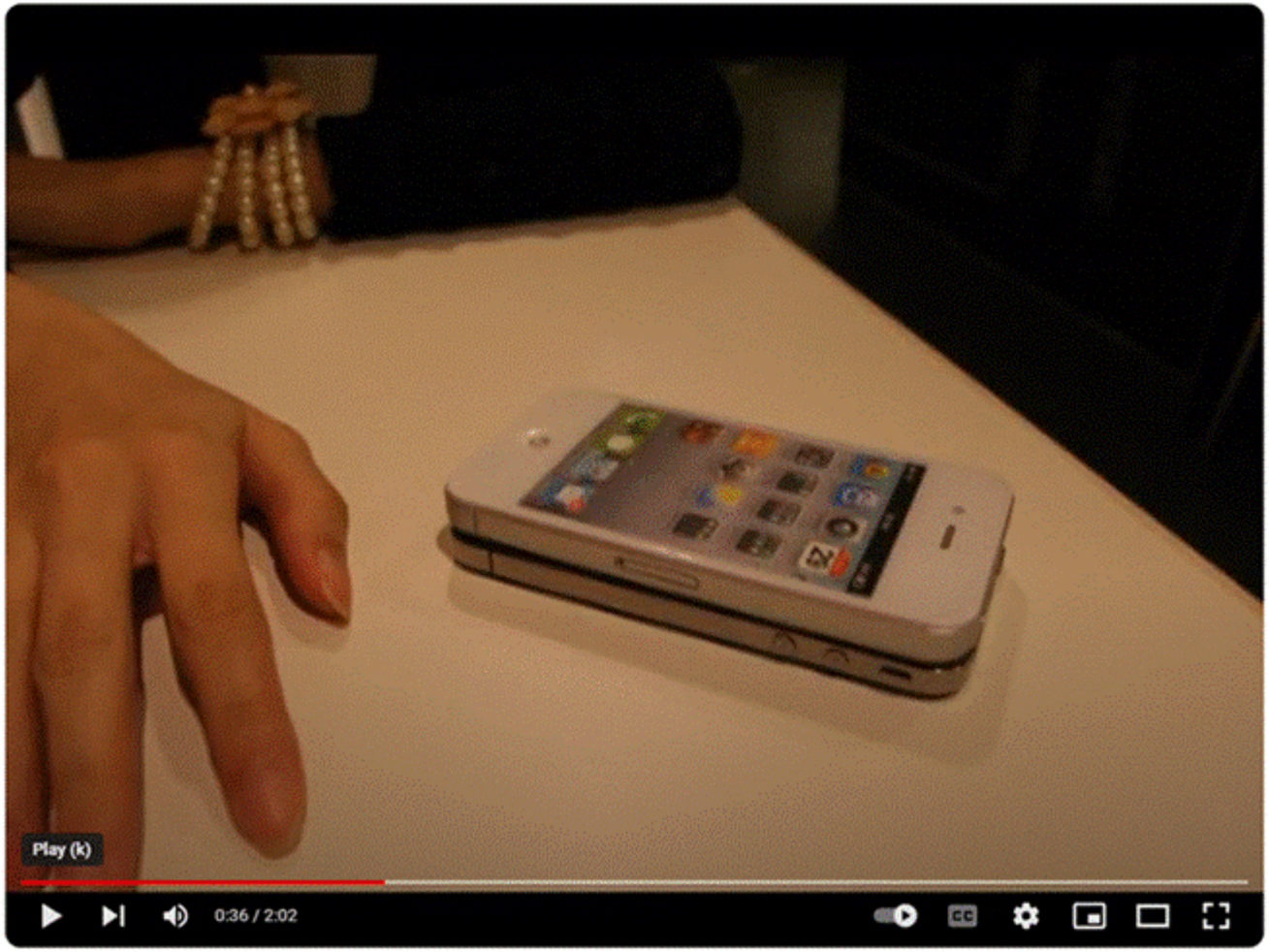
- https://www.youtube.com/watch?v=LENL8FH7h80 (dated Apr. 12, 2011)
- https://www.youtube.com/watch?v=s2pMXdOA3TY (dated Feb. 13, 2012)
- https://www.youtube.com/watch?v=lwsTdYXpWxI (dated June 12, 2012)
- https://www.saydigi.com/2012/06/blog-post-7414.html (dated June 8, 2012)
- https://tw.news.yahoo.com/%E5%8F%B0%E5%8C%97%E9%9B%BB%E8%85%A6%E5%B1%95-%E9%80%B1%E9%82%8A%E9%85%8D%E4%BB%B6%E6%90%9E%E5%89%B5%E6%84%8F-105215310.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAA1uMSFWq-JmHIla1xCfDTwVbmtHTpzOXE9G_ap1mklpfV0-4em8uAELj3U6LziFyfZzaBjuL-iuETjsJ2JOygwVYNRqGwwuElOlrOEWXiGBgjYkamCAiWh4wJhBBgetCUCS26Bl11A0XGYZxxE6SfTJX4X00r1YGnA_aDPF3Sy

The contentions in this exhibit are based on information presently available to Samsung. Samsung reserves the right to supplement these contentions based on further discovery including third party discovery.

Claim Limitation	Exemplary Prior Art Disclosures
[1p] A dual mode wireless power receiver configured to selectively apply a received power to a load device and utilize at least a part of the stored power to power-up a secondary	On information and belief, the Winstream Solution discloses the preamble. The Winstream Solution includes a phone case that can be detachably connected to an iPhone that does not have wireless charging capability. The case can be slid onto the iPhone and electrically connected to the iPhone's charging port. The Winstream Solution enables the iPhone (i.e., a load) to be wirelessly charged via a charging dock, and to wirelessly charge another iPhone equipped with the same Winstream Solution. For example:

Claim Limitation	Exemplary Prior Art Disclosures
wireless power receiver and communicate with said secondary wireless power receiver to cause an action or transaction or charge said secondary wireless power receiver's load device, said dual mode wireless power receiver comprising:	 威臣科技-雙向無線充電2012COMPUTEX展覽影片.mpg

Claim Limitation	Exemplary Prior Art Disclosures
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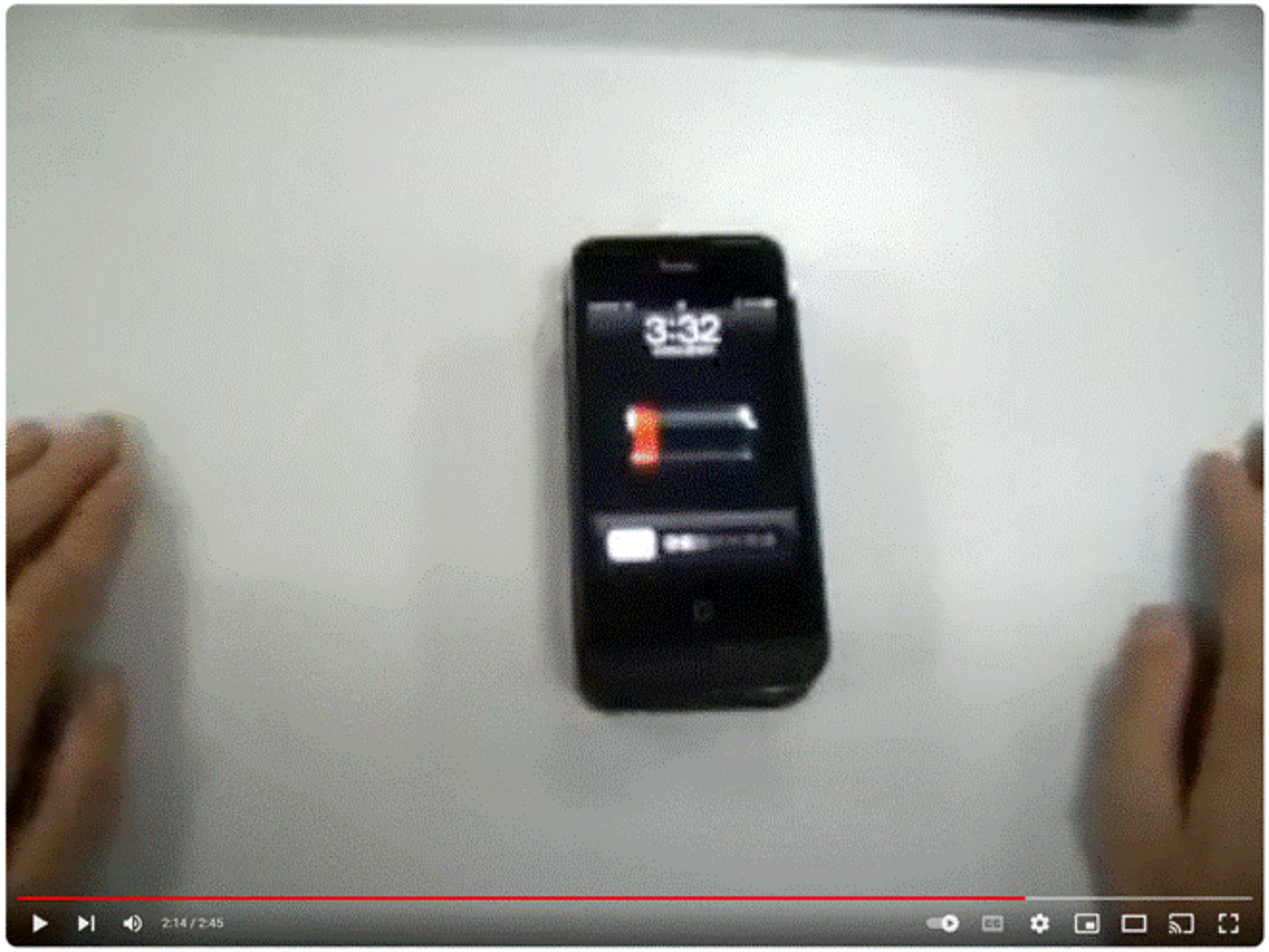
Claim Limitation	Exemplary Prior Art Disclosures
	 威臣科技無線充電產品示範

Claim Limitation	Exemplary Prior Art Disclosures
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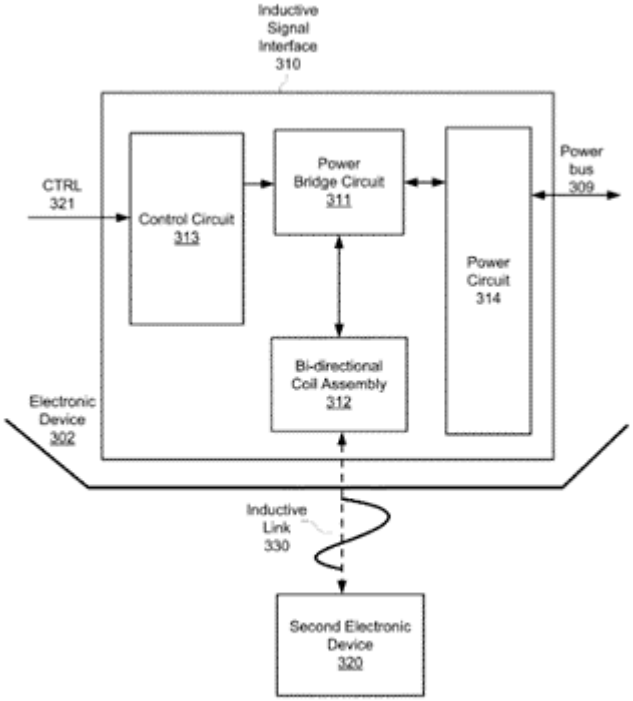
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Claim Limitation	Exemplary Prior Art Disclosures
	 (https://www.youtube.com/watch?v=LENL8FH7h80) To the extent the Winstream Solution does not disclose the preamble, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than

Claim Limitation	Exemplary Prior Art Disclosures
	well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses an electronic device that can be used to create an inductive link with a second electronic device for transmitting or receiving power. For example: > The disclosed embodiments relate generally to the field of inductive signal interfaces. In particular, the disclosed embodiments relate to ***an inductive signal interface capable of bi-directional inductive signaling***. Chatterjee, ¶ 2. > Embodiments described herein include ***an inductive signal interface that uses shared circuit elements to be operable as either a power transmitter or a power receiver***. More specifically, an inductive signal interface includes a three-legged (or three-branched) structure that uses separate pairs of legs or branches to operate as an inductive power transmitter or an inductive power receiver. > An inductive signal interface includes a coil assembly which has one or more inductive coils. The inductive signal interface also has a bridge circuit that couples to the coil assembly to a power input/output (I/O). ***The bridge circuit has components that operate to enable the inductive signal interface to selectively operate in either a power transmit mode or a power receive mode.*** Chatterjee, ¶¶ 29-30. > Still further, another embodiment provides a computing system that includes a first and a second computing devices, each computing device including a similarly structured inductive signal interface. The inductive signal interface of each computing device includes a coil assembly which has one or more inductive coils and a bridge circuit that couples to the coil assembly to a power input/output (I/O). ***Each bridge circuit has components that operate to enable the respective inductive signal interface to selectively operate in either a power transmit mode or a power receive mode***. Chatterjee, ¶ 33. > A device having inductive signal interface **310**, may be referenced as an 'electronic device', and correspond to, for example, a mobile computing device or docking station. ***The inductive signal***

Claim Limitation	Exemplary Prior Art Disclosures
	interface 310 is shown in FIG. 1 to be provided on a first electronic device 302, and used to create an inductive link 330 with a second electronic device 320. The second electronic device 320 may be any device capable of inductively receiving or transmitting signals. For example, in one implementation, the first electronic device corresponds to a docking station, and the second electronic device corresponds to a mobile computing device. In another implementation, both the first and second computing device may correspond to mobile computing devices. Other variations are similarly possible. On the first electronic device **302**, the combination of the bi-directional coil assembly **312** and the power bridge circuit **311** establish the inductive link **330** with the second electronic device **320**. ***In one implementation, the first device 302 operates to transmit power to the second electronic device 320, in which case inductive signal interface 310 uses a power bus 309 and power circuits 314 to inductively transmit power to the second device 320***. As mentioned below, the power bridge circuit **311** may be structured to handle a DC current that originates from a power source, such as a wall outlet (in which case rectifiers may be used to convert the AC signal to DC) or battery unit. ***In another implementation, the first device 302 operates to receive power over the inductive link 330. The same power bridge circuit 311 may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes***, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶¶ 34, 35. ***In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302***, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 37. In usages ***when inductive signal interface 310 is in a power receive mode, the power signal is received from the second electronic device 320 over the inductive link 330***. The inductive signal interface 310 may be coupled to a power storage element, such as a rechargeable battery. The inductive signal interface 310 may be configured to charge the power storage element or to provide power to other circuitry within the first electronic device through the voltage supply line. The power circuit 314 receives current transmitted from the power bridge circuit 311 and is configurable to perform voltage and current regulation in order to charge the power storage element or provide power to other circuitry. The bi-directional coil assembly 312 receives power inductively from the second electronic device 320, the power bridge circuit 311 converts AC current received inductively at the bi-directional coil assembly 312 to DC current to be transferred to the power circuit via the power bus. FIG. 4 illustrates an embodiment of the ***inductive signal interface capable of performing data transfer through an inductive link***. According to an embodiment, the inductive signal interface 410 resides on an electronic device 402 (e.g. mobile computing device or dock) and includes a power bridge circuit 411, a bi-directional coil assembly 412, a processor 413, a power circuit 414, and a communication circuit 415. Similar to the inductive signal interface 310 of FIG. 3, the inductive signal interface 410 may reside on any device that is capable of inductively receiving or transmitting power with another suitably configured device. As with an embodiment of FIG. 3, a first computing device uses the inductive signal interface 410 to form an inductive link 430 with a second electronic device 420. The second electronic device may also include an embodiment of inductive signal interface 410. Chatterjee, ¶¶ 40-41. Similar to the inductive signal interface 310 of FIG. 3, ***certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes***. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. Chatterjee, 42.

Claim Limitation	Exemplary Prior Art Disclosures
	During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420. The power signal is transmitted in modulated form over the power bridge circuit 411, which performs rectification to output a DC current to the power circuit 414. The power circuit 414 is configured to clamp current levels, regulate voltage levels, and perform other functions to transmit an outgoing power signal in the power receive mode. According to embodiments, the resulting power signal is a DC signal and is routed to: (i) charge a rechargeable battery within the electronic device 402, and/or (ii) provide power to circuit elements within the electronic device. Chatterjee, ¶ 46.  **FIG. 3**

Claim Limitation	Exemplary Prior Art Disclosures

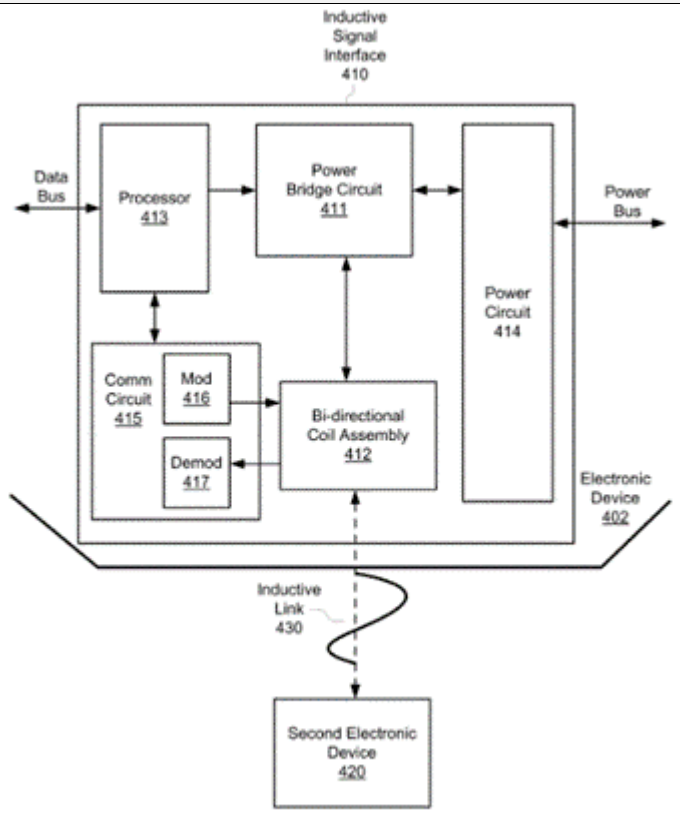


FIG. 4

Chatterjee, Figs. 3, 4, 5.

> In usages when inductive signal interface 310 is in a power receive mode, the power signal is received from the second electronic device 320 over the inductive link 330. The inductive signal interface 310 may be coupled to a power storage element, such as a rechargeable battery.

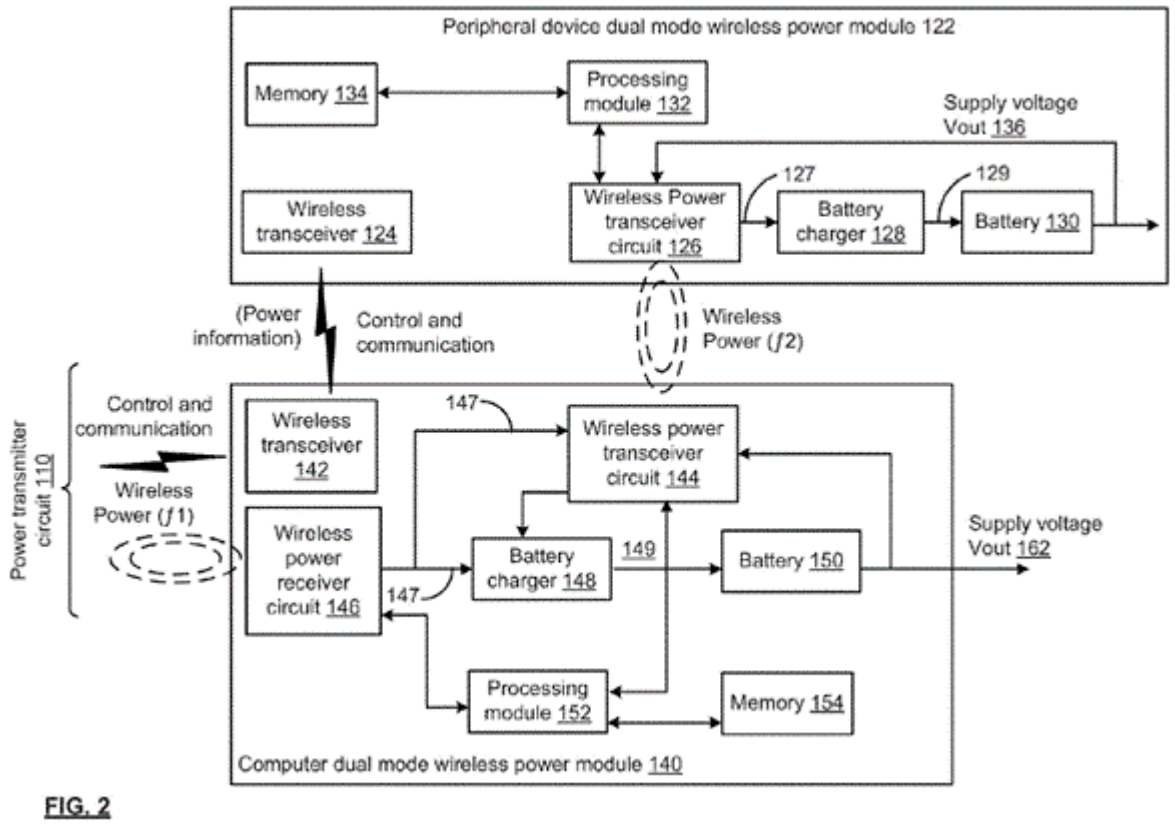
Chatterjee, ¶ 40.

> ***FIG. 4 illustrates an embodiment of the inductive signal interface capable of performing data transfer through an inductive link***. According to an embodiment, the inductive signal interface 410

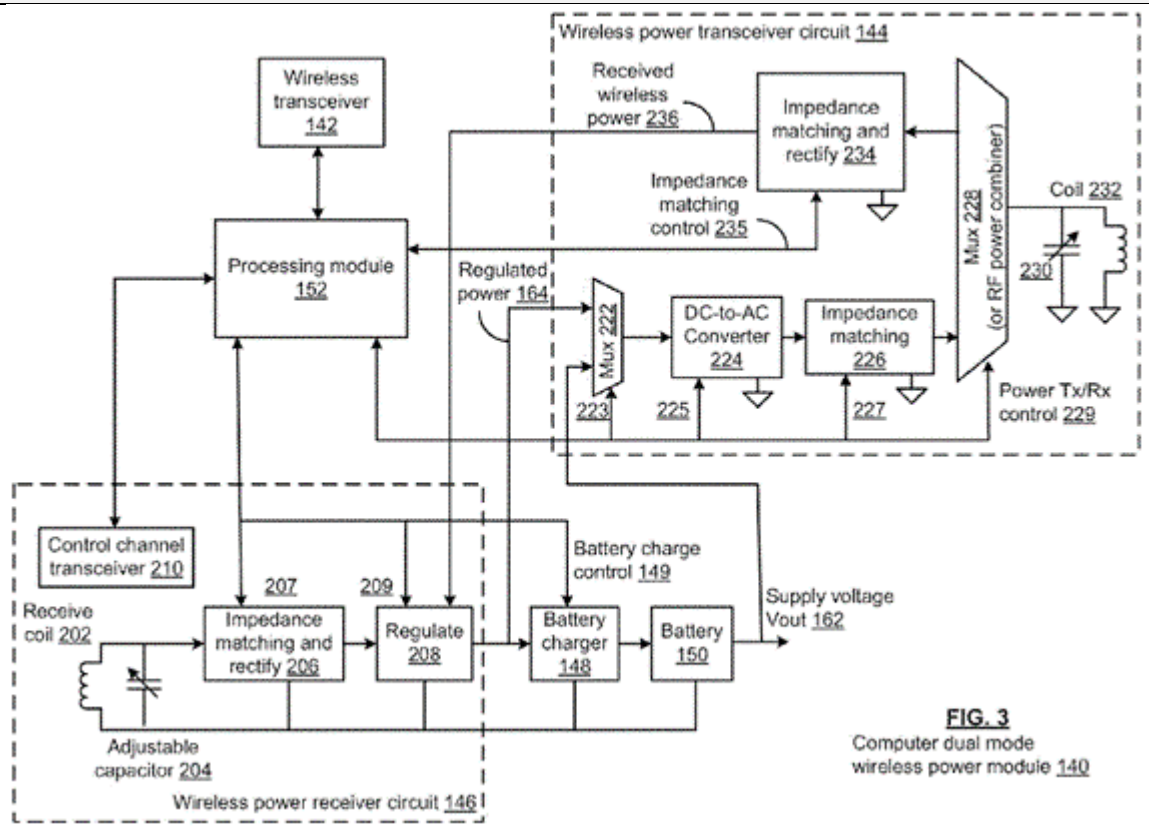
Claim Limitation	Exemplary Prior Art Disclosures
	resides on an electronic device 402 (e.g. mobile computing device or dock) and includes a power bridge circuit 411, a bi-directional coil assembly 412, a processor 413, a power circuit 414, and a communication circuit 415. Similar to the inductive signal interface 310 of FIG. 3, the inductive signal interface 410 may reside on any device that is capable of inductively receiving or transmitting power with another suitably configured device. ***As with an embodiment of FIG. 3, a first computing device uses the inductive signal interface 410 to form an inductive link 430 with a second electronic device 42***0. The second electronic device may also include an embodiment of inductive signal interface 410. Chatterjee, ¶ 41. The bi-directional coil assembly 412 is configurable to form the inductive link 430 with the second electronic device 420. The bi-directional coil assembly 412 is coupled to the power bridge circuit 411 to transmit and/or receive a power signal. The bi-directional coil assembly 412 operates in a similar fashion as the bi-directional coil assembly 312 of FIG. 3 to transmit and receive the power signal. ***The bi-directional coil assembly 412 is also coupled to the communication circuit 415 to receive and transmit modulated data signals***. Chatterjee, ¶ 45. The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430. The ***communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. Chatterjee, ¶ 51. ***The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal***. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. Chatterjee, ¶ 53.

Claim Limitation	Exemplary Prior Art Disclosures
	The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. *See generally* Chatterjee, Figs. 3-10. Chatterjee also discloses communication between two electronic devices that results in charging of the second electronic device. For example: In some embodiments, ***the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from*** (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) ***by identification of the second electronic device 320*** in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36. The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410***. The processor is also coupled to the power bridge circuit **411** to control the operation of the power bridge circuit **411** based on the determined mode of operation. The processor **413** may also be configured to process communication

Claim Limitation	Exemplary Prior Art Disclosures
	data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. *See generally* Figs. 3-5. **Van Der Lee** Van Der Lee discloses a "dual mode wireless power module for a device that includes a wireless power transceiver circuit" that can transmit or receive power. (Van Der Lee, Abstract). For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 2 Van Der Lee, Fig. 2.

Claim Limitation	Exemplary Prior Art Disclosures

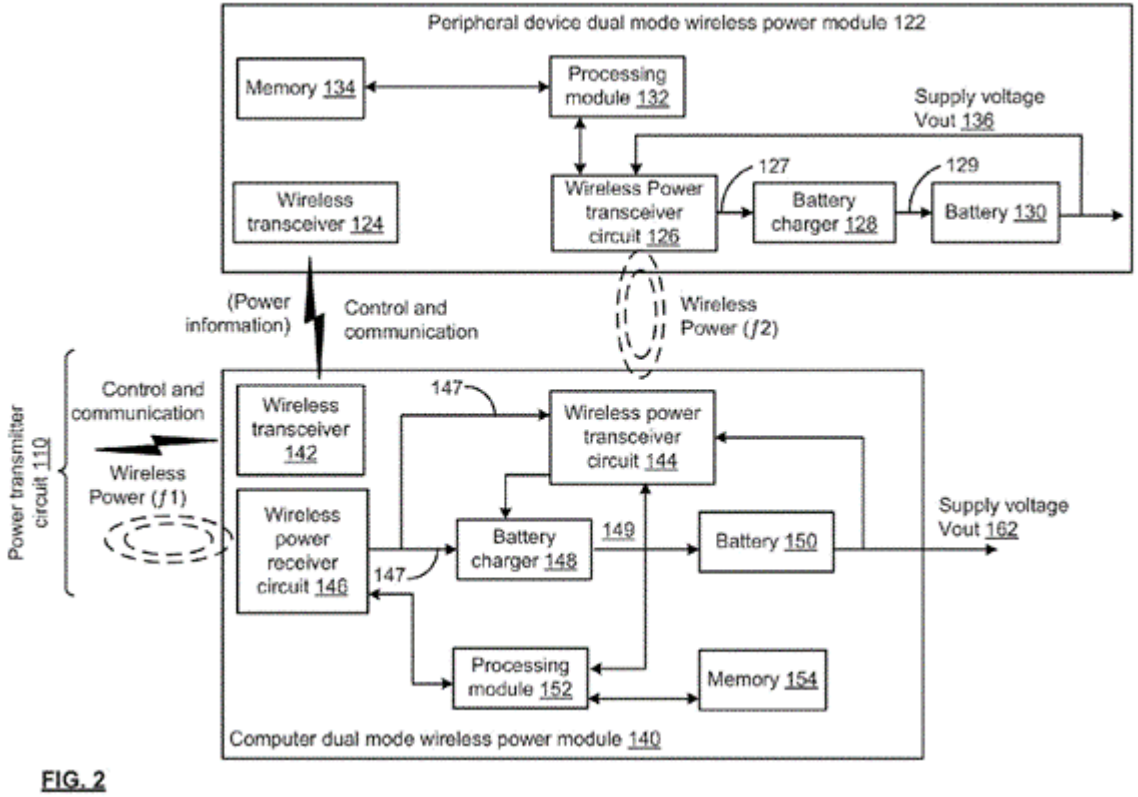


Van Der Lee, Fig. 3.

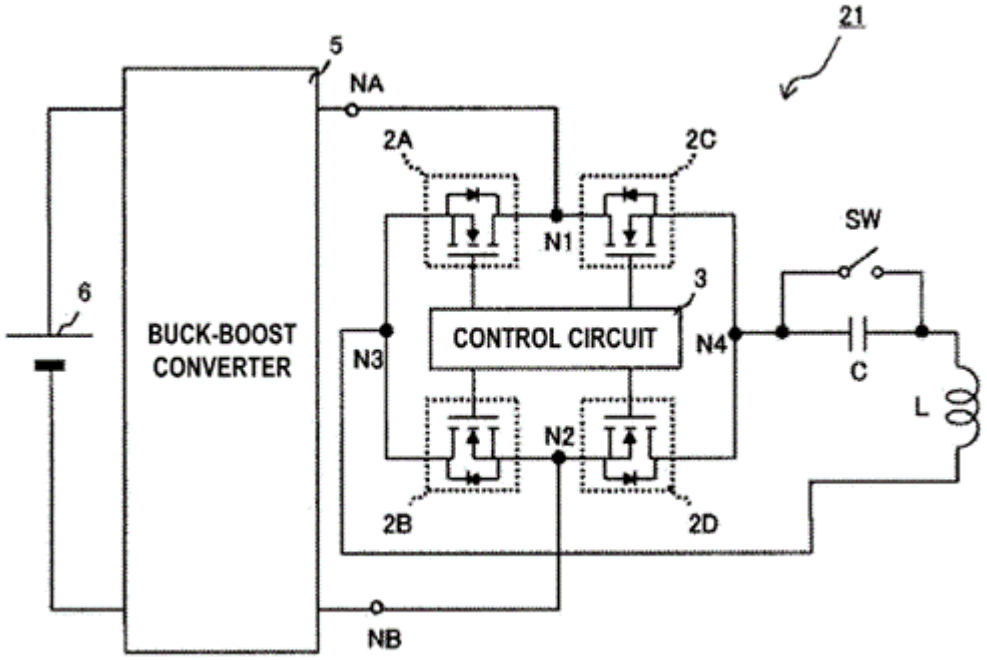
When in ***a wireless power transmit mode, the wireless power transceiver circuit 144 generates an electromagnetic field that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122***. The wireless power transceiver circuit 144 may be sourced by the DC rail voltage 147 when the computer dual mode wireless power module 140 is sufficiently proximal to the power transmitter circuit 110, or sourced by the supply

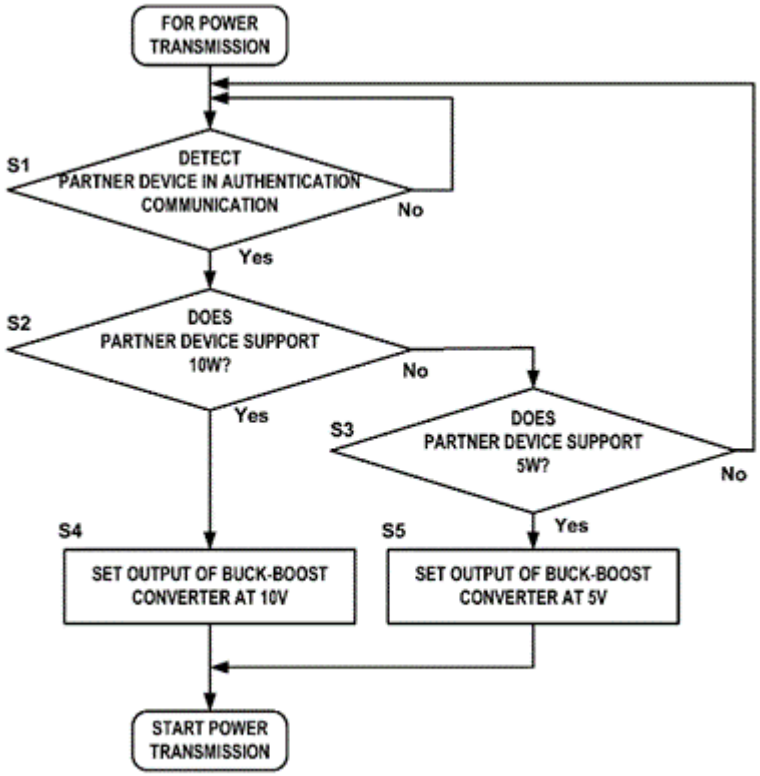
Claim Limitation	Exemplary Prior Art Disclosures
	voltage Vout 162 from the battery 150 when the computer dual mode wireless power module 140 is not sufficiently proximal to the power transmitter circuit 110. When ***in a wireless power receive mode, the wireless power transceiver circuit 144 receives an electromagnetic field that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122***. The wireless power transceiver circuit 144 converts the wireless power link into a voltage delivered to the battery charger 148, which in turn charges the battery 150. Van Der Lee, ¶¶ 46-47. ***When in a wireless power transmit mode,*** as dictated by the power Tx/Rx control 229 from the processing module 152, ***the wireless power transceiver circuit 144 is powered by*** two possible sources, the first being the regulated power 164 (that is, a regulated rail voltage) when receiving wireless power from wireless power receiver circuit 146, and the second being ***the battery 150 via the supply voltage Vout 162*** when the computer is in a battery operated mode (further presuming the battery 150 has sufficient energy to charge other devices, as is discussed later in further detail with respect to FIGS. 5 and 6). ***In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228***. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232 to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. ***The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module***. When ***in a wireless power receive mode***, such as when the computer dual mode wireless power module 140 does not receive wireless power via the wireless power receiver circuit 146, as indicated through the power Tx/Rx control 229 from the processing module 152, ***the coil 232 of the wireless power transceiver circuit 144 receives a wireless power signal*** transmitted by the coil another device

Claim Limitation	Exemplary Prior Art Disclosures
	having a peripheral device dual mode wireless power module. In this mode, ***the impedance matching and rectify circuit 234 converts the AC voltage into a received wireless power 236, which is rectified to a DC voltage. The DC voltage is regulated via the regulate circuit 208 for the battery charger 148, which in turn charges the battery 150***. Van Der Lee, ¶¶ 53–55. For clarity, in discussion of the Figures, the computer 100 may be referred to as a primary device, and the other devices as peripheral devices. The understanding being that these labels for the purpose of convenience and clarity, and with the further understanding that some or all of the devices may include a dual mode wireless power module as discussed herein. Van Der Lee, ¶ 23. Van Der Lee also discloses a first wireless power module that receives power information from a second wireless power module to place the first wireless power module in, for example, a power transmit mode. For example: ***The computer dual mode wireless power module 140 communicates with the peripheral device dual mode wireless power module 122 with power information*** via the wireless transceivers 142 and 124, respectively, using a control and communication link (for example, Radio Frequency (RF), Bluetooth, Millimeter Wave (MMW), Near Field Communications (NFC), et cetera) regarding wireless power matters (such as, frequency selection, operating frequency, impedance matching settings, power levels, et cetera). Van Der Lee, ¶ 48. ***From the frame-of-reference of the device receiving the power information, a determination is made whether to place that the dual mode wireless power device in either of a receive wireless power mode when the power status of the other device is favorable, or of a transmit wireless power mode when the power status of the other device is unfavorable***. Van Der Lee, ¶ 77. In the other context ***when the power status of the other device is unfavorable***, indicating that the other, or peripheral, device seeks to charge or replenish the peripheral device's battery, and the

Claim Limitation	Exemplary Prior Art Disclosures
	primary, or computer, device has the voltage capacity and ***the wireless power transceiver of the computer dual mode wireless power module is placed in a power transmit mode*** at step 408. Van Der Lee, ¶ 79.  FIG. 2 Van Der Lee, Fig. 2; *see also id.* ¶¶ 75-79, Fig. 5. **Shinoda** Shinoda discloses a wireless power transfer terminal that enables a power device to be used for both power transmission and power reception.

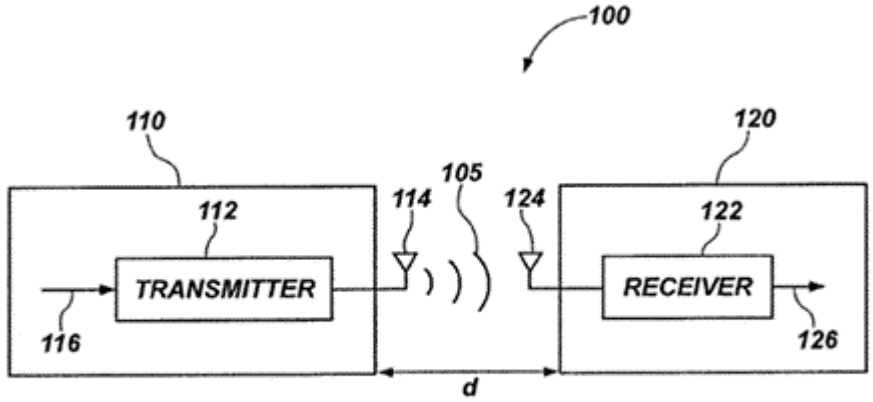
Claim Limitation	Exemplary Prior Art Disclosures
	For example: This disclosure provides ***a wireless power transfer terminal that enables a power device to be used for both power transmission and power reception*** and allows space savings of circuits and a reduction in the cost of manufacturing. Shinoda, Abstract. The present invention relates ***to a wireless power transfer terminal that transmits and receives power to and from an electronic device*** in a noncontact manner. Shinoda, 1:15-17. Traditionally, ***a wireless power transfer terminal used for both transmission and reception that can both receive and transmit power by wireless power transfer*** has been proposed. See, for example, Japanese Unexamined Patent Application Publication No. 2006-60910 (Patent Literature 1). Such a wireless power transfer terminal can be utilized as an auxiliary power source of an electronic device, such as a cellular phone terminal or a potable player, and in giving power to and receiving power from other electronic devices. FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. ***The power transmission circuit 103 includes an inverter for converting an input voltage from, for example, a battery, into an alternating-current output***. ***The coil 102 used, for both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device***. The power reception circuit 104 includes a rectifier circuit for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 2:22-46. FIGS. 2A to 3B are circuit diagrams of a wireless power transfer terminal 1 according to the present embodiment. The arrows with the broken lines in FIGS. 2A and 2B indicate a current for ***power transmission mode*** and those in FIGS. 3A and 3B indicate a current ***for power reception mode***.

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda, 3:23-27.  FIG.5 Shinoda Figs. 5; *see also id.* Figs. 1-5, 7. Shinoda also discloses communication between a wireless power transfer terminal and a partner device before transmitting power to charge the partner device. For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the

Claim Limitation	Exemplary Prior Art Disclosures
	coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5.  FIG.6

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda, Fig. 6. > ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20. **Singh-203** Singh-203 discloses an electronic device that can wirelessly share power by an inductive method, and that the electronic device can operate in a load mode in which it can be supplied power from another device, or a source mode in which it can provide power to another device. For example: > Embodiments of the present disclosure relate generally to inductive wireless power transfer and, more particularly, to apparatuses and related method for having different modes of operation for inductive wireless power transfer. Singh-203, 1:8-11. > Embodiments of the present disclosure include an inductive wireless power enabled device. The inductive wireless power enabled device comprises a transceiver including a plurality of switches coupled with a resonant tank, and control logic configured to drive the plurality of switches to operate the resonant tank in one of a transmit mode and a receive mode. > Another embodiment of the present disclosure includes an inductive wireless power enabled device. The inductive wireless power enabled device comprises a transceiver including a plurality of switches coupled with a resonant tank. The transceiver is configured to both transmit a wireless power signal through the resonant tank and generate power from an incoming wireless power signal through the resonant tank depending on a current operational mode. Singh-203, 1:45-59.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 1 is a schematic block diagram of an inductive wireless power transfer system 100. The inductive wireless power transfer system 100 includes a wireless power transmitting apparatus 110, and a wireless power receiving apparatus 120. The wireless power transmitting apparatus 110 includes a transmitter 112 having a transmit coil 114 configured to generate an electromagnetic field 105 for providing energy transfer to the wireless power receiving apparatus 120. The wireless power receiving apparatus 120 includes a receiver 122 having a receive coil 124 configured to couple with the electromagnetic field 105. The transmit coil 114 and the receive coil 124 may be sized according to the particular devices and applications to be associated therewith. The electromagnetic field 105 may also be referred to as the wireless power signal 105 for energy transfer from the transmitter 112 to the receiver 122. An input signal 116 may be provided to the transmitter 112 for providing the transmitter 112 with the power for generating the wireless power signal 105 that provides an energy transfer to the wireless power receiving apparatus 120. The receiver 122 may couple to the wireless power signal 105 and generates an output signal 126 in response thereto. The output signal 126 may provide the power that is used by the wireless power receiving apparatus 120 for storing (e.g., charging a battery), consumption (e.g., providing system power), or both. Singh-203, 3:39-64.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1 The wireless power transmitting apparatus 110 may be a wireless power charger. The wireless power receiving apparatus 120 may be a mobile electronic device, such as a cell phone, smart phone, media player (e.g., mp3 player, DVD player, etc.), electronic reader, tablet computer, personal digital assistant (PDA), camera, laptop computer, and personal electronic device in which wireless power may be received. The wireless power receiving apparatus 120 may also be a less mobile electronic device, such as a television, personal computer, media player (e.g., DVD player, Blu-ray player, etc.) or any other device that may operate by, and/or store electrical power. The wireless power receiving apparatus 120 may be one of a number of other items, such as an automobile or any other devices that may include batteries that may be charged through the wireless power transmitting apparatus 110. Singh-203, 4:44-59. FIG. 2 is a schematic block diagram of an inductive wireless power transfer system 200 according to an embodiment of the present disclosure. The inductive wireless power transfer system 200 includes a first wireless power enabled device 210 and a second wireless power enabled device 220. The first wireless power enabled device 210 may include a wireless charging transceiver 212, a load 215, and control logic 217. Similarly, the second wireless power enabled device 220 may include a wireless charging transceiver 222, a load 225, and control logic 227.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, 5:3-12.

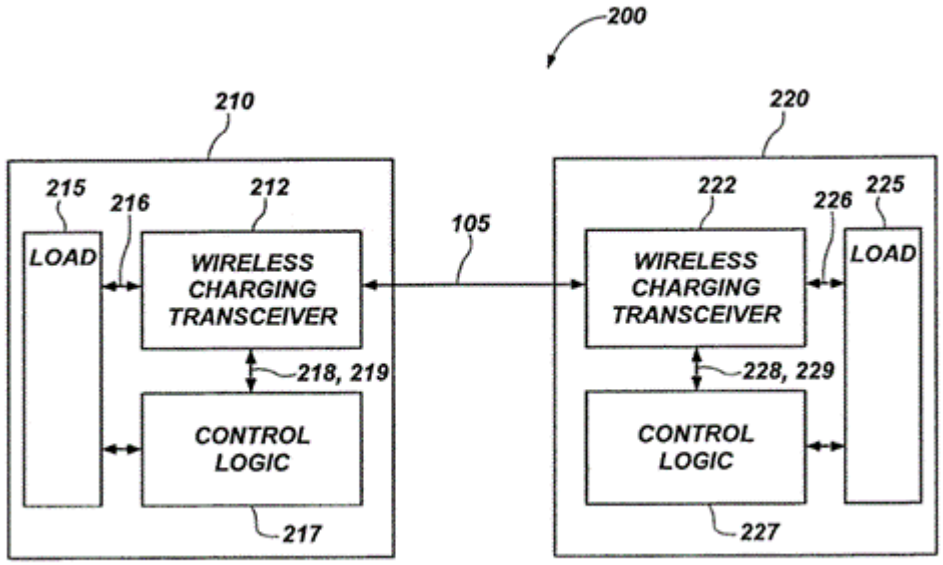
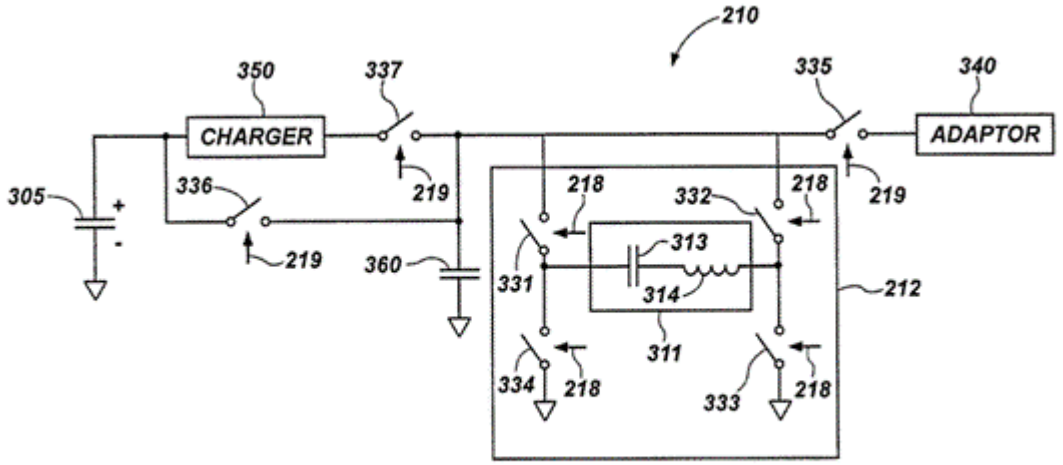


FIG. 2

The first wireless power enabled device 210 and the second wireless power enabled device 220 may each be configured to either transmit or receive the wireless power signal 105 depending on its mode of operation. For example, the first wireless power enabled device 210 may be configured to have a transmit mode and a receive mode. In the transmit mode, the first wireless power enabled device 210 may generate the wireless power signal 105 for energy transfer another device. In the receive mode, the first wireless power enabled device 210 may receive the wireless power signal 105 and generate an output power signal 216 for a load 215. Likewise, the second wireless power enabled device 220 may be configured to have a transmit mode and a receive mode. In the transmit mode, the second wireless power enabled device 220 may generate the wireless power signal 105 for energy transfer another device. In the receive mode, the second wireless power enabled device 220 may receive the wireless power signal 105 and generate an output power signal 226 for a load 225. The control logic 217, 227 may be configured to determine which mode of operation the respective wireless power enabled device

Claim Limitation	Exemplary Prior Art Disclosures
	210, 220 is desired to operate in. The control signals 218, 219, 228, 229 may be transmitted to the wireless charging transceivers 212, 222 to drive the desired operations. As an example, the control logic 217, 227 may include a processor (e.g., microcontroller) that is configured (e.g., programmed) to determine whether the respective wireless charging transceiver 212, 222 is to operate in transmit mode or receive mode. The control logic 217, 227 may further include computer-readable media (e.g., memory) storing computing instructions for execution by the processor related to performing processes of the embodiments of the present disclosure. Memory may include volatile and non-volatile memory. The loads 215, 225 may include energy storage devices (e.g., batteries), system components of the wireless power enabled devices 210, 220, or both. Thus, the output power signals 216, 226 may be a charging signal for an energy storage device, or a system power signal for the various system components. Because each of the wireless power enabled devices 210, 220 may be configured for either transmitting or receiving power, the wireless power enabled devices 210, 220 may be configured for wireless power "charging on the go" (OTG charging). For example, each of the wireless power enabled devices 210, 220 may be an electronic device (e.g., cell phone, tablet, laptop, etc.) that may provide power to, or receive power from, another electronic device (e.g., cell phone, tablet, laptop, etc.). Of course, a wireless power enabled devices that is configured for OTG charging may inductively couple with wireless power devices that are only configured for one-way charging. For example, the first wireless power enabled device 210 may operate in receive mode to receive the wireless power signal 105 generated from a wireless power transmitting apparatus that only operates in a transmit mode. Likewise, the first wireless power enabled device 210 may operate in transmit mode to generate the wireless power signal 105 for reception from a wireless power receiving apparatus that only operates in a receive mode. In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may

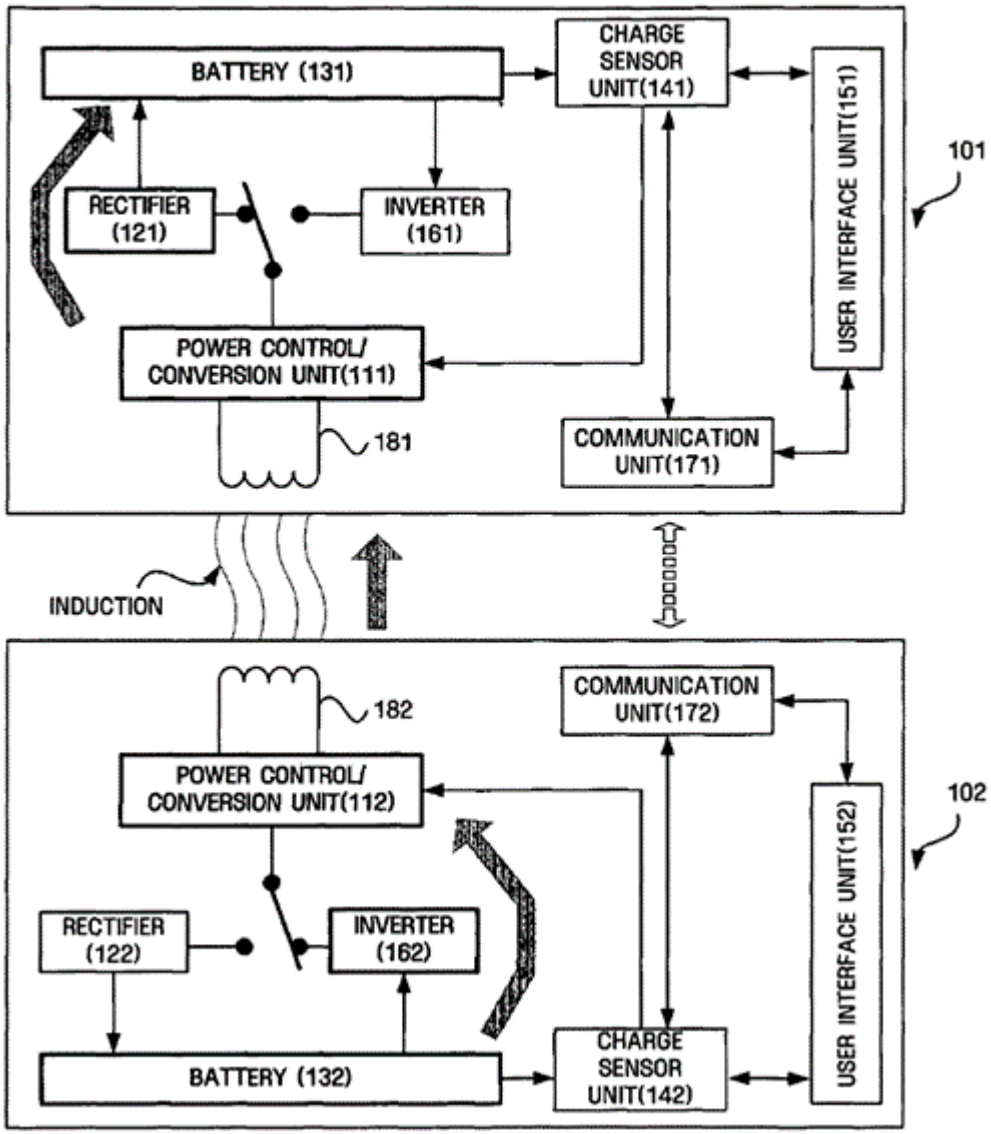
Claim Limitation	Exemplary Prior Art Disclosures
	establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated. Singh-203, 5:13-6:38. Referring specifically to FIG. 3A, the wireless power enabled device 210 may include a wireless charging transceiver 212 that is coupled to an energy storage device 305. As discussed above, the energy storage device 305 may be included as part of the load 215 (FIG. 2) that receives the power from the wireless energy transfer. The wireless charging transceiver 212 may provide power to the energy storage device 305 through a charger 350 during receive mode. Although not specifically shown in FIGS. 3A through 3D, it is recognized that other system components of the wireless power enabled device 210 may receive power from the wireless charging transceiver 212, and that a path for system power may also be provided. The wireless charging transceiver 212 may receive power from the energy storage device 305 through the path parallel to the charger 350 to generate the wireless power signal 105 (FIG. 2) during transmit mode. In some embodiments, the wireless power enabled device 210 may receive power through non-wireless methods, such as being coupled with an adaptor 340 that may be plugged in to a traditional AC outlet. A plurality of switches 335, 336, 337 are coupled with the wireless charging transceiver 212 to control the power flow for the appropriate mode of operation. The plurality of switches 335, 336, 337 may be controlled by control signals 219 from the control logic 217 (FIG. 2). Singh-203, 6:39-7:9; *see also* FIGs 3A & 3B and descriptions thereof.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3A Singh-203, FIG. 3A. **Sagoo** Sagoo discloses an electronic device that can wirelessly share power by an inductive method, and that the electronic device can operate in a load mode in which it can be supplied power from another device, or a source mode in which it can provide power to another device. For example: > Apparatuses and methods consistent with the present invention relate to ***charging a power supply in a non-contact manner***, and more particularly, to ***wirelessly sharing power by an inductive method***. Sagoo, 1:16-19. > The present invention provides a method of ***inductively charging a battery in a non-contact or wireless manner***, and more particularly, a method of charging a battery by providing a common interface among mobile/portable devices and sharing power supplies in a wireless or non-contact

Claim Limitation	Exemplary Prior Art Disclosures
	manner. The present invention also provides ***a device which detects other devices to enable charging or discharging in a non-contact manner***. Sagoo, 2:9-16. According to an aspect of the invention, there is provided an apparatus for wirelessly sharing power by induction, the apparatus including a first battery supplying power; a rectifier supplied with an AC voltage, converts the AC voltage into a DC voltage, and outputs the DC voltage; an inverter supplied with the DC voltage, converts the DC voltage into the AC voltage, and outputs the AC voltage; a power control/conversion unit connected to the rectifier or the inverter and supplying power to charge the first battery or a second battery that is provided in an external device as a power supply for the first battery; and a local communication unit communicating with the external device. According to another aspect of the invention, ***there is provided a method of wirelessly loading power by induction***, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil***. According to still another aspect of the invention, ***there is provided a method of wirelessly supplying power by induction***, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil***. Sagoo, 2:22-55. Hereinafter, a mode in which a mobile device provides energy to another device is referred to as a ***source mode***, and a mode in which the battery of the mobile device is charged by energy from another device is referred to as a ***load mode***. Sagoo, 4:30-33.

Claim Limitation	Exemplary Prior Art Disclosures
	The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. The charge sensor unit 140 checks the charge state of the battery 130 and supplies the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160. Sagoo, 4:56-5:4.

FIG. 4



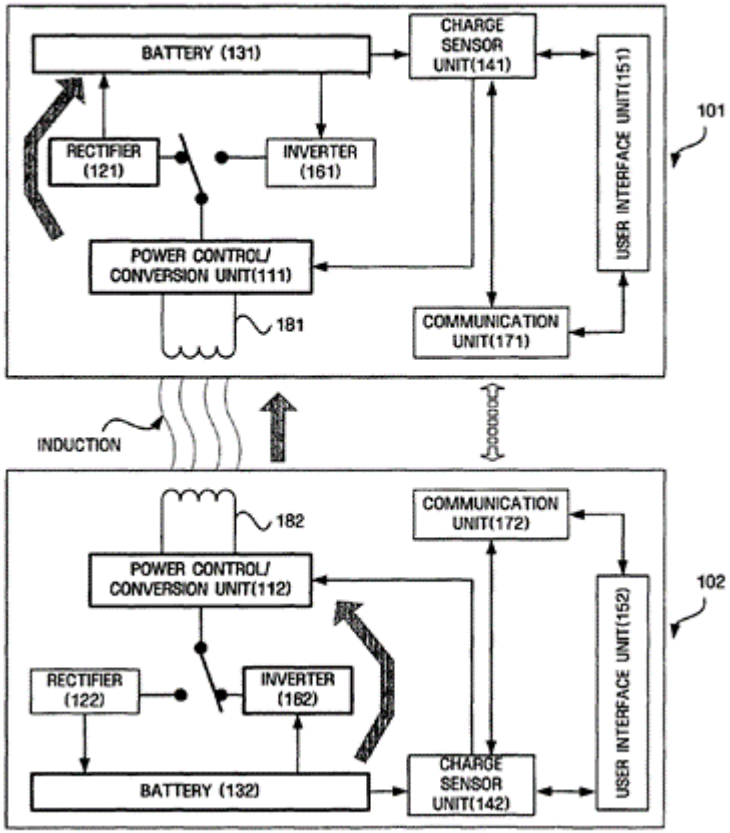
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Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Fig. 4; *see also id.* Figs. 3-8. FIG. 4 is a view showing two mobile devices according to an exemplary embodiment of the invention, which perform charging in a non-contact manner. ***In FIG. 4, a first device 101 is in the load mode, and a second device 102 is in the source mode***. Sagoo, 5:40-44. FIG. 6 is a flowchart showing ***an operation in the load mode in which a mobile device according to an exemplary embodiment of the invention receives energy from another mobile device***. First, the charge state of the battery is checked (S210). The charge state of the battery is checked by the charge sensor unit. When the battery needs to be charged (Yes in S220), a process of receiving energy is performed. When the battery does not need to be charged (No in S220), the charge sensor unit periodically checks the charge state of the battery (S210). When the battery needs to be charged, a device capable of operating in the source mode is detected among neighboring devices (S230). The mobile device performs local area communication with the neighboring devices through a local area communication unit so as to detect the amounts of charge in the neighboring devices. The detected charge states of the neighboring devices are output (S240). A specific device is selected among the neighboring devices through the user interface unit (S250). Alternatively, it is possible to automatically select a special device without requiring input from the user. It is checked whether the selected mobile device can operate in the source mode (S260). For example, the selected mobile device may be set so as not to operate in the source mode. Further, in a case in which the selected mobile device operates in the source mode only when the two devices authenticate each other, if the authentication fails, the selected mobile device does not operate in the source mode. When the selected mobile device cannot operate in the source mode, another mobile device can be selected. When the selected mobile device (hereinafter, referred to as a source device) can operate in the source mode, ***the mobile device to be charged is switched to the load mode (S270). When the mobile device to be charged is switched to the load mode, the rectifier is connected to the battery and the power control/conversion unit such that energy can be received from the outside. Further, the inductive coil is set as the secondary coil (S280). Energy is received from the secondary coil and the primary coil of the source device (S290)***. The charge state of the battery can be checked while the energy is being received such that the battery is prevented from being excessively charged.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 7 is a flowchart showing ***the operation of the mobile device according to an exemplary embodiment of the invention when the mobile device is in the source mode for providing energy to another mobile device.*** The charge state of the battery is transmitted to a mobile device requiring charging (referred to as a charge device) (S310). The source device receives data instructing the source device to operate in the source mode from the charge device (S320). The source device performs an authentication process with respect to the charge device (S330). This is to prevent the source device from being discharged by an unauthenticated device. Next, it is determined whether the authentication process succeeded (S340). When the authentication fails, the source device does not provide energy. When the authentication succeeds, the source device performs an operation for supplying energy. ***First, the source device is switched to the source mode (S350). As described above, in order for the source device to be switched to the source mode, the inverter is connected to the battery and the power control/conversion unit such that the power of the battery can be supplied to the charge device. Then, the inductive coil is set to the primary coil (S360). Next, the source device provides energy to the charge device by using the power of the battery (S370).*** While providing energy, the source device can check the charge state of the battery such that the battery is prevented from being excessively discharged. Sagoo, 7:4-8:6. Sagoo also discloses communication between two electronic devices that results in charging of the second electronic device. ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be

Claim Limitation	Exemplary Prior Art Disclosures
	applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. An example of a process in which the two mobile devices share energy in a non-contact manner will now be described. A user having the first device 101 is informed through a user interface unit 151 that the battery does not have enough charge. The charge sensor unit 141 measures the charge state of the battery and communicates with the communication unit about the charge state of the battery. Rechargeable batteries such as the battery 131 of the first device 101 can be installed in devices, such as a notebook computer, a PDA, an MP3 player, and a game console, and have different voltages, currents, and capacities. The battery can be formed of, for example, a nickel metal hydride (NiMH) battery or a lithium-ion battery. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device and outputs the received information to the user interface unit 151***. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:4-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, the communication units can perform authentication with respect to each other such that charging is performed between authenticated devices. Sagoo, 6:43-48.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 4  Sagoo, Fig. 4; *see also id.* Figs. 3-7. **Schuessler**

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler discloses a bi-directional wireless charger that includes a coil for wireless power transfer and a rechargeable battery, and can selectively cause power to be delivered from its battery to the coil to recharge another device, or from the coil to its battery. For example: ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively causes power to be delivered from the coil to the battery and selectively causes power to be delivered from the battery to the coil, and a control mechanism***. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the coil to the battery***, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the battery to the coi***l. Schuessler, Abstract. ***A bi-directional charging device may wirelessly receive power and wirelessly deliver power***. When the bi-directional charging device is in the vicinity of a charging bay it may receive power from the charging bay to recharge an internal battery. When the bi-directional charging device is in the vicinity of a rechargeable electronic device it may deliver power to the electronic device for recharging an internal battery of the electronic device. Thus, the bi-directional charging device may be kept near rechargeable electronic devices to recharge batteries in the electronic devices, for example throughout the day. The bi-directional charging device may itself be recharged when it is placed in the vicinity of a charging bay, for example overnight. Schuessler, 1:41-53. FIG. 1A illustrates a bi-directional charging device 105 and a rechargeable electronic device 115 placed in the vicinity of a charging bay 110. In the configuration illustrated in FIG. 1A, ***bi-directional charging device 105 and electronic device 115 receive power from charging bay 110 wirelessly, for example, through a near field or far field coil-to-coil energy transfe***r. The distance d between bi-directional charging device 105 and charging bay 110 or between electronic device 115 and charging bay 110 depends on the charging mechanism used. In some implementations, distance d may be small, in terms of a few centimeters. In other implementations, distance d may be several centimeters or meters.

Claim Limitation	Exemplary Prior Art Disclosures
	Bi-directional charging device 105 is a portable unit that may be selectively configured to receive power from a charging bay 110 or selectively configured to deliver power, as described below. In some implementations, bi-directional charging device 105 may be configured only for the receiving or delivering of power. In many other implementations, bi-directional charging device 105 may be configured for the receiving and delivering of power as only one of many functions with device 105. For example, ***bi-directional charging device 105 may be a portable device such as a notebook computer, laptop computer, tablet computer, or a cellular phone, to name just a few examples. In such a device 105, the device 105 may both use the power received from charging bay 110 and share the power with a rechargeable electronic device 115***. In this manner, a portable device may provide power for other portable devices in the vicinity, including providing power for other rechargeable electronic devices 115. Schuessler, 1:56-2:19. While being charged by charging bay 110, bi-directional charging device 105 may provide power to charge electronic devices 115. For example, power may be received by bi-directional charging device 105 at one coil and power may be delivered to an electronic device 115 from another coil substantially concurrently. For another example, power may be received by bi-directional charging device 105 at a coil at one frequency and power may be delivered to an electronic device 115 from the same coil at a different frequency substantially concurrently. ***The capability to both receive power and deliver power substantially concurrently*** may be used to stack devices oh a charging bay 110 for maximum utilization of available surface space of charging bay 110. Schuessler, 3:23-35. FIG. 1B illustrates an exemplary system 100 in which a bi-directional charging device 105 is placed in the vicinity of a rechargeable electronic device 115 away from charging bay 110, in an exemplary configuration for charging the electronic device 115. The distance d between bi-directional charging device 105 and electronic device 115 depends on the charging mechanism used, as described above. The same mechanism used to charge devices 105 and 115 from charging bay 110 may be used to ***charge rechargeable electronic device 115 from bi-directional charging device 105***. For example, rechargeable electronic device 115 may use the same coil for receiving power from bi-directional charging device 105 as used for receiving power from charging bay 110, and ***bi-directional charging device 105 may use the same coil to provide power to rechargeable electronic device 115 as used for***

Claim Limitation	Exemplary Prior Art Disclosures
	receiving power from charging bay 110. However, in some implementations, ***bi-directional charging device 105 may use one coil to receive power from charging bay 110 and a separate coil to provide power to rechargeable electronic device 115***. Schuessler, 3:36-55. Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in ***a power receiving mode*** or directing power from rechargeable battery 215 ***in a power delivering mode***. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. ***Rechargeable battery 215 represents a device capable of storing charge, accepting charge for storage, and delivering charge from the stored charge***. Some examples of rechargeable battery technology include the use of lead-acid; alkaline; combinations with nickel such as nickel-iron, nickel-cadmium, and nickel-zinc; lithium forms or combinations with lithium such as lithium ion, lithium polymer, lithium-sulfur, lithium titanate, and thin film lithium; and other elemental combinations such as zinc-bromium; sodium-sulfur; and silver-zinc. ***Rechargeable battery 215 may represent multiple rechargeable batteries*** 215, as discussed above. In a bi-directional charging device 105 with multiple rechargeable batteries 215, the batteries 215 may be of different technologies. Schuessler, 4:61-5:7.

Claim Limitation	Exemplary Prior Art Disclosures
	Control mechanism 225 represents the control hardware, firmware, and/or software that determines ***the mode for the bi-directional charging device 105, for example, a power receiving mode or a power delivering mode***. As discussed above, there may be multiple concurrent modes. Schuessler, 5:39-43. FIG. 3A illustrates an exemplary charging bay 305 that may be plugged into a wall receptacle for connection to a building main power supply. A charging bay such as bay 305 may be placed in an entryway or a corner or the like so that as occupants of the building enter, they may place a bag on charging bay 305. Inside the bag is a ***bi-directional charging device 105 to be charged from charging bay 305. Exemplary bags illustrated in FIG. 3A are a handbag 310, briefcase 315, and backpack 320 each containing one bi-directional charging device 105***. Of course, more than one bi-directional charging device 105 may be carried in a bag. As a bag is placed on charging bay 305, a bi-directional charging device 105 inside the bag may recognize the presence of charging bay 305 and begin receiving power from charging bay 305. Bi-directional charging device 105 may recognize the presence of charging bay 305 by, for example, recognizing that a large power source at an appropriate frequency is nearby, or by communicating with charging bay 105 through external communication interface 235. In some implementations, charging bay 305 may be able to charge a bi-directional device 105 from a distance. For example, as illustrated in FIG. 3A, backpack 320 is placed a distance from charging bay 305, but may still be able to receive energy transfer from charging bay 305 if the energy transfer mechanism is able to span the distance. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. ***If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested***. A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 7:49-8:21; *see also* Schuessler, Figs. 1-5. Schuessler also discloses communication between two electronic devices that results in charging the second electronic device. For example: ***One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status***. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. If communication capability is included in both bi-directional charging device 105 and rechargeable electronic device 115 as described above, then the devices may communicate with each other to coordinate energy transfer. Coordination of energy transfer may include beginning and ending energy transfer and status communication during energy transfer. Schuessler, 3:56-61. External communication interface 235 optionally provides the capability for communication with external devices such as charging bay 110 or rechargeable electronic device 115, as discussed above. External communication interface 235 includes the hardware, firmware and/or software necessary for communication through the implemented protocol. For example, interface 235 may include integrated circuit transceiver chips with associated circuitry and multiple levels of software to enable communications using Bluetooth protocol. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, ***external communication interface 235 may perform handshaking with an external device, and then inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure rechargeable battery

Claim Limitation	Exemplary Prior Art Disclosures
	215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. ***External communication interface 235 may be used by bi-directional charging device 105 to make requests to external devices for charging***. For example, upon recognizing that a charging bay 110 is in the vicinity, bi-directional charging device 105 may request the charging bay 110 to begin delivering power. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215. Schuessler, 6:52-7:6. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. ***A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge***. Schuessler, 8:7-21. **Yeh** Yeh discloses a bidirectional wireless charging and discharging device for an electronic device that selectively operates in a receiving mode and a transmission mode to charge a battery of the electronic device, or to transmit power from the battery to charge a second electronic device. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	Disclosed is a ***bidirectional wireless charging and discharging device*** for portable electronic device. The bidirectional wireless charging and discharging device includes: a wireless receiving and transmitting unit and a logic control unit, a step-up/step-down unit, first and second reverse current protectors, a control switch, and at least a supercapacitor. The first and second reverse current protectors function to prevent reverse current and to switch. The step-up/step-down unit controls step-up conversion in discharging and step-down conversion in charging. The logic control unit detects if a load exists on an opposite side of the wireless receiving and transmitting unit and controls the operations of the step-up/step-down unit and the first and second reverse current protectors, and can be even combined with a control switch to control selectively charging and discharging operations. The supercapacitor absorbs surge occurring in each charging operation. Yeh, Abstract. The present invention relates to a bidirectional wireless charging and discharging device, and in particular to ***a bidirectional wireless charging and discharging device for portable electronic device that protects a rechargeable battery*** from accumulated damage caused by repeated charging and improves wireless charging/discharging efficiency and step-up/step-down efficiency. Yeh, 1:7-14. The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to ***the transmission mode***, the control switch 5 is actuated to effect switching. Presumably, ***a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device***. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize

Claim Limitation	Exemplary Prior Art Disclosures
	supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition. The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so ***that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37***. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, ***the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current***. Yeh, 5:40-6:37.

Claim Limitation	Exemplary Prior Art Disclosures
	The ***receiving mode*** of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with ***a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93*** of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition. Yeh, 6:48-7:18; *see also* Yeh, Figs. 1-3. Yeh also discloses communication between two electronic devices such as whether a load exists on the detection pin, that results in charging of the second electronic device. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: if there is no load: the transmission is stopped; ***if there is a load***: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that ***electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:4-29; *see also id.* Figs. 3-7. **Cook** Cook discloses a bidirectional wireless power transceiver in a device that can operate in a receive mode to charge a battery of the device and a transmit mode to provide power from the battery to charge a second device. For example: Typically, each powered device such as a wireless electronic device requires its own wired charger and power source, which is usually an alternating current (AC) power outlet. Such a wired configuration becomes unwieldy when many devices need charging. Approaches are being developed that use over-the-air or wireless power transmission between a transmitter and a receiver coupled to the electronic device to be charged. ***The receive antenna collects the radiated power and rectifies it into usable power for powering the device or charging the battery of the device***.

Claim Limitation	Exemplary Prior Art Disclosures
	Cook, ¶10 ***The term "wireless power" is used herein to mean any form of energy associated with electric fields, magnetic fields, electromagnetic fields, or otherwise that is transmitted from a transmitter to a receiver without the use of physical electromagnetic conductors***. Power conversion in a system is described herein to wirelessly charge devices including, for example, mobile phones, cordless phones, iPod, MP3 players, headsets, etc. Generally, one underlying principle of wireless energy transfer includes magnetic coupled resonance (i.e., resonant induction) using frequencies, for example, below 30 MHz. However, various frequencies may be employed including frequencies where license-exempt operation at relatively high radiation levels is permitted, for example, at either below 135 kHz (LF) or at 13.56 MHz (HF). At these frequencies normally used by Radio Frequency Identification (RFID) systems, systems must comply with interference and safety standards such as EN 300330 in Europe or FCC Part 15 norm in the United States. By way of illustration and not limitation, the abbreviations LF and HF are used herein where "LF" refers to f0=135 kHz and "HF" to refers to f0=13.56 MHz. Cook, ¶25. An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to ***charge a battery 136*** as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118. Cook, ¶31. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates ***an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210***. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between

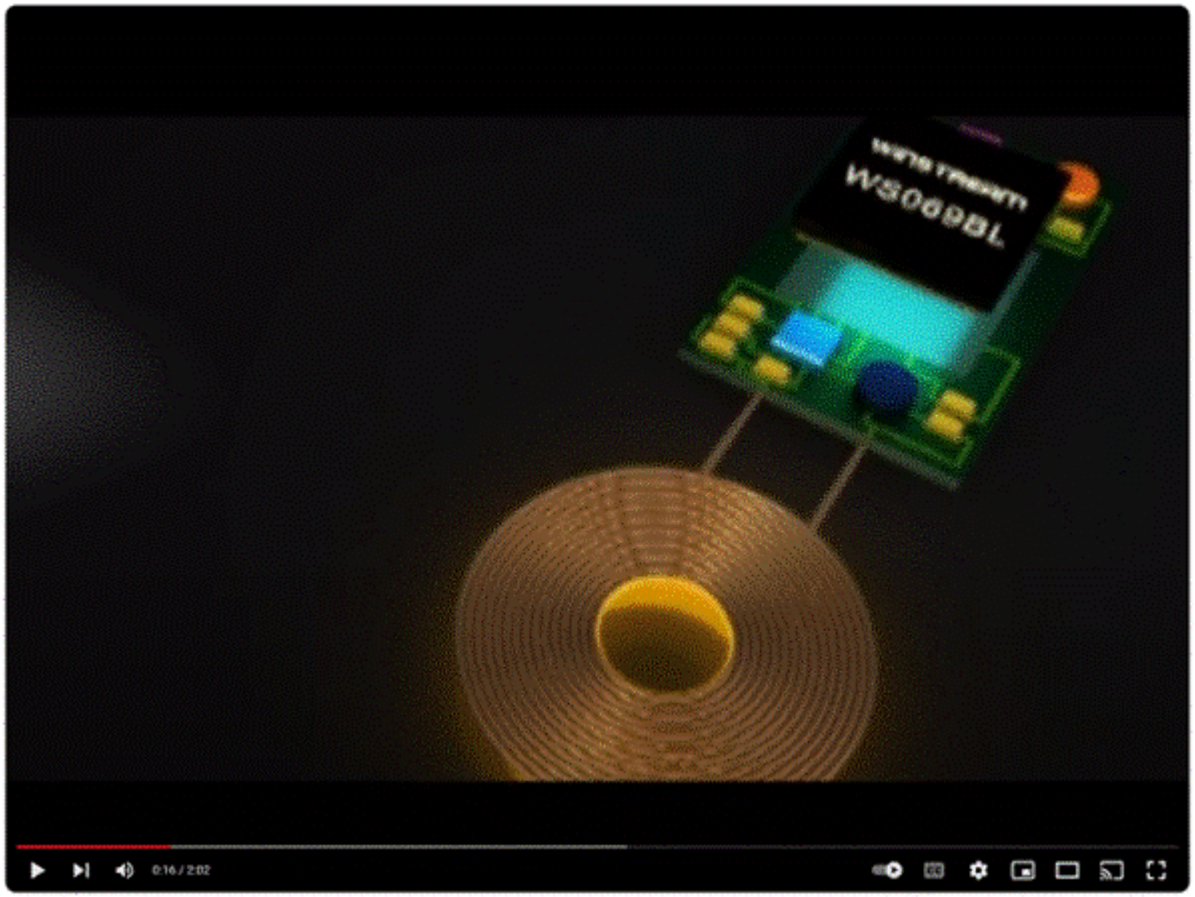
Claim Limitation	Exemplary Prior Art Disclosures
	the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Cook, ¶39. While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable. Accordingly, ***the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device***. ***Various benefits of such a configuration include the ability of a device receive and store wireless power and then to subsequently transmit or "donate" stored power to another receiving or "absorbing" device***. Accordingly, such a configuration may also be considered as a "peer-to-peer" "charitable" charging configuration. Such a device-charging arrangement provides considerable convenience in location under which charging occurs (i.e., the receiver or "absorbing" device need not necessarily receive a charge from an inconveniently located or unavailable charging pad). Cook, ¶¶42-43. FIG. 5A and FIG. 5B illustrate a bidirectional wireless power device, in accordance with an exemplary embodiment. ***Bidirectional wireless powering and charging of electronic devices*** (e.g. mobile phones, head sets, MP3 players, etc.) is disclosed in which ***electrical energy can be wirelessly transferred, as illustrated in FIG. 5A, from a power conversion circuit 220 and transmit antenna 214 of a power base 302 (e.g. charging pad) to a bidirectional wireless power transceiver 318*** including a transceiver antenna 306 and a bidirectional power conversion circuit 308 of an electronic device 300 as illustrated in FIG. 5B. Then, as illustrated with reference to FIG. 5B, ***the wirelessly transmitted power is stored in a load illustrated as battery 310. The stored power in battery 310 is then donated through the bidirectional power conversion circuit 308 and transceiver antenna 306 of electronic device 300 to a***

Claim Limitation	Exemplary Prior Art Disclosures
	receive antenna 312 and a power conversion circuit 314 of another electronic device 304 for consumption or storage in load or battery 316. Cook, ¶ 44. As stated, electronic device 300 is configured for bidirectional wireless power transmission. With further reference to FIG. 5A, ***in a receiving or "absorbing" mode, battery (e.g., power storage device) 310 may be wirelessly charged from an AC mains supplied power base (e.g. charging pad) 302***. With further reference to FIG. 5B, electronic device 300 may be operated in reverse ***in a transmit or "donor" mode for transmission of wireless power to another electronic device 304 for operation and storage at a battery 316 that is used to power the electronic device 304***. Cook, ¶47. FIG. 6A and FIG. 6B illustrate various operational contexts for an electronic device configured for bidirectional wireless power transmission, in accordance with exemplary embodiments. Specifically, an electronic device 300 configured for bidirectional wireless power transmission engages in wireless power transmission with ***a power base 302 wherein electronic device 300 receives wireless power and stores the received power in a battery***. Subsequently electronic device 300 is solicited, volunteers or otherwise is enlisted as a donor of stored power. Accordingly, one or more electronic devices 304A, 304B receive power from electronic device 300 through a wireless power transmission process. It is contemplated that the wireless transmission process with electronic device 300 operating in donor mode, may be to provide power replenishment e.g. in an urgency, or at least temporary charge, to another device 304B, or the charging of a micro-power device 304A, such as headsets, MP3 players, etc. For this purpose, device A is set into donor mode via a user interface or responsive to allowed solicitations. Furthermore, ***donor electronic device 300 may also perform energy management of its own available power to avoid excessive depletion of stored power within the battery of the donor electronic device 300***. Accordingly, assuming a standardized wireless power interface, devices may be recharged or partially recharged almost everywhere from any wireless power device that can act as donor electronic device and that provides sufficient battery capacity. Cook, ¶¶48-49. FIG. 7 illustrates a block diagram of ***an electronic device configured for bidirectional wireless power transmission***, in accordance with an exemplary embodiment. The electronic device 300 includes an

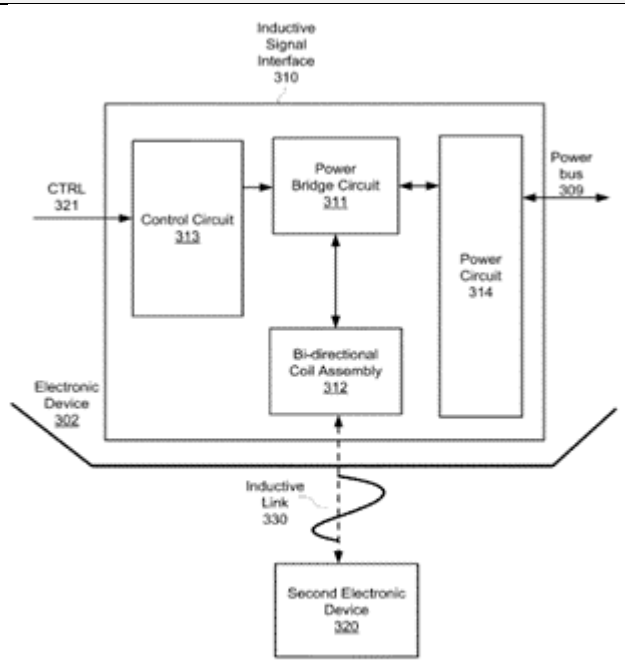
Claim Limitation	Exemplary Prior Art Disclosures
	antenna 306, a bidirectional power conversion circuit 308 and ***a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324***. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane. Bidirectional power conversion circuit 308 further includes a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which ***the electronic device shares its power stored in battery 310 while in donor mode***. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶¶ 50-51. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a ***battery 462 (e.g. Li-Ion)***. Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶57. FIG. 10 illustrates a circuit diagram of a wireless power transmission system, in accordance with another exemplary embodiment. This exemplary embodiment enables exchange of energy from one battery operated device to another battery operated device equally in both directions. A wireless power transmission system 500 includes a bidirectional wireless power transceiver 318T (where "T" indicates a ***Transmitter configuration or transmit mode***) and a bidirectional wireless power transceiver 318R (where "R" indicates a ***Receiver configuration or receive mode***). Cook, ¶58. FIG. 11 illustrates a flowchart of a method for transceiving wireless power, in accordance with an exemplary embodiment. Method 600 for transceiving wireless power is supported by the various structures and circuits described herein. Method 600 includes step 602 for receiving an induced current from an antenna resonating in response to a magnetic near-field and rectifying the induced current into

Claim Limitation	Exemplary Prior Art Disclosures
	DC power through a bidirectional power conversion circuit when the bidirectional power conversion circuit is configured in ***receive mode***. Method 600 further includes step 604 for generating an induced current at a resonant frequency into the antenna from stored DC power through the bidirectional power conversion circuit and generating a magnetic near-field from the antenna when the bidirectional power conversion circuit is configured in ***transmit mode***. Cook, ¶64. *See generally* Cook, Figs. 1-10. Cook discloses a communication channel between a transmitter and receiver, and a frequency generation control circuit operates to control a bidirectional wireless power transceiver to operate in a transmit mode. For example: ***A communication channel 119 may also exist between the transmitter 104 and the receiver 108***. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel 119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32. Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate

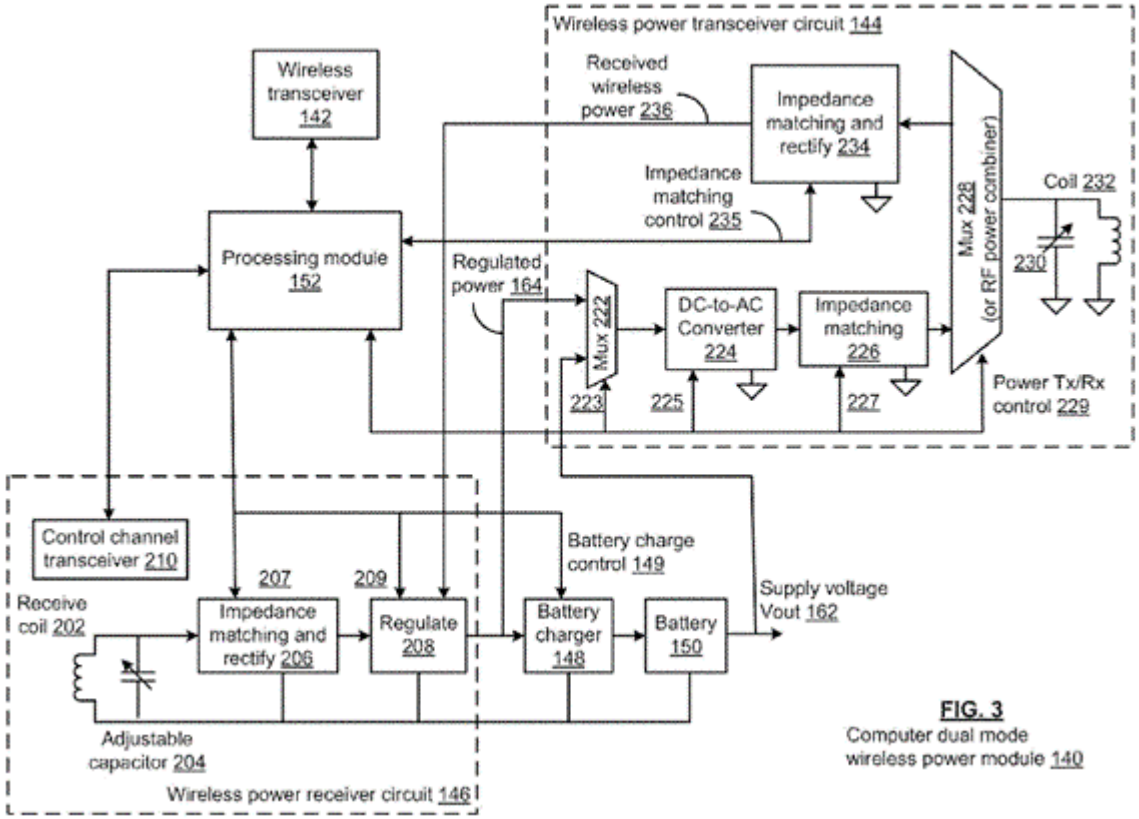
Claim Limitation	Exemplary Prior Art Disclosures
	voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63.
[1a] one of coil and capacitor electrodes;	On information and belief, the Winstream Solution discloses this limitation. For example:

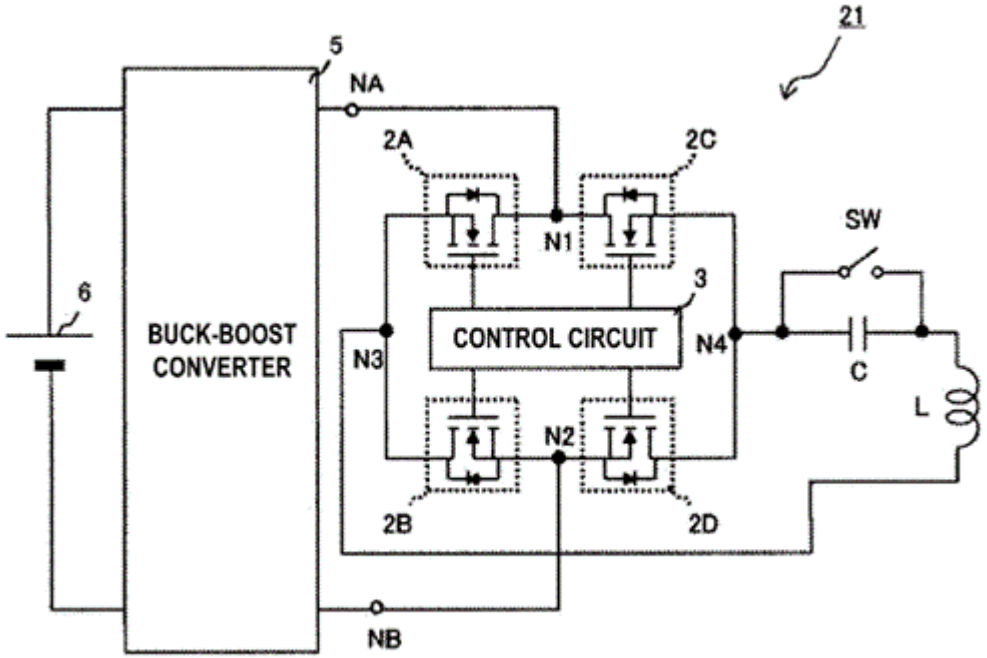
Claim Limitation	Exemplary Prior Art Disclosures
	 (https://www.youtube.com/watch?v=lwsTdYXpWxI) To the extent the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee Chatterjee discloses coils or inductors in a bi-directional coil assembly. For example: > **The bi-directional coil assembly 312 receives power *inductively from the second electronic device 320***, the power bridge circuit **311** converts AC current received inductively at the bi-directional coil assembly **312** to DC current to be transferred to the power circuit via the power bus. > The bi-directional coil assembly 412 is configurable to form the inductive link 430 with the second electronic device 420. ***The bi-directional coil assembly 412 is coupled to the power bridge circuit 411 to transmit and/or receive a power signal***. The bi-directional coil assembly 412 operates in a similar fashion as the bi-directional coil assembly 312 of FIG. 3 to transmit and receive the power signal. The bi-directional coil assembly 412 is also coupled to the communication circuit 415 to receive and transmit modulated data signals. Chatterjee, ¶¶ 40, 45. > During the power transmit mode of the inductive signal interface 410, the ***bi-directional coil assembly 412 is used to carry the modulated power signal to the second electronic device 420***. The power may originate from another component on the electronic device 402, such as a battery (not shown) or from other power sources, such as a wall adapter (not shown). The power circuit 414 is configured to treat the incoming power signal (as described above) to transmit a treated outgoing power signal to the power bridge circuit 411. According to some embodiments, the output power signal of the power circuit 414 to the power bridge circuit 411 in the power transmit mode is substantially a DC signal, and the power bridge circuit 411 performs DC to high-frequency conversion to output a high-frequency power signal to the bi-directional coil assembly 412. The bi-directional coil assembly 412 transmits power via the inductive link 430 to the second electronic device 420. Chatterjee, 47.

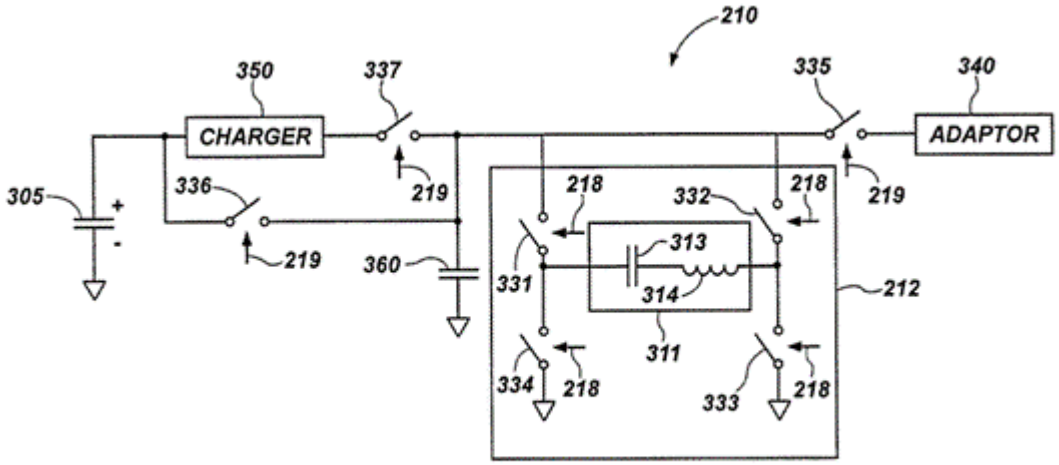
Claim Limitation	Exemplary Prior Art Disclosures
	 **FIG. 3** Chatterjee, Fig. 3; *see also id.* Figs. 4, 5. ***FIG. 6A illustrates a circuit level embodiment of the power bridge circuit 311, 411, 511 and the bi-directional coil assembly 312, 412, 512 of FIGS. 3, 4, and 5, respectively***. An embodiment depicted shows the power bridge circuit 610 as being "3-legged", meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for use with either the H-bridge or the synchronous bridge rectifier branch. In more detail, power bridge circuit 610 includes an H-bridge branch 611, a shared branch 612, and a sync bridge branch 613. The power bridge circuit 610 has a power input/output (I/O) to receive or transmit a DC current. Each of the three branches is coupled to the power I/O and includes two serially-connected switches. On each of the three branches, one of the serially-connected switches is coupled to the power I/O and the other of the serially-connected switches is coupled to a ground voltage level or a negative supply voltage. On each of the

Claim Limitation	Exemplary Prior Art Disclosures
	three branches, the node between the two serially-connected switches is coupled to the bi-directional coil assembly 631. The H-bridge branch 611 includes switches 621 and 622 which are connected at a node 601 and are controlled by signals G1 and G2 respectively. The shared branch 612 includes switches 623 and 624 which are connected at a node 602 and are controlled by signals G3 and G4 respectively. The sync bridge branch 613 includes switches 625 and 626 which are connected at a node 603 and are controlled by signals G5 and G6 respectively. The bi-directional coil assembly 631 is coupled to all three branches of the power bridge circuit and includes a capacitor C1 and ***two inductive coils L1 and L2***. The capacitor C1, inductive coils L1 and L2 are coupled to a node 604. C1 is also coupled to the H-bridge branch 611 at the node 601. Inductive coil L1 is also coupled to the shared branch 612 at node 602. Inductive coil L2 is also coupled to the sync bridge branch 613 at the node 603. The inductive coils L1 and L2 can form an inductive link with an second electronic device to transfer power and/or data. Chatterjee, ¶¶ 61–62; *see also id.* Figs. 6-10. **Van Der Lee** Van Der Lee discloses inductive coupling using coils and capacitive energy transfer using capacitor electrodes. For example: Commercial wireless power products generally include either of a transmit unit or a receive unit, and a bidirectional control channel. In these products, the primary method of energy transfer is ***inductive coupling***, but some lower power applications may include solar energy transfer, thermo-electronic energy transfer, and/or ***capacitive energy transfer***. Van Der Lee, ¶ 5. FIG. 3 is a schematic block diagram of an embodiment of a computer dual mode wireless power module 140 that includes the wireless power receiver circuit 146, the battery charger 148, the battery 150, the wireless power transceiver circuit 144, the wireless transceiver 142, and the processing module 152. The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, a

Claim Limitation	Exemplary Prior Art Disclosures
	DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, an adjustable capacitor 230, and a ***coil 232***. Van Der Lee, ¶¶ 50-51.  **FIG. 3** Computer dual mode wireless power module 140 Van Der Lee, Fig. 3. **Shinoda** Shinoda discloses coils.

Claim Limitation	Exemplary Prior Art Disclosures
	For example: This wireless power transfer terminal 101 includes ***a coil 102*** used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. Shinoda, 1:33-36. The wireless power transfer terminal 1 includes FETs 2A to 2D, ***a coil L***, and a control circuit 3. Shinoda, 3:28-29.  FIG.5 Shinoda, Figs. 5; *see also id.* Figs. 1-5, 7. **Singh-203**

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203 discloses at least one of coil and capacitor electrodes. For example: > The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. Singh-203, 7:10-22. > Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. Singh-203, 7:31-39.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3A **Sagoo** Sagoo discloses coils. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; ***setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil***. Sagoo, 2:34-45. FIG. 2 is a view showing a transformer according to a first exemplary embodiment of the invention including a mobile device. The transformer includes a primary coil 51 and a secondary coil 52. Transformers are essentially composed of the primary and secondary coils, and ***energy is transferred***

Claim Limitation	Exemplary Prior Art Disclosures
	from the primary coil to the secondary coil by an induced voltage. According to an exemplary embodiment of the invention, ***the primary coil and the secondary coil are separately mounted in two different devices and charging can be performed when the two devices are close to each other without being contacted with each other***, unlike the related art in which primary and secondary coils are in one device. For example, the ***primary coil 51*** is provided in a first device 31 and the ***secondary coil 52*** is provided in a second device 32. When the distance between the two devices is smaller than a predetermined distance, the primary coil 51 and the secondary coil 52 constitute a transformer such that energy can be transferred. In this case, the first device serves as a charger, and the second device is charged by energy from the first device. Sagoo, 3:52-4:4. An ***inductive coil 180 serves as the primary coil or the secondary coil*** according to whether the mobile device supplies energy or is supplied with energy, as described with reference to FIG. 2. The ***inductive coil 180*** performs the function of the secondary coil when the mobile device is in the load mode, and performs the function of the primary coil when the mobile device is in the source mode. Sagoo, 5:22-30. In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode. The second device 102 is in the source mode and the power control/conversion unit 112 is connected to the inverter 162. DC energy of the battery 132 is converted into an alternating current by the inverter 162, and the alternating current is supplied to the first device 101 through the inductive coil 182 serving as a primary coil of a transformer. The charge sensor unit 142 checks the amount of charge in the battery 132 and provides information on the charge of the battery to the power control/conversion unit 112 to prevent excessive charging of the battery. **Sagoo, 6:26-42.**

Claim Limitation	Exemplary Prior Art Disclosures
	A first device 103 and a second device 106 receive energy from a third device 104. The second device 106 and the third device 104 each have ***two inductive coils***, and can operate in the load mode or the source mode. ***An inductive coil 184 of the third device 104 is coupled with an inductive coil 183 of the first device 103 so as to supply energy, and an inductive coil 185 of the third device 104 is coupled with an inductive coil 187 of the second device 106 so as to supply energy***. Sagoo, 6:52-60; *see also id.* Figs. 2-7. **Schuessler** Schuessler discloses coils. For example: Bi-directional charging device 105 includes ***a coil for receiving or delivering power***, a rechargeable battery for storing energy, and electronics to control the receiving and delivering of power. Bi-directional charging device 105 is discussed in detail below with respect to FIG. 2. Schuessler, 2:27-31. FIG. 2 illustrates a block diagram of components of an exemplary bi-directional charging device 200 including ***a coil 205***, a selection mechanism 210, a rechargeable battery 215, an external connection interface 220, a control mechanism 225, an external indicator interface 230, an external communication interface 235, and connections 240-250. Bi-directional charging device 200 may include more or fewer components than those shown. In one implementation, for example, the external connection interface 220, the external indicator interface 230, or the external communication interface 235 may not be included. In another implementation, there may be multiple coils 205 or multiple batteries 215. Other implementations are also possible. In each implementation of a bi-directional charging device 105 ***at least one coil 205 is selectively used to provide power to at least one rechargeable battery 215 and to receive power from at least one rechargeable battery 215***. ***Coil 205 is configured to receive or deliver power. Coil 205 may be metal, ceramic, semiconductor material, or other material suitable for forming coils, and may be one or more layers. Thus, coil 205 may be, for example, a ring, multiple layers of rings, a trace around a circuit board, or multiple layers of a MEMS (microelectromechanical systems) device, to name just a few***.

Claim Limitation	Exemplary Prior Art Disclosures
	Coil 205 generally is coupled to circuitry, not shown in FIG. 2, for the ***transfer of energy through coil 205***. For example, coil 205 may be included in a resonant circuit for energy transfer through resonance. As another example, coil 205 may be included in a switched power amplification circuit. Coil 205 may be included in a wide variety of other circuits for delivering or receiving power. Circuits including coil 205 may include the capability for tuning the energy delivery or receipt frequency. ***Coil 205 may represent multiple coils 205***. In a first exemplary implementation with multiple coils 205, separate coils are used to receive and to deliver power. In a second exemplary implementation, different coils are used to receive or to deliver power at different frequencies, for example, to power multiple devices in parallel, or to receive power at one frequency and deliver power at another frequency. Schuessler, 3:62-4:27; *see also id.* Figs. 1-2. **Yeh** Yeh discloses a wireless receiving and transmitting unit that comprises an internal winding for converting between electrical current and magnetic force. For example: In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. ***When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current.*** Yeh, 6:30-37. When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives ***electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2*** thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. Yeh, 6:51-58.

Claim Limitation	Exemplary Prior Art Disclosures
	Cook Cook discloses antennas coupling via magnetic field or electric field. For example: FIG. 1 illustrates wireless power transmission system 100, in accordance with various exemplary embodiments. Input power 102 is provided to ***a transmitter 104 for generating a magnetic field 106 for providing energy transfer. A receiver 108 couples to the magnetic field 106 and generates an output power 110*** for storing or consumption by a device (not shown) coupled to the output power 110. Both the transmitter 104 and the receiver 108 are separated by a distance 112. In one exemplary embodiment, transmitter 104 and receiver 108 are configured according to a mutual resonant relationship and when the resonant frequency of receiver 108 and the resonant frequency of transmitter 104 are matched, transmission losses between the transmitter 104 and the receiver 108 are minimal when the receiver 108 is located in the "near-field" of the magnetic field 106. Transmitter 104 further includes ***a transmit antenna 114 for providing a means for energy transmission and receiver 108 further includes a receive antenna 118 for providing a means for energy reception or couplin***g. The transmit and receive antennas are sized according to applications and devices to be associated therewith. As stated, an efficient energy transfer occurs by coupling a large portion of the energy in the near-field of the transmitting antenna to a receiving antenna rather than propagating most of the energy in an electromagnetic wave to the far-field. In this near-field, a coupling may be established between the transmit antenna 114 and the receive antenna 118. The area around the antennas 114 and 118 where this near-field coupling may occur is referred to herein as a coupling-mode region. Cook, ¶¶28-29; *see also* Cook, Figs. 1-3. As illustrated in FIG. 3, ***antennas used in exemplary embodiments may be configured as a "loop" antenna 150, which may also be referred to herein as a "magnetic," "resonant" or a "magnetic resonant" antenna***. Loop antennas may be configured to include an air core or a physical core such as a ferrite core. Furthermore, an air core loop antenna allows the placement of other components within the core area. In addition, an air core loop may more readily enable placement of the receive antenna 118 (FIG. 2) within a plane of the transmit antenna 114 (FIG. 2) where the coupled-mode region of the transmit antenna 114 (FIG. 2) may be more effective.

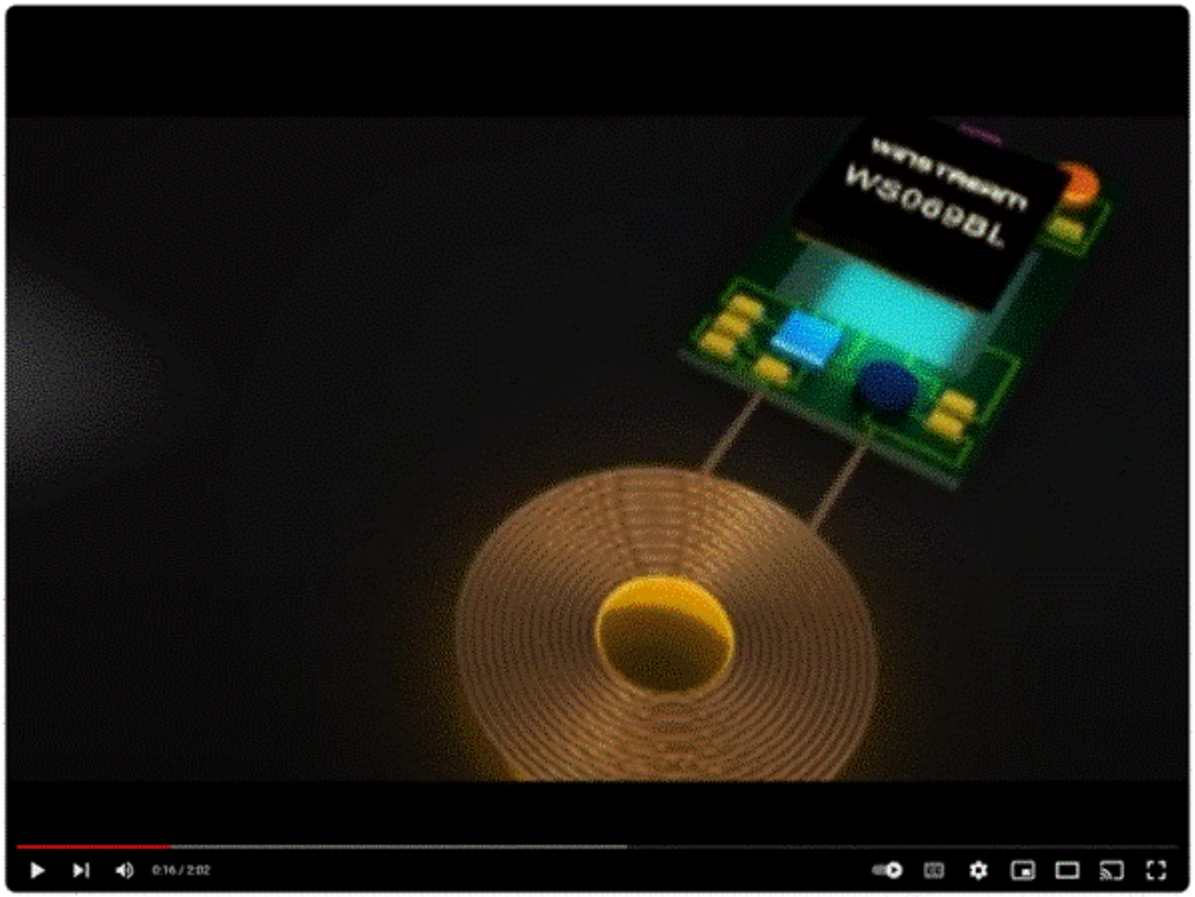
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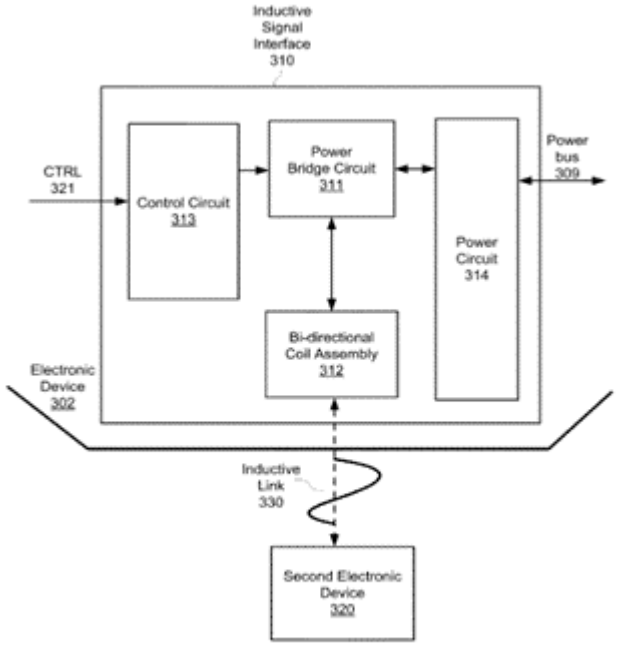
Claim Limitation	Exemplary Prior Art Disclosures
	Cook, ¶33 Exemplary embodiments of the invention include coupling power between two antennas that are in the near-fields of each other. As stated, the near-field is an area around the antenna in which electromagnetic fields exist but may not propagate or radiate away from the antenna. They are typically confined to a volume that is near the physical volume of the antenna. In the exemplary embodiments of the invention, antennas such as single and multi-turn loop antennas are used for both transmit (Tx) and receive (Rx) antenna systems since most of the environment possibly surrounding the antennas is dielectric and thus has less influence on a magnetic field compared to an electric field. Furthermore, antennas dominantly configured as "electric" antennas (e.g., dipoles and monopoles) or a combination of magnetic and electric antennas is also contemplated. The Tx antenna can be operated at a frequency that is low enough and with an antenna size that is large enough to achieve good coupling efficiency (e.g., >10%) to a small Rx antenna at significantly larger distances than allowed by far-field and inductive approaches mentioned earlier. If the Tx antenna is sized correctly, high coupling efficiencies (e.g., 30%) can be achieved when the Rx antenna on a host device is placed within a coupling-mode region (i.e., in the near-field or a strongly coupled regime) of the driven Tx loop antenna Furthermore, wireless power transmission approaches may be affected by the transmission range including device positioning (e.g., close "proximity" coupling for charging solutions at virtually zero distance or "vicinity" coupling for short range wireless power solutions). Close proximity coupling applications (i.e., strongly coupled regime, coupling factor typically k>0.1) provide energy transfer over short or very short distances typically in the order of millimeters or centimeters depending on the size of the antennas. Vicinity coupling applications (i.e., loosely coupled regime, coupling factor typically k<0.1) provide energy transfer at relatively low efficiency over distances typically in the range from 10 cm to 2 m depending on the size of the antennas. Cook, ¶¶36-38. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly

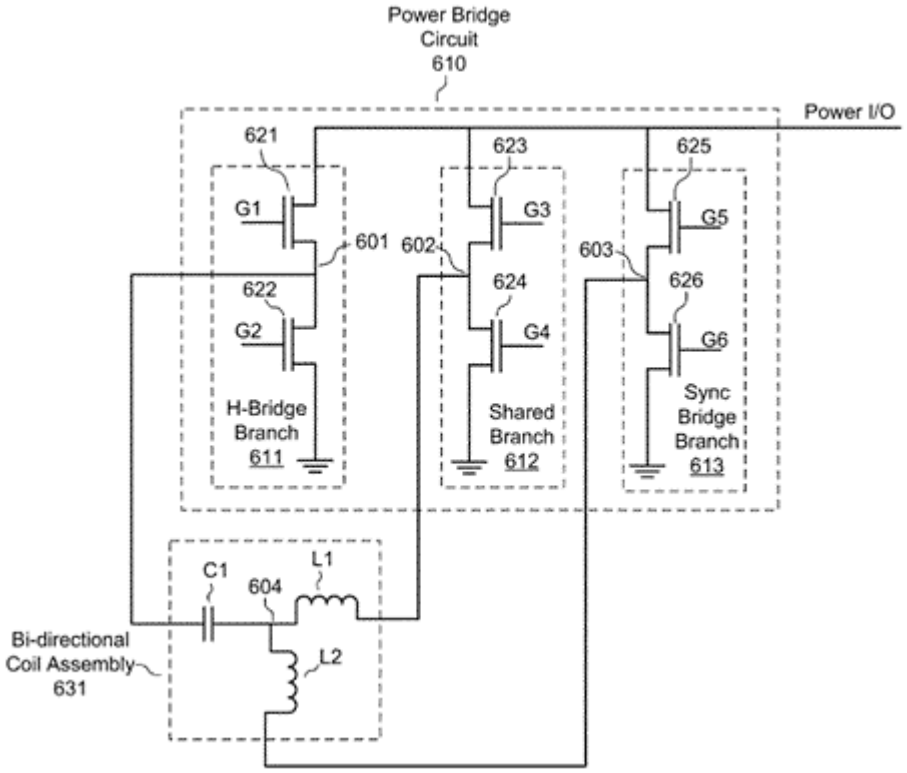
Claim Limitation	Exemplary Prior Art Disclosures
	couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. ***Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception***. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter. ***Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0***. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/***coil***) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among

Claim Limitation	Exemplary Prior Art Disclosures
	similarly configured electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes ***an antenna 306***, a bidirectional power conversion circuit 308 and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane. Cook, ¶50. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an ***antenna 306R***. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit

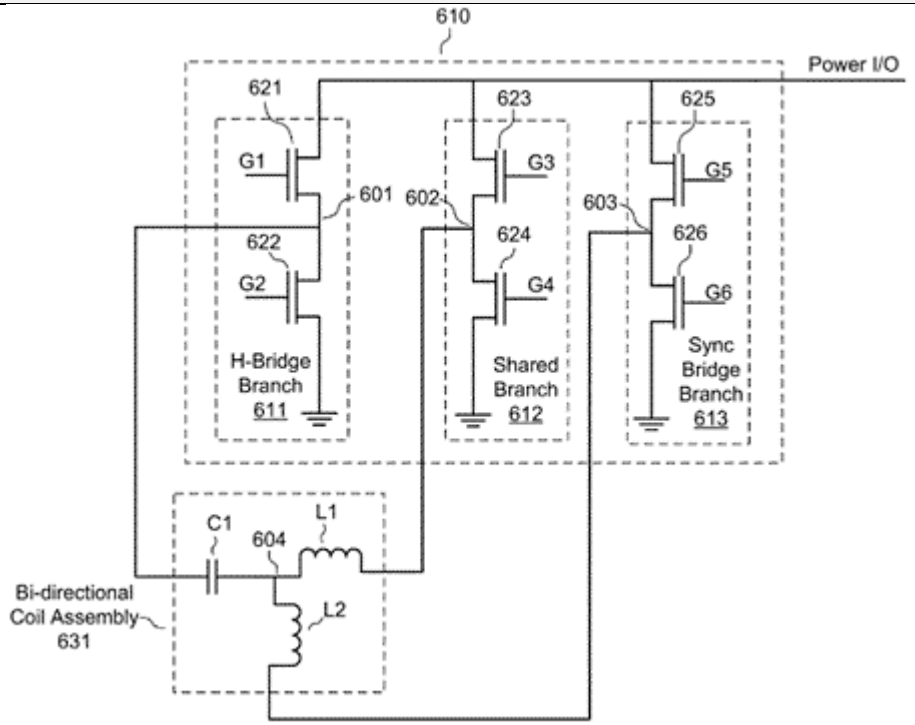
Claim Limitation	Exemplary Prior Art Disclosures
	mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. Cook, Figs. 7-10.
[1b] a first circuitry comprising: an impedance network; a switch network; a filter capacitor;	On information and belief, the Winstream Solution discloses this limitation. For instance, the Winstream Solution comprises a first circuitry with illustrated components. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 (https://www.youtube.com/watch?v=lwsTdYXpWxI) To the extent the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the references below. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee First, Chatterjee discloses and/or renders obvious "a first circuitry comprising: an impedance network." Chatterjee discloses a bi-directional coil assembly whose impedance is changeable. For example:  FIG. 3 Chatterjee, Fig. 3; *see also id.* Fig. 4. By selectively turning off the H-bridge branch 611 or the sync bridge branch 613, the power bridge circuit 610 is configurable to ***selectively turn off current paths in the bi-directional coil assembly 631 to change the impedance of the bi-directional coil assembly 631 based on the mode of operation of the inductive signal interface***. For example, in the power receive mode of the inductive signal interface, the current paths through the bi-directional coil assembly 631 caused by the power bridge

Claim Limitation	Exemplary Prior Art Disclosures
	circuit 610 is the series combination of the capacitor C1 and the inductive coil L1. In the power transmit mode, the current path through bi-directional coil assembly 631 caused by the power bridge circuit 610 is the series combination of the inductive coils L1 and L2. Chatterjee, ¶ 66.  Chatterjee, Figs. 6A; *see also id*. Figs. 6B-6D, ¶¶ 61-73. *See generally* Chatterjee, Figs. 7, 9, 10. Second, Chatterjee discloses and/or renders obvious "a first circuitry comprising: . . . a switch network." Chatterjee discloses a power bridge circuit that form different circuits depending on the mode of operation.

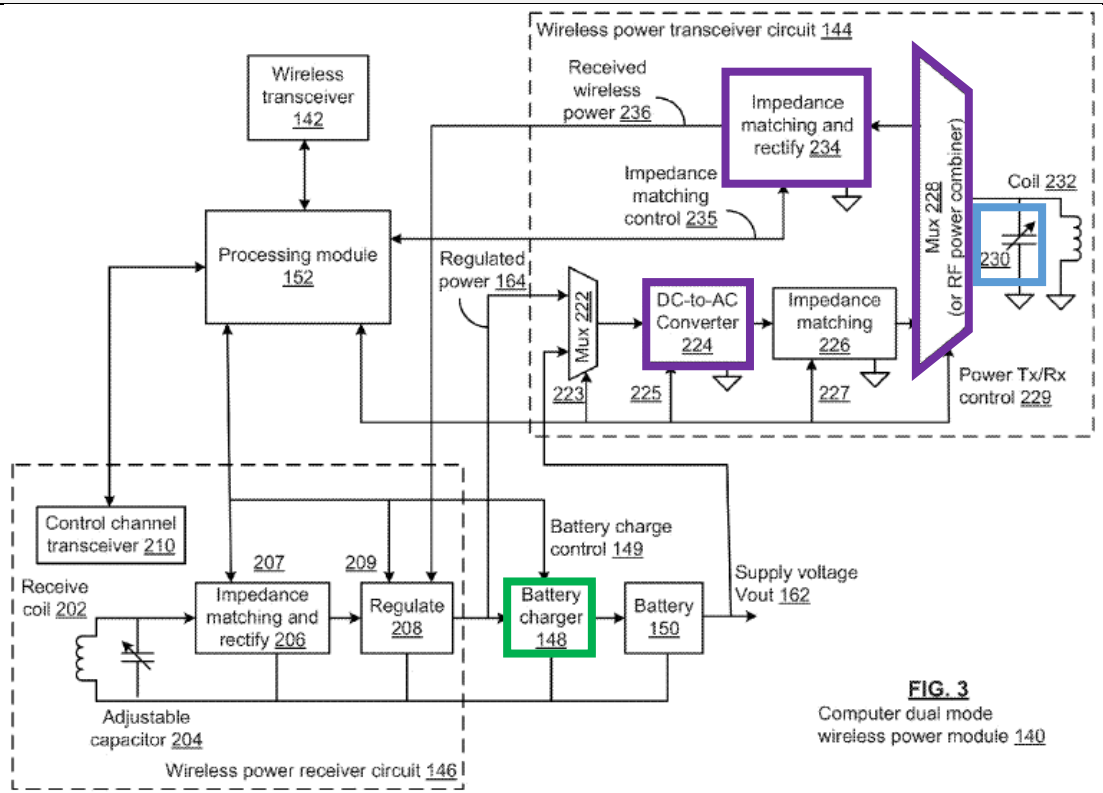
Claim Limitation	Exemplary Prior Art Disclosures
	For example: According to embodiments described herein, the power bridge circuit **311** corresponds to a circuit element that is used by the inductive signal interface **310** when in both power transmit and power receive modes. ***More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode***. FIG. 6A illustrates a circuit level embodiment of the power bridge circuit **311**, **411**, **511** and the bi-directional coil assembly **312**, **412**, **512** of FIGS. 3, **4**, and **5**, respectively. An embodiment depicted shows the ***power bridge circuit 610 as being "3-legged", meaning the power bridge circuit includes an H-bridge branch, a synchronous bridge rectifier branch, and a shared branch for use with either the H-bridge or the synchronous bridge rectifier branch***. Chatterjee, ¶¶ 38, 61. In the power transmit mode of the inductive signal interface, the power I/O transmits an input DC current to the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the input DC current can be a regulated current transmitted by the power circuit **314** or **414**. ***In the power transmit mode, G5 and G6 are de-asserted by the control logic so that the switches 625 and 626 in the sync bridge branch 613 are in an off (i.e. open) state. Thus, the sync bridge branch 613 is off while the H-bridge branch 611 and the shared branch 612 are active***. Accordingly, current flow through the inductor L**2** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of capacitor C**1** and inductive coil L**1**. In the power receive mode of the inductive signal interface, the power I/O transmits an output DC current from the power bridge circuit **610**. Referring back to FIGS. 3 and 4, for example, the output DC current may be transmitted via the power bus to the power circuit **314** or **414** which performs voltage and current regulation on the output DC current in order to output a regulated current. ***In this mode of operation of the inductive signal interface, the signals G1 and G2 de-asserted such that the switches 621 and 622 of the H-bridge branch 611 are in the off state. Thus, the H-bridge branch 611 is off while the sync bridge branch 613 and the shared branch 612 are active***. By turning off the H-bridge branch **611**, current flow through capacitor C**1** is turned off and current flow through the bi-directional coil assembly **631** is directed through the series combination of inductive coils L**1** and L**2**. Chatterjee, ¶¶ 64–65.

Claim Limitation	Exemplary Prior Art Disclosures
	 Chatterjee, Fig. 6A; *see also id.* Fig. 6B–6D, ¶¶ 61-73. ***FIG. 1 illustrates an H-bridge inverter circuit 110 for transferring power from a DC supply 120 to an AC load 115***. The H-bridge inverter circuit **110** includes four switches **111**-**114** each controlled by a respective one of control signals H**1**-H**4**. During the operation of the H-bridge inverter **110**, the switches **111**-**114** turn on and off in pairs to deliver an AC current to the AC load **115**. For example, at one instance, the signals H**1** and H**4** are asserted to turn on switches **111** and **114**, while the signals H**2** and H**3** are de-asserted to turn off the switches **112** and **113**. Current flows from DC power supply **120** through switch **111**, to the AC load **115**, through the switch **114**, and to a ground voltage or a negative supply voltage. At another instance, the signals H**1** and H**4** are de-asserted to turn off switches **111** and **114**, while the signals H**2** and H**3** are asserted to turn on the switches **112** and **113**. During this instance, the current flows from the DC supply **120** through the switch **113**, to the AC load **115**,

Claim Limitation	Exemplary Prior Art Disclosures
	through the switch **112**, and to the ground voltage or the negative supply voltage. By altering the direction of the current flow, the H-bridge inverter is configured to deliver an AC current from the DC supply **120** to the AC load **115**. ***FIG. 2 illustrates a sync bridge circuit 210 for transferring power from an AC supply 215 to a DC load 220***. The sync bridge circuit **210** includes four switches **211**-**214** each controlled by a respective one of control signals S**1**-S**4**. The sync bridge circuit **210** receives an AC current from the AC supply **215**, and the switches **211**-**214** of the sync bridge circuit **210** turn on and off in pairs to deliver a DC current to the DC load. Chatterjee, ¶¶ 3–4; *see also id.* Figs. 1–2. 3. The inductive signal interface of claim 2, wherein two of the three branches operate to form an H-bridge circuit while the inductive signal interface operates in the power transmit mode. 4. The inductive signal interface of claim 2, wherein two of the three branches operate to form a synchronous bridge rectifier circuit while the inductive signal interface operates in the power receive mode. Chatterjee, cls. 3, 4. *See generally* Chatterjee, Figs. 7-11. Third, Chatterjee discloses and/or renders obvious a "a first circuitry comprising: . . . a filter capacitor." For example: The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. ***The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode)***. The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal.

Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 37. The power circuit 414 operates in a similar fashion as the power circuit 314 of FIG. 3 to handle current received in either the power transfer mode or the power receive mode. The power bridge circuit 411 operates in a similar fashion as the power bridge circuit 311 of FIG. 3. Chatterjee, ¶ 44. FIG. 10 illustrates a power bridge circuit and a bi-directional coil assembly, together **1010**, coupled to current conditioning circuitry, under an embodiment. The power bridge circuit and bi-directional coil assembly combination **1010**, which may be any of the above described embodiments, is coupled via a signal line Power I/O to a decoupling circuit 1020. ***The decoupling circuit 1020 operates to act as a filter for certain signal frequencies and prevents those signals from passing through.*** Chatterjee, ¶¶ 89; *see also id.* Fig. 10. **Van Der Lee** First, Van Der Lee discloses and/or renders obvious "a first circuitry comprising: an impedance network." Van Der Lee discloses and/or renders obvious a capacitor and/or a coil whose impedance is adjustable. For example:

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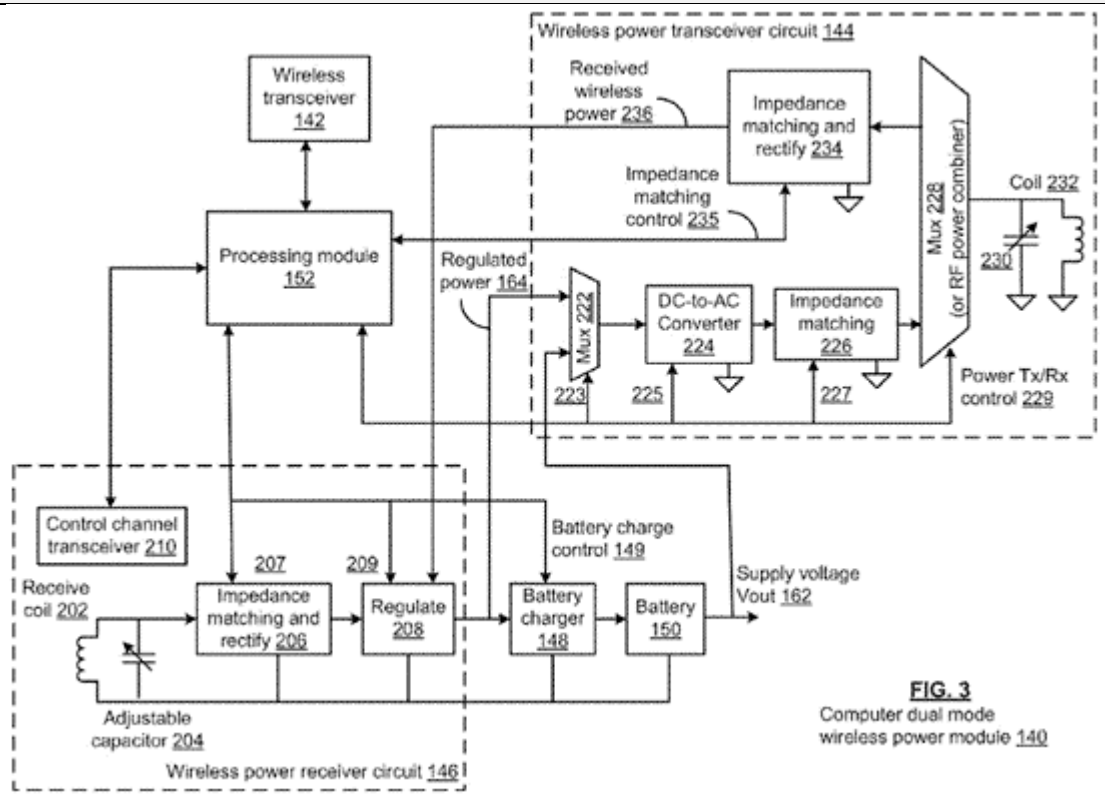
Van Der Lee, Fig. 3.

> The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, a DC-to-AC converter 224, an impedance matching circuit 226, an impedance matching and rectify circuit 234, ***an adjustable capacitor 230***, and a coil 232.

Van Der Lee, ¶ 51.

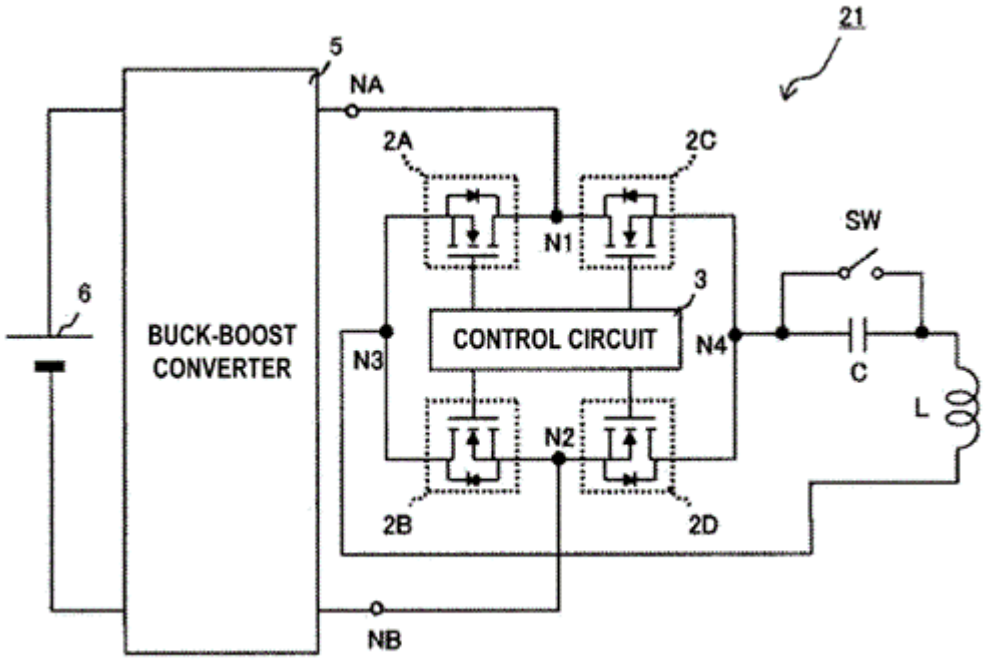
> In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228.

Claim Limitation	Exemplary Prior Art Disclosures
	The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224 at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. ***As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit***. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54, Fig. 3; *see also id.* ¶¶ 62, 73, Fig. 4. Van Der Lee discloses and/or renders obvious "a first circuitry comprising: . . . switch network". Van Der Lee discloses a rectifier, an inverter, and/ a multiplexer that chooses between the two modes of operation. For example:

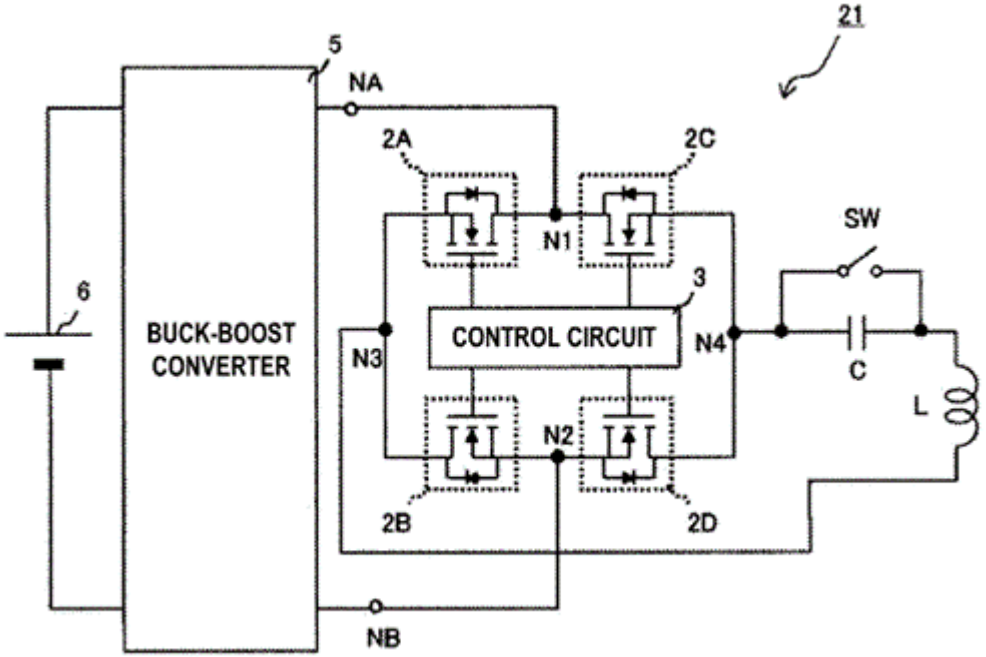
Claim Limitation	Exemplary Prior Art Disclosures
	 Van Der Lee, Fig. 3. The wireless power receiver circuit 146 includes receive (RX) coil 202, an adjustable capacitor 204, the impedance matching & rectify circuit 206, the regulation circuit 208, and the control channel transceiver 210. The wireless power conversion transceiver circuit 144 includes a multiplexer 228, ***a DC-to-AC converter 224***, an impedance matching circuit 226, an impedance matching and ***rectify circuit 234***, an adjustable capacitor 230, and a coil 232. Van Der Lee, ¶ 51. Note that the processing module 152 may be fabricated on a single integrated circuit or on a multiple integrated circuit with one or more of the components of the regulator 208, ***the rectifier portion of the***

Claim Limitation	Exemplary Prior Art Disclosures
	impedance matching and rectify circuit 206 and 234, battery charger 148, and/or a battery current sense. Van Der Lee, ¶ 59. In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. ***The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232***. ***The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224*** at a desired frequency. In an alternate embodiment, ***the DC-to-AC converter 224 may include a half bridge inverter topology***. The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232 to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or an over-damped circuit. The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module. Van Der Lee, ¶ 54. ***The processing module 142 provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit or a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 56; *see also id.* ¶¶ 62, 72-73, Fig. 4. ***The terms "circuit" and "circuitry" as used herein may refer to an independent circuit or to a portion of a multifunctional circuit that performs multiple underlying functions.*** For example, depending on the embodiment, processing circuitry may be implemented as a single chip processor or as a plurality of processing chips. Likewise, ***a first circuit and a second circuit may be combined in one embodiment into a single circuit*** or, in another embodiment, operate independently perhaps in separate chips. The term "chip," as used herein, refers to an integrated circuit. Circuits and circuitry may comprise general or specific purpose hardware, or may comprise such hardware and associated software such as firmware or object code.

Claim Limitation	Exemplary Prior Art Disclosures
	Van Der Lee, ¶ 88. Third, Van Der Lee discloses "a first circuitry comprising: . . . filter capacitor." > The primary device and/or the peripheral device may include an integrated circuit (IC) to support the above-described functions. For example, an IC may include at least a portion of the wireless power transceiver circuit (for example, one or more of the coil, capacitor, and diodes of the rectifying circuit may be off-chip), ***at least a portion of the battery charger (for example***, one or more of the switching transistors, ***the output filter capacitor***, the inductor may be off-chip), the transceiver, and the processing module. Van Der Lee, ¶ 36. **Shinoda** First, Shinoda discloses and/or renders obvious "a first circuitry comprising: an impedance network." Shinoda discloses a resonant capacitor that can be connected or bypassed in different modes. For example: > The wireless power transfer terminal 11 includes the FETs 2A to 2D, coil L, control circuit 3, a switch SW, and a resonant capacitor C. The resonant capacitor C is provided between the node N4 and the coil L, and the switch SW is provided in parallel with the resonant capacitor C. ***The capacitance of the resonant capacitor C is set such that it is connected to the coil L and resonates in series therewith***. > ***For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:52-6:2.

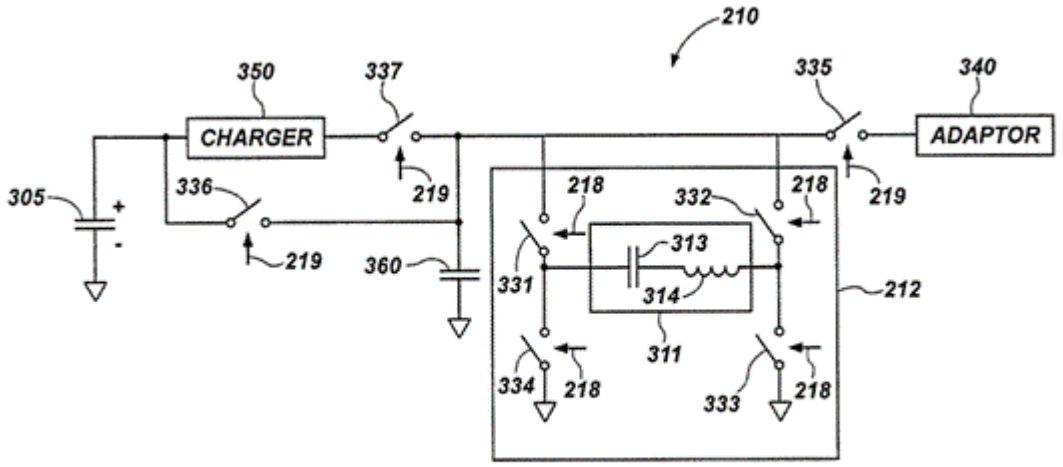
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 4, 7. Second, Shinoda discloses and/or renders "a first circuitry comprising: . . . a switch network". Shinoda discloses switching elements (FETs 2A to 2D) that operate as different circuits depending on the mode of operation. For example: FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via ***a respective power transmission circuit 103 and a power reception circuit 104***. ***The power transmission circuit 103 includes an inverter*** for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for

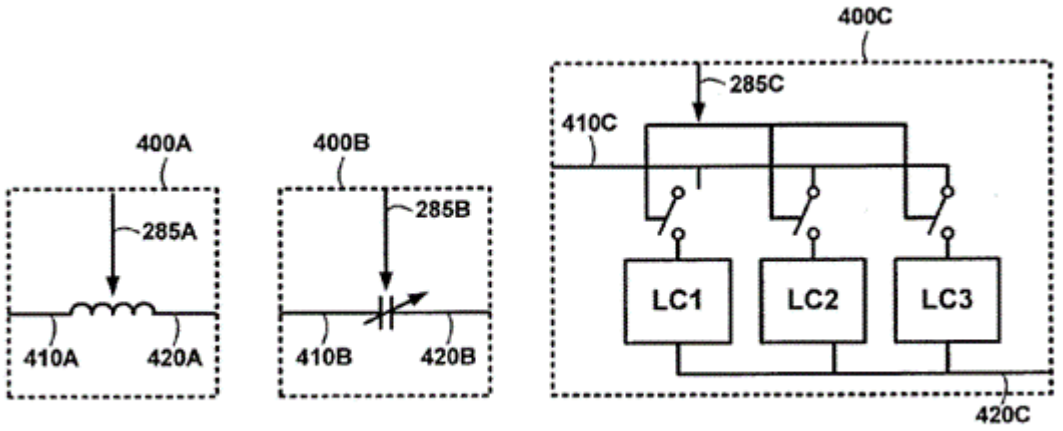
Claim Limitation	Exemplary Prior Art Disclosures
	both transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit*** for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage. Shinoda, 1:31-46. ***For a power transmission mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the ***FETs 2A to 2D function as a full-bridge inverter circuit***. Shinoda, 3:52-62. ***For a power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the ***FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. The above described parallel circuit including ***first to fourth semiconductor switching elements (i.e., FETs 2A to 2D) operating as a full-bridge inverter circuit*** can apply an alternating-current output to the coil, thus enabling the wireless power transfer terminal to transmit power. Also, the parallel circuit including the ***first to fourth semiconductor switching elements operating as a rectifier circuit*** can rectify an alternating-current input applied from the coil, thus enabling the wireless power transfer terminal to receive power. In this way, the use of the parallel circuit including the first to fourth semiconductor switching elements as a full-bridge inverter circuit or a full-wave rectifier circuit can

Claim Limitation	Exemplary Prior Art Disclosures
	reduce the total number of the semiconductor switching elements, increase space savings of the circuit configuration of the wireless power transfer terminal 1, and reduce cost of manufacturing. For the present embodiment, an FET element is used as a semiconductor switching element. With this, the parallel circuit can operate as a full-wave rectifier circuit using a parasitic diode between the drain and the source of the FET element. However, embodiments consistent with the disclosure can also be suitably carried out using other semiconductor switching elements. For example, a combination of a bipolar transistor and a diode can also be used as substantially the same circuit configuration as that of the present embodiment, and with other embodiments consistent with this disclosure. Shinoda, 5:17-43.  FIG.5

Claim Limitation	Exemplary Prior Art Disclosures
	Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** For instance, Singh-203 describes first circuitry that includes a coil 314 and/or capacitor 313 which are an impedance network, switches 331, 332, 333, and 334 which form a switch network, and capacitor 360 is a filter capacitor. For example: The wireless charging transceiver 212 includes a resonant tank 311 that includes a capacitor 313 and an inductive coil 314. The capacitor 313 and inductive coil 314 may be configured in an LC network, such as being coupled in series (as shown) or in parallel. Additional capacitors and inductive coils may be included within the LC network of the resonant tank 311. The resonant frequency of the resonant tank 311 may be based on the inductance of the inductive coil 314 and the capacitance of the plates of the capacitor 313. If the resonant frequencies of the resonant tank 311 is substantially the same as the other inductively coupled device, the coupling efficiency and wireless power transfer may be improved. The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210. Thus, during transmit mode, the wireless charging transceiver 212 may be configured to generate the wireless power signal 105 through the inductive coil 314 for providing energy transfer to a wireless power receiving apparatus. In receive mode, the wireless charging transceiver 212 may be configured to receive the wireless power signal 105 from a wireless power transmitting apparatus, such that a current is generated in the inductive coil 314 via inductive coupling. The plurality of switches 331, 332, 333, 334 may be configured as a full-bridge circuit, such that the resonant tank 311 is coupled on one end at a node between the first switch 331 and the fourth switch 334, and at a node between the second switch 332 and the third switch 333 on the other end. In other words, the first switch 331 and the fourth switch 334 may be serially coupled having a first node therebetween, and the second switch 332 and the third switch 333 may be serially coupled having a

Claim Limitation	Exemplary Prior Art Disclosures
	second node therebetween. The resonant tank 311 may be coupled between the first node and the second node. Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. Singh-203, 7:10-8:12. The capacitor 360 may act as a filter capacitor during receive mode. The capacitor 360 and the charger 350 may be configured to further smooth the DC signal and set it to an appropriate DC voltage as a power output for use by the load 215 (FIG. 2). As discussed above, the load 215 may include system components such that the rectified voltage (VRECT) is used to provide system power for the wireless power enabled device 210. The load 215 may also include an energy storage device 305 (e.g., battery) such that the rectified voltage (VRECT) is used to provide the charging power for the energy storage device 305. Some embodiments may utilize the rectified voltage (VRECT) to provide both system power and charging power simultaneously. The wireless charging transceiver 212 may be disconnected from receiving power from the energy storage device 305 and the adaptor 340 by opening the sixth switch 336, and the fifth switch 335, respectively.

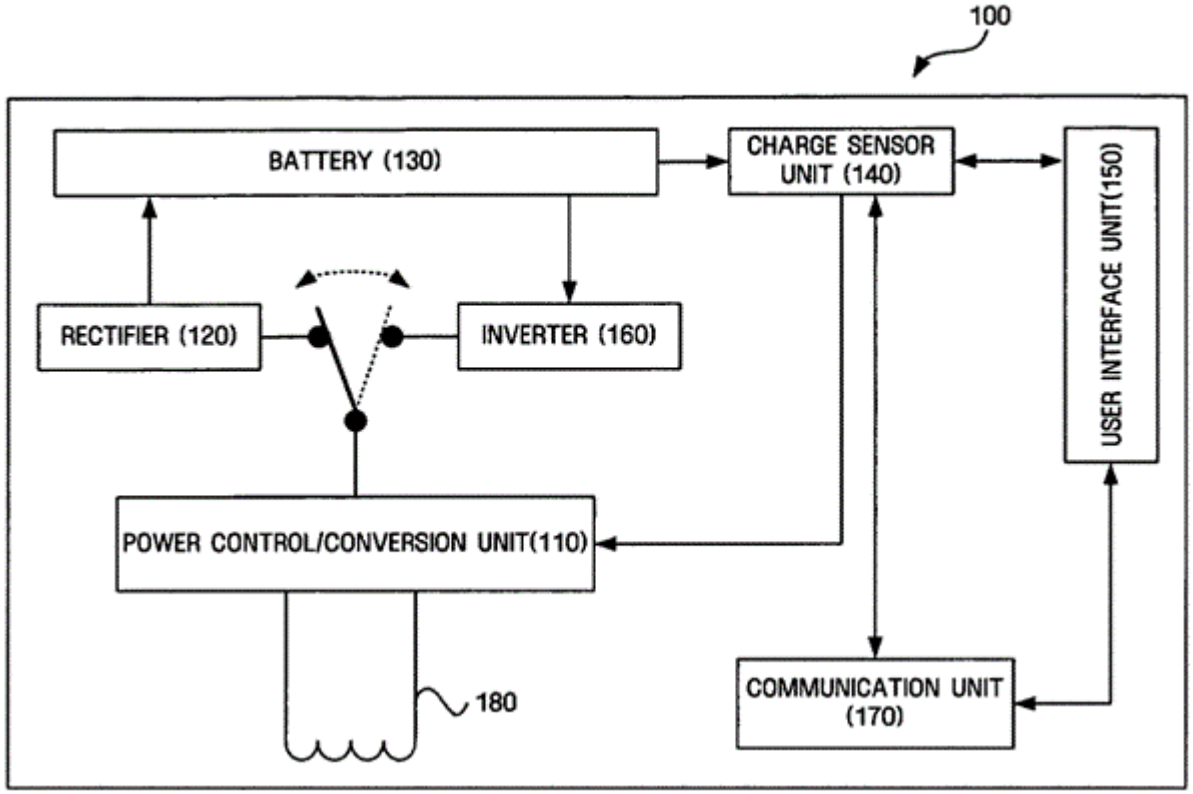
Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, 9:9-25; *see also* FIGS. 3A-3D.  FIG. 3A **Singh-167** Singh-167 teaches an impedance adjuster 400 that provides variable impedance.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 4A FIG. 4B FIG. 4C Singh-167 at Figs. 4A-4C; *see also* Singh-167, Figs. 2-3. Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN. Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above. Singh-167, ¶¶ 48-49.

Claim Limitation	Exemplary Prior Art Disclosures
	FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. **Sagoo** Sagoo discloses a power control/conversion unit coupled to the coil. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a

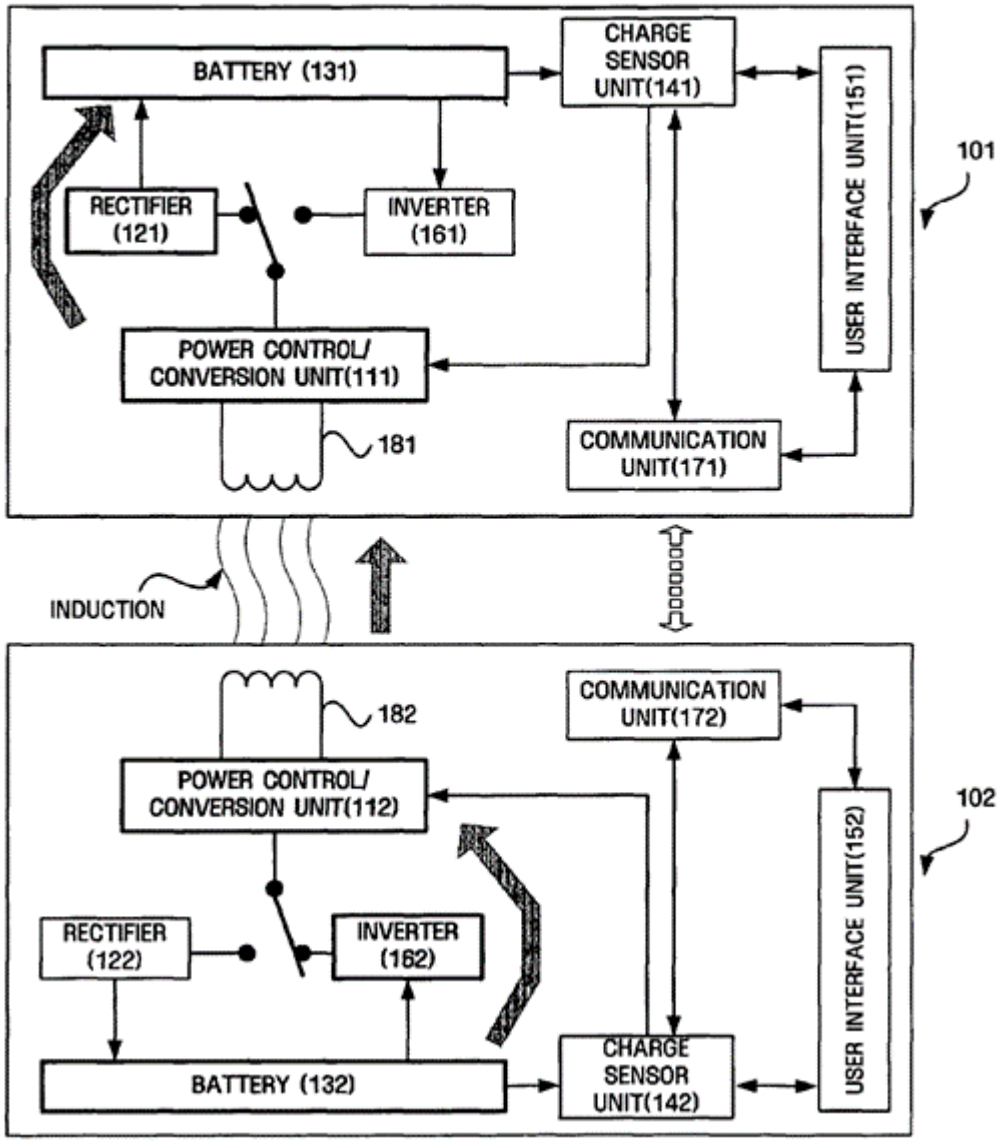
Claim Limitation	Exemplary Prior Art Disclosures
	local communication unit; instructing a first device of the detected devices to operate in the source mode; connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside; setting ***an inductive coil coupled with the power control/conversion unit*** as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device; setting an ***inductive coil coupled with the power control/conversion unit*** as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:35-55; *see also id.* Figs. 3-5. In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. ***An inductive coil 181 coupled with the power control/conversion unit 111*** serves as a secondary coil of a transformer. The first device is switched to the load mode. Sagoo, 6:26-32. Second, Sagoo discloses and/or renders "a first circuitry comprising: . . . a switch network". Sagoo discloses a rectifier and an inverter, and that the power control/conversion unit is selectively coupled to one of the rectifier and the inverter. For example: An apparatus and method of wirelessly sharing power by an inductive method are provided. The apparatus includes a first battery supplying power; a ***rectifier*** supplied with an AC voltage, converts the AC voltage into a DC voltage, and outputs the DC voltage; an ***inverter*** supplied with the DC voltage, converts the DC voltage into the AC voltage, and outputs the AC voltage; ***a power control/conversion unit connected to the rectifier or the inverter*** and supplying power to charge the first battery or a second battery that is provided in an external device as a power supply for the first battery; and a communication unit communicating with the external device.

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Abstract. ***The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage***. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage***. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160*** so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. Sagoo, 4:40-64.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 3  Sagoo, Fig. 3. A power control/conversion unit 111 of the first device 101 is connected to a rectifier 121, and the rectifier 121 converts an AC voltage into a DC voltage and provides the DC voltage to a battery 131 to charge the battery 131. A power control/conversion unit 112 of the second device 102 is connected to an inverter 162. When the inverter 162 converts a DC voltage charged in a battery 132 into an AC voltage and supplies the

Claim Limitation	Exemplary Prior Art Disclosures
	AC voltage to the power control/conversion unit 112, the power control/conversion unit 112 provides energy to the first device 101. Sagoo, 5:45-55.

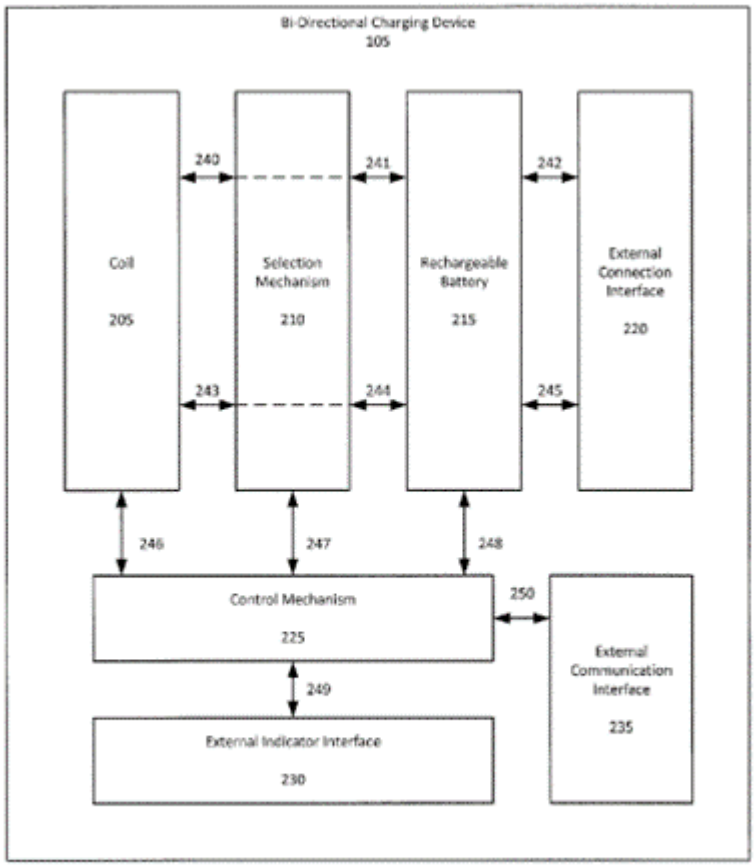
FIG. 4



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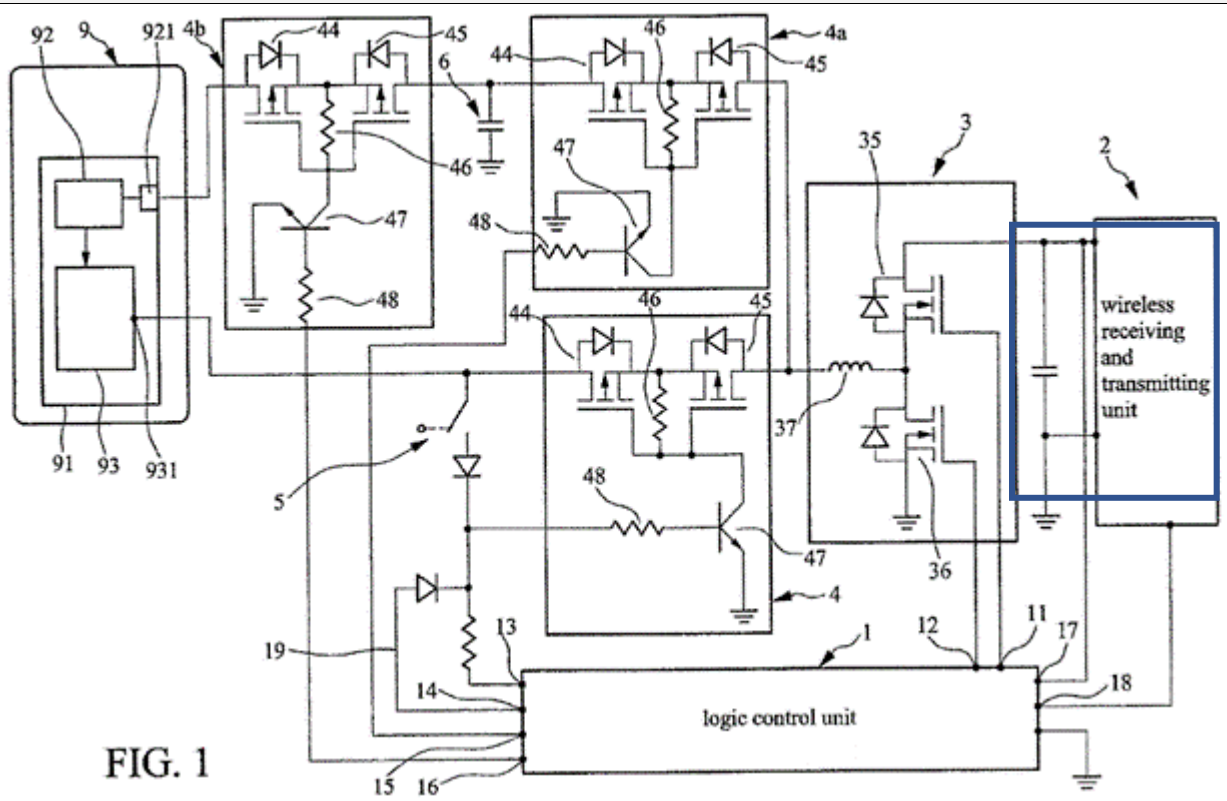
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Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, Fig. 4; *see also* Figs. 5-7. In order to charge the battery 131 by receiving energy from the selected second device 102, the ***power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131***. An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode. The second device 102 is in the source mode and the ***power control/conversion unit 112 is connected to the inverter 16***2. DC energy of the battery 132 is converted into an alternating current by the inverter 162, and the alternating current is supplied to the first device 101 through the inductive coil 182 serving as a primary coil of a transformer. The charge sensor unit 142 checks the amount of charge in the battery 132 and provides information on the charge of the battery to the power control/conversion unit 112 to prevent excessive charging of the battery. Sagoo, 6:26-42. **Schuessler** First, Schuessler discloses and/or renders obvious "a first circuitry comprising: an impedance network." Schuessler discloses circuits such as a resonant circuit, a switched power amplification circuit, and/or circuits that may include the capability for tuning the energy deliver or receipt frequency. For example: Coil 205 generally is coupled to circuitry, not shown in FIG. 2, for the transfer of energy through coil 205. For example, ***coil 205 may be included in a resonant circuit for energy transfer through resonance. As another example, coil 205 may be included in a switched power amplification circuit. Coil 205 may be included in a wide variety of other circuits for delivering or receiving power. Circuits including coil 205 may include the capability for tuning the energy delivery or receipt frequency***. Schuessler, 4:19-27. ***Control mechanism 225 may provide adjustment to coil 205, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 5:57-62.  Fig. 2 Schuessler, Fig. 2. Second, Schuessler discloses and/or renders "a first circuitry comprising: . . . a switch network". Schuessler discloses a selection mechanism that includes switching circuitry including power FETs.

Claim Limitation	Exemplary Prior Art Disclosures
	For example: Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Selection mechanism 210 may include electrical and/or mechanical selection. For example, a ***selection mechanism 210 may be a mechanical switch*** on the outside of a housing containing bi-directional charging device 105. As another example, ***selection mechanism 210 may be circuitry internal to bi-directional charging device 105, such as switching circuitry including power FETs (field effect transistors) or other electronic switches***. Selection mechanism 210 may be controlled by control mechanism 225, discussed below. Schuessler, 4:35-60. Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the ***FETs may be turned on and off by electrical signals from control mechanism 225***. Schuessler, 6:11-17. Bi-directional charging device 105 may include combinations of discrete and integrated components. For example, control mechanism 225 may include a processor implemented on a semiconductor device, and discrete input/output circuitry for the processor. Further, multiple functions or portions of functions may be integrated within one or more semiconductor devices. For example, portions of selection mechanism 210, external connection interface 220, control mechanism 225, external indicator

Claim Limitation	Exemplary Prior Art Disclosures
	interface 230, and external communication interface 235 may all be integrated within one semiconductor device. Schuessler, 7:20-30. Control mechanism 225 may be additional to an ***external selection option such as a switch*** accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 6:18-26. **Yeh** First, Yeh discloses a capacitor connected to a wireless receiving and transmitting unit.

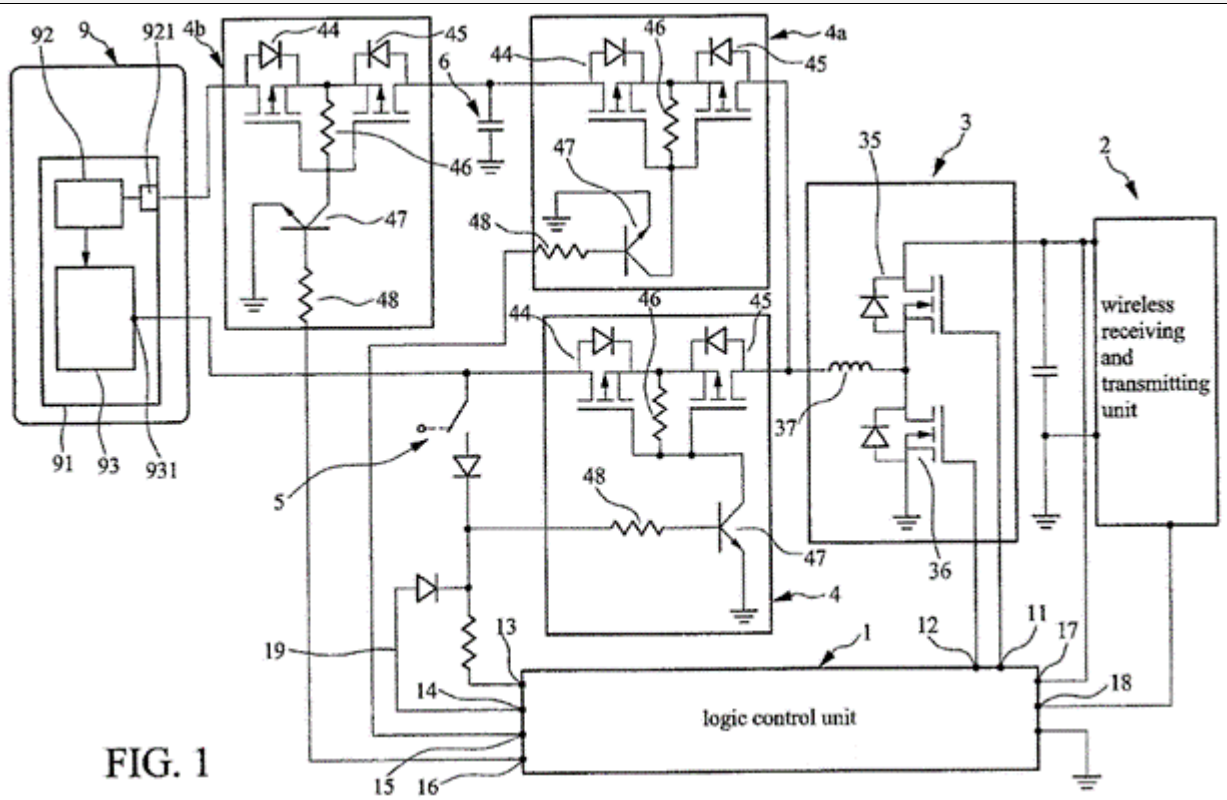
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1 Yeh, Fig. 1. Second, Yeh discloses and/or renders "a first circuitry comprising: . . . a switch network". Yeh discloses a step up/step down unit, a first reverse current protector, a second reverse current protector, and/or a third reverse current protector, that comprise switches that operate differently under different modes. For example: The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. The two control terminals 33, 34 are respectively and electrically connected to the first and second

Claim Limitation	Exemplary Prior Art Disclosures
	control pins 11, 12 of the logic control unit 1. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, ***the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification***. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36. The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. Yeh, 3:58-4:30. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1. Yeh, 4:40-47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third

Claim Limitation	Exemplary Prior Art Disclosures
	reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. Referring to FIGS. 1 and 2, ***each reverse current protector (4, 4a, 4b) comprises a first resistor 46 and serially-connected oppositely-directed first and second MOSFETs 44, 45***. Two ends of the two serially-connected MOSFETs are respectively the input terminal 41 and the output terminal 42 of the reverse current protector. The first and second MOSFETs 44, 45 each have a control terminal (not labeled), and the two control terminals are electrically connected to the control terminal 43 of the reverse current protector. The first resistor 46 has an end electrically connected between the first and second MOSFETs 44, 45 and an opposite end also electrically connected to the control terminal 43 of the reverse current protector. Further, each reverse current protector (4, 4a, 4b) further comprises a transistor 47 and a second resistor 48. The transistor 47 has a first terminal electrically connected to the control terminals (not labeled) of the first and second MOSFETs 44, 45, and a second terminal of the transistor 47 is grounded. The second resistor 48 is electrically connected between a third terminal of the transistor 47 and the control terminal 43 of the reverse current protector. Yeh, 5:17-36. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery

Claim Limitation	Exemplary Prior Art Disclosures
	93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. ***When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1***. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. Yeh, 5:44-63. if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3. ***With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2***. Yeh, 6:12-29. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 6:38-44. When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first

Claim Limitation	Exemplary Prior Art Disclosures
	through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition***, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:51-7:18.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 1 Yeh, Fig. 1; *see also id.* Figs. 2-3. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a battery. ***The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type***

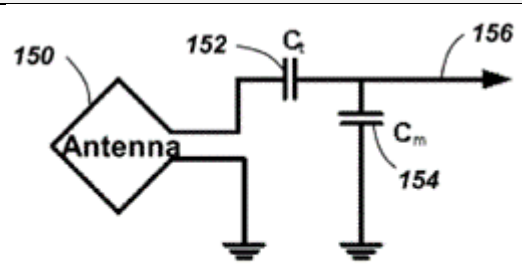
Claim Limitation	Exemplary Prior Art Disclosures
	synchronous rectification, so that step-up/step-down conversion efficiency can be improved. ***The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency***. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. Third, Yeh discloses and/or renders obvious "a first circuitry comprising . . . a filter capacitor." Yeh discloses a supercapacitor. For example: An objective of the present invention is to provide a bidirectional wireless charging and discharging device, which makes use of the arrangement of supercapacitors in specific locations and ***the supercapacitors having resistances lower than a battery to allow, in a charging operation, the supercapacitors to be charged first for blocking surges occurring in the charging operation*** and thus realizing protection against accumulated damage caused by charging of the battery; makes use of the function of preventing reverse current by first and second reverse current protectors to eliminate electrical leakage to thereby save power. Yeh, 2:52-62. To realize the above objectives, the present invention provides a bidirectional wireless charging and discharging device, which is applicable to a portable electronic device having a circuit device. The circuit device is electrically connected to a power receiving terminal and a battery. The bidirectional wireless charging and discharging device comprises a logic control unit, a wireless receiving and transmitting unit, a step-up/step-down unit, a first reverse current protector, a second reverse current protector, a control switch, and a first supercapacitor, wherein the logic control unit comprises a plurality of pins; the wireless receiving and transmitting unit has a transmission terminal and a test terminal, the test terminal being electrically connected to a detection pin of the logic control unit; the

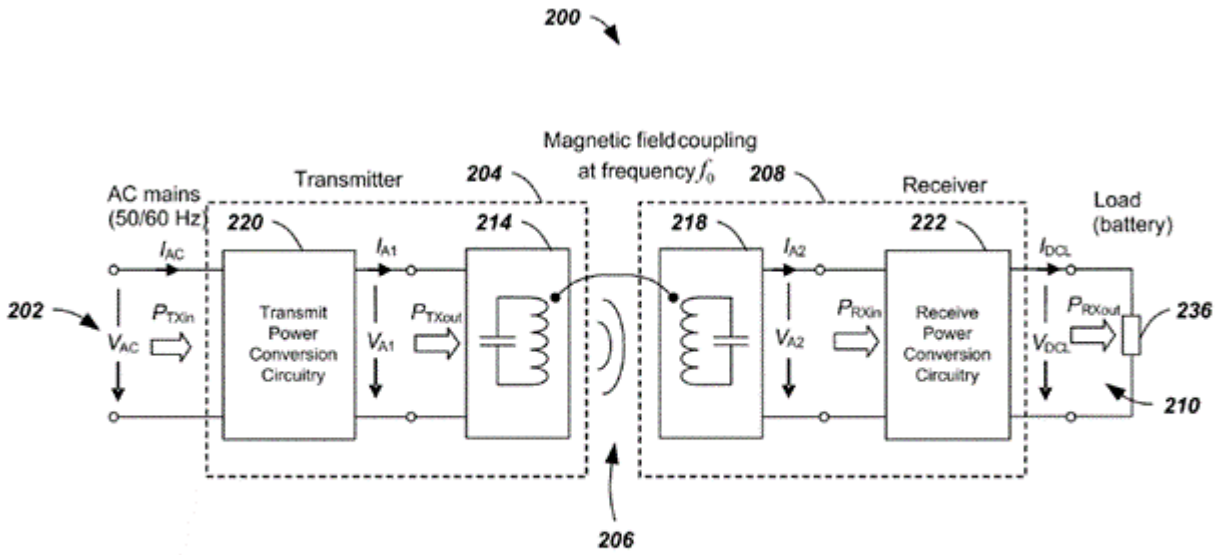
Claim Limitation	Exemplary Prior Art Disclosures
	step-up/step-down unit has a first voltage regulation terminal, a second voltage regulation terminal, and two control terminals, the second voltage regulation terminal being electrically connected to the transmission terminal of the wireless receiving and transmitting unit, the two control terminals being respectively and electrically connected to first and second control pins of the logic control unit; a power pin of the logic control unit being electrically connected to the second voltage regulation terminal and the transmission terminal that are connected to each other; the first reverse current protector has an input terminal, an output terminal, and a control terminal, the input terminal and the output terminal being respectively and electrically connected to a discharging terminal of the battery and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a third control pin of the logic control unit; the control switch has an end electrically connected to the discharging terminal of the battery and an opposite end electrically connected to the control terminal of the first reverse current protector and the third control pin of the logic control unit; the second reverse current protector has an input terminal, an output terminal, and a control terminal, the output terminal and the input terminal being respectively and electrically connected to the power receiving terminal of the circuit device and the first voltage regulation terminal of the step-up/step-down unit, the control terminal being electrically connected to a fifth control pin of the logic control unit; and the ***first supercapacitor has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounde***d. As such, ***the supercapacitor may be used block surges occurring in each charging operation in order to protect a battery from accumulated damaged caused by charging***. Further, the first and second the reverse current protectors provide a function of preventing reverse current so as to eliminate electrical leakage and thus save power. Yeh, 2:20-3:3. ***The first supercapacitor 6 has an end electrically connected to connection between the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the output terminal 42 of the second reverse current protector 4a and forms a first node 61 there. Another end of the first supercapacitor 6 is grounded***. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third

Claim Limitation	Exemplary Prior Art Disclosures
	reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not. In addition, it is possible to further comprise a second supercapacitor (not shown). ***The second supercapacitor is connected in parallel to the battery 93***. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. ***Since resistances of the first supercapacitor 6 and the second supercapacitor are lower than that of the battery 93, each time a charging operation is performed, the supercapacitors are charged first, whereby the supercapacitors may function to resist the surge occurring in the charging operation. Further, the supercapacitors can be easily charged in full and then immediately charge the battery 93***. Yeh, 4:48-5:15. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and ***the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b)*** to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.)

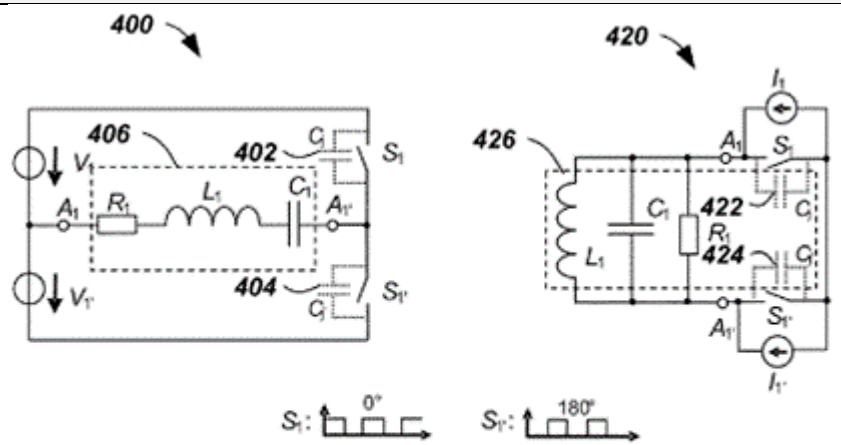
Claim Limitation	Exemplary Prior Art Disclosures
	Yeh, 6:59-7:10. In summary, the bidirectional wireless charging and discharging device for portable electronic device according to the present invention has the following features: ***Supercapacitors are arranged at specific locations and the supercapacitors have resistances lower than the battery, so that in a charging operation, the supercapacitors will be charged first and the supercapacitors can block surges occurring in charging processes in order to eliminate the accumulated damage caused in charging a batter***y. The first and second reverse current protectors 4, 4a provide protection against reverse current so that electrical leakage can be prevented and thus saving of power is realized. The step-up/step-down unit 2 is arranged as a step-up/step-down unit with synchronous rectification, preferably MOSFET type synchronous rectification, so that step-up/step-down conversion efficiency can be improved. The first to third reverse current protectors 4, 4a, 4b are provided that use the first and second MOSFETs 44, 45 as important components for reverse current prevention or switching, so that the electrical power consumed in conduction is reduced ant thus the discharging efficiency is improved to thereby improving power transmission efficiency. The bidirectional wireless charging and discharging device of the present invention is capable of wireless charging and discharging in a bidirectional manner, so that a portable electronic device 9 that is equipped with the bidirectional wireless charging and discharging device according to the present invention is chargeable in a wireless manner and is also dischargeable in a wireless manner. Yeh, 7:45-8:5. a first supercapacitor, which has an end electrically connected to a connection between the power receiving terminal of the circuit device and the output terminal of the second reverse current protector and forming a first node at the connection and an opposite end grounded. Yeh, cl. 1. 2. The bidirectional wireless charging and discharging device as claimed in claim 1 further comprising a second supercapacitor, the second supercapacitor being connected in parallel with the battery. Yeh, cl. 2; *see also* Yeh, Figs. 1-3. **Cook**

Claim Limitation	Exemplary Prior Art Disclosures
	First, Cook discloses and/or renders obvious "a first circuitry comprising: an impedance network." Cook discloses and/or renders obvious a capacitor connected to the coil and has adjustable capacitance. For example: An electronic device 120 couples to or includes the receiver 108. Receiver 108 may include a matching circuit 132 and a rectifier and switching circuit 134 to generate a DC power output to charge a battery 136 as shown in FIG. 2 or power host electronics in device 120 coupled to the receiver 108. ***The matching circuit 132 may be included to match the impedance of the receiver 108 to the receive antenna 118***. Cook, ¶31. As stated, ***efficient transfer of energy between the transmitter 104 and receiver 108 occurs during matched or nearly matched resonance between the transmitter 104 and the receiver 108***. However, even when resonance between the transmitter 104 and receiver 108 are not matched, energy may be transferred at a lower efficiency. Transfer of energy occurs by coupling energy from the near-field of the transmitting antenna to the receiving antenna residing in the neighborhood where this near-field is established rather than propagating the energy from the transmitting antenna into free space. ***The resonant frequency of the loop antennas is based on the inductance and capacitance. Inductance in a loop antenna is generally the inductance created by the loop, whereas, capacitance is generally added to the loop antenna's inductance to create a resonant structure at a desired resonant frequency***. As a non-limiting example, ***capacitor 152 and capacitor 154 may be added to the antenna to create a resonant circuit that generates a sinusoidal or quasi-sinusoidal signal 156***. Accordingly, for larger diameter loop antennas, the size of capacitance needed to induce resonance decreases as the diameter or inductance of the loop increases. Furthermore, as the diameter of the loop antenna increases, the efficient energy transfer area of the near-field increases for "vicinity" coupled devices. Of course, other resonant circuits are possible. As another non-limiting example, a capacitor may be placed in parallel between the two terminals of the loop antenna. In addition, those of ordinary skill in the art will recognize that for transmit antennas the resonant signal 156 may be an input to the loop antenna 150. Cook, ¶¶ 34-35.

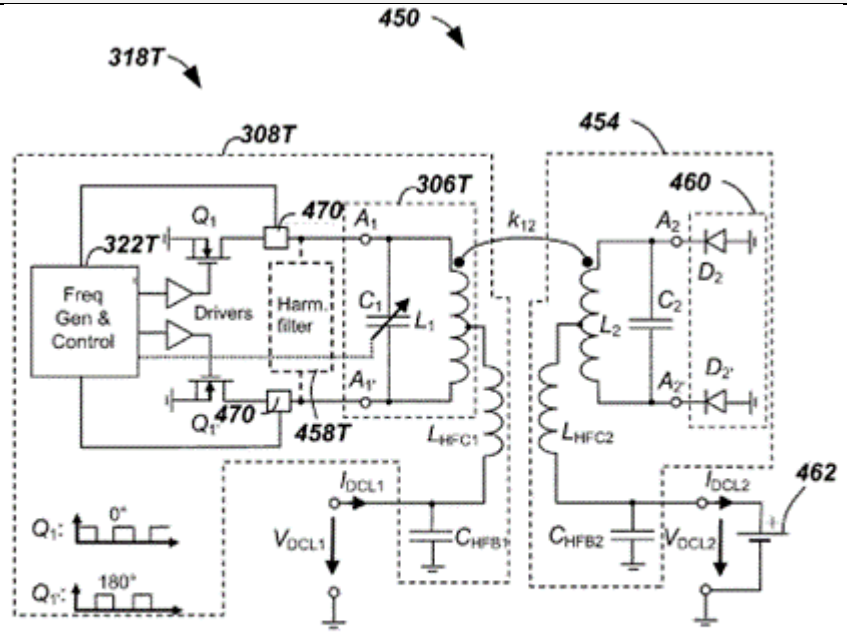
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3 *see also* Cook, Figs. 2, 3. FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter. Receiver 208 further includes a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from

Claim Limitation	Exemplary Prior Art Disclosures
	transmit antenna 214 to the receive antenna 218 via the magnetic field if ***both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0***. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41.  FIG. 4 Cook, Fig. 4 As described herein, wireless power transfer uses ***coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common***

Claim Limitation	Exemplary Prior Art Disclosures
	resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow). The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein. Cook, ¶¶45-46. As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of a half bridge rectifier topology 400 including ***a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna*** where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration. The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. ***The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency***. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 8 Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where "T" indicates a Transmitter configuration) with a half bridge active rectifier configured with the ***switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454***. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. ***Furthermore, low loss zero voltage switching, also***

Claim Limitation	Exemplary Prior Art Disclosures
	relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , a half bridge passive diode rectifier 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). ***Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency***. Cook, ¶¶54-57.

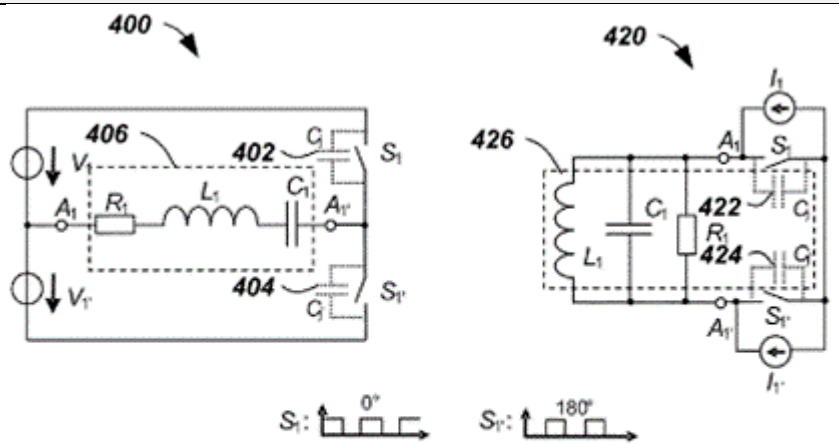
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 9 Cook, Fig. 9. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and ***an antenna 306T***. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, ***low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T, L1 and C1, to eliminate***

Claim Limitation	Exemplary Prior Art Disclosures
	any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶61. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. ***The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all.*** Cook, ¶61. *See also* Cook, Figs 7-10.

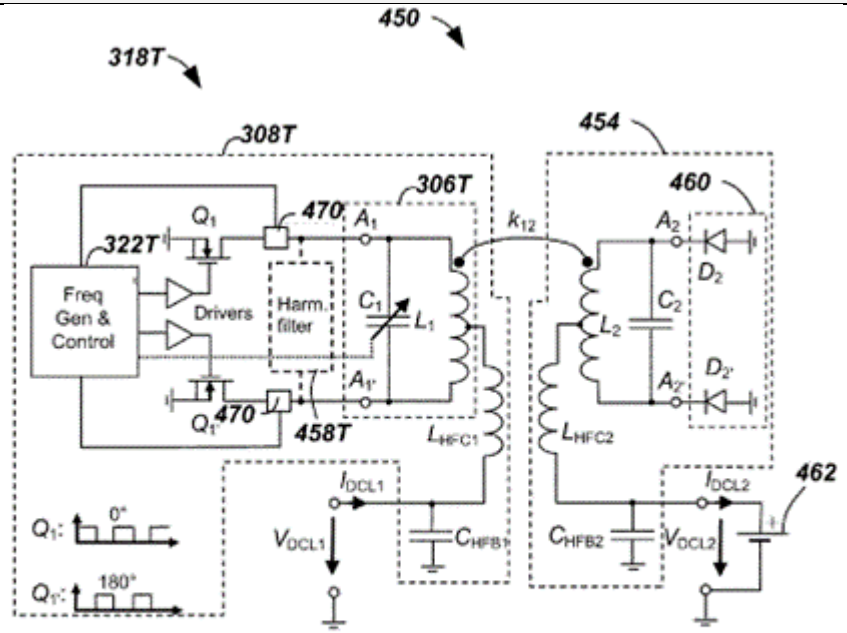
Claim Limitation	Exemplary Prior Art Disclosures
	Cook discloses and/or renders obvious "a first circuitry comprising: . . . switch network". Cook discloses a power conversion circuit that comprises synchronous switches that operate differently under different modes. For example: FIG. 4 illustrates a functional block diagram of a wireless power transmission system configured for direct field coupling between a transmitter and a receiver, in accordance with an exemplary embodiment. Wireless power transmission system 200 includes a transmitter 204 and a receiver 208. Input power PTXin is provided to transmitter 204 at input port 202 for generating a predominantly non-radiative field with direct field coupling k 206 for providing energy transfer. Receiver 208 directly couples to the non-radiative field 206 and generates an output power PRXout for storing or consumption by a battery or load 236 coupled to the output port 210. Both the transmitter 204 and the receiver 208 are separated by a distance. In one exemplary embodiment, transmitter 204 and receiver 208 are configured according to a mutual resonant relationship and when the resonant frequency, f0, of receiver 208 and the resonant frequency of transmitter 204 are matched, transmission losses between the transmitter 204 and the receiver 208 are minimal while the receiver 208 is located in the "near-field" of the radiated field generated by transmitter 204. Transmitter 204 further includes a transmit antenna 214 for providing a means for energy transmission and receiver 208 further includes a receive antenna 218 for providing a means for energy reception. Transmitter 204 further includes ***a transmit power conversion circuit 220 at least partially functioning as an AC-to-AC converter***. Receiver 208 further includes ***a receive power conversion circuit 222 at least partially functioning as an AC-to-DC converter***. Various transmit and receive antenna configurations described herein use capacitively loaded wire loops or multi-turn coils forming a resonant structure that is capable to efficiently couple energy from transmit antenna 214 to the receive antenna 218 via the magnetic field if both the transmit antenna 214 and receive antenna 218 are tuned to a common resonance frequency, f0. Accordingly, highly efficient wireless charging of electronic devices (e.g. mobile phones) in a strongly coupled regime is described where transmit antenna 214 and receive antenna 218 are in close proximity resulting in coupling factors typically above 30%. Accordingly, various transmitter and receiver power conversion concepts comprised of a wire loop/coil antenna and power conversion circuits are described herein. Cook, ¶¶39-41.

Claim Limitation	Exemplary Prior Art Disclosures
	While wireless power transmission may occur when one device in a wireless power transmission system includes a transmitter and another device includes a receiver, a single device may include both a wireless power transmitter and a wireless power receiver. Accordingly, such an embodiment could be configured to include dedicated transmit circuitry (e.g., a transmit power conversion circuit and a transmit antenna) and dedicated receiver circuitry (e.g., a receive antenna and a receive power conversion circuit). ***Since a device is not concurrently configured as a wireless power transmitter and a wireless power receiver, reuse of common circuitry including antennas is desirable***. Accordingly, the various exemplary embodiments disclosed herein identify bidirectional power transmission, namely, the capability for a device to both receive wireless power at the device and to transmit wireless power from the device. Cook, ¶42. As described herein, wireless power transfer uses coupled resonance (e.g. capacitively loaded wire loop/coil) that is capable of efficiently coupling energy from a transmitter to a receiver via the magnetic or electric field if both transmitter and receiver are tuned to a common resonance frequency. The various exemplary embodiments described herein include a wireless power transceiver including a resonant antenna 306 and ***a bidirectional power conversion circuit 308 that can be operated in at least two quadrants, meaning that bidirectional power conversion circuit 308 can either be used as power sink (i.e., positive power flow) or as a power source (i.e., negative power flow)***. The wireless power transceiver 300 integrated into electronic devices enables wireless exchange of electrical energy among similarly configured electronic devices. ***The bidirectional power conversion circuit 308 may include a synchronous rectifier as described herein***. Cook, ¶¶45-46. FIG. 7 illustrates a block diagram of an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, ***a bidirectional power conversion circuit 308*** and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324. ***Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane***. Cook, ¶50.

Claim Limitation	Exemplary Prior Art Disclosures
	As described, the active rectifier in bidirectional power conversion circuit 306 may be configured as a synchronous rectifier. FIG. 8 illustrates circuit diagrams of ***a half bridge rectifier topology 400*** including a series resonant magnetic antenna and its dual topology 420 including a parallel resonant magnetic antenna where 'dual' refers to the dualism of electrical circuits that is well known in electrical engineering. ***A synchronous rectifier circuit further described below is based upon a half bridge inverter (push-pull Class D amplifier) topology further arranged in a dual configuration.*** The dual configuration provides performance benefits at higher frequencies (at HF, e.g. >1 MHz) with respect to switching losses and soft switching and is applicable to transmit and receive power conversion. As illustrated in circuit 400, conventional half bridge inverter designs include shortcomings relating to switching losses affecting the resonance of antenna 406 caused by junction capacitance of switch transistors. As illustrated in FIG. 8, even when soft switching at zero current control is applied, junction capacitance C j 402 needs to be charged and C j′ 404 to be discharged or vice-versa at each switching event, causing significant losses at higher frequency. This in contrast to its dual counterpart (i.e., serial-to-parallel conversion) where junction capacitances C j 422 and Cj′ 424 may be considered merged into a total capacitance comprised of C1 and junction capacitances C j 422 and Cj′ 424. The total capacitance is then adjusted to achieve resonance in the antenna 426 at the desired frequency. The circuit topology of circuit 420 performs with low dV/dt voltage across switches S1, S1′ and enables zero voltage switching, similar to Class E amplifier circuits. Cook, ¶¶52-54.

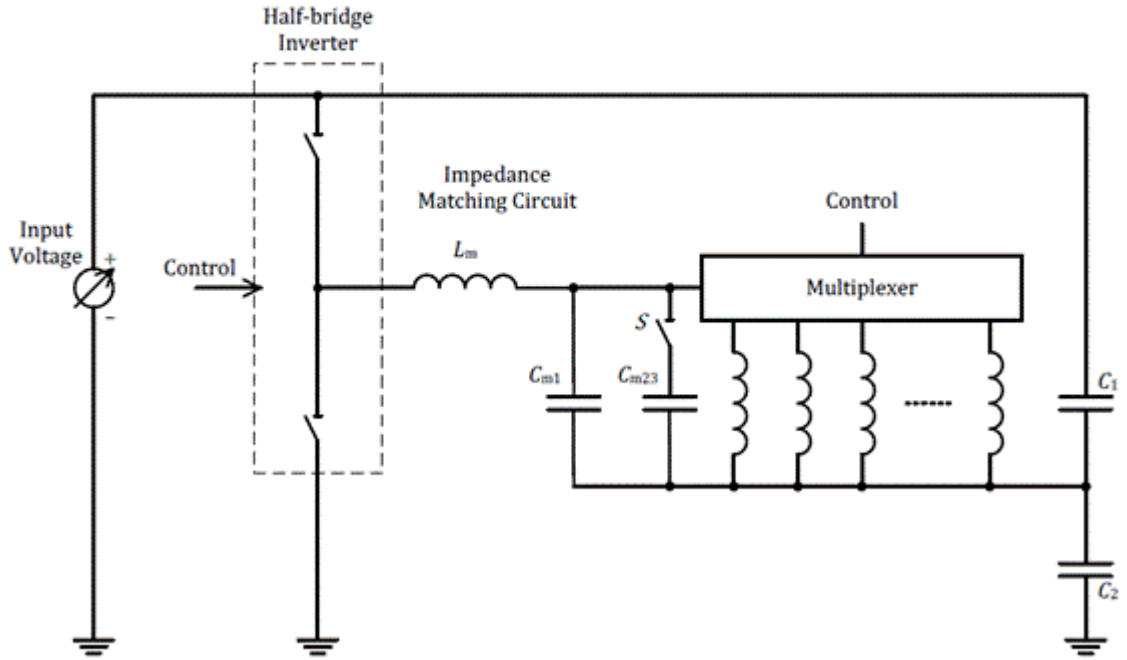
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 8 Cook, Fig. 8 FIG. 9 illustrates a circuit diagram of a wireless power transmission system, in accordance with an exemplary embodiment. A wireless power transmission system 450 includes a bidirectional wireless power transceiver 318T (where "T" indicates a Transmitter configuration) with a ***half bridge active rectifier*** configured with the switching capacitance of switches Q1 and Q1′ merged into the resonance capacitance C1and a receiver 454. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, ***a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage

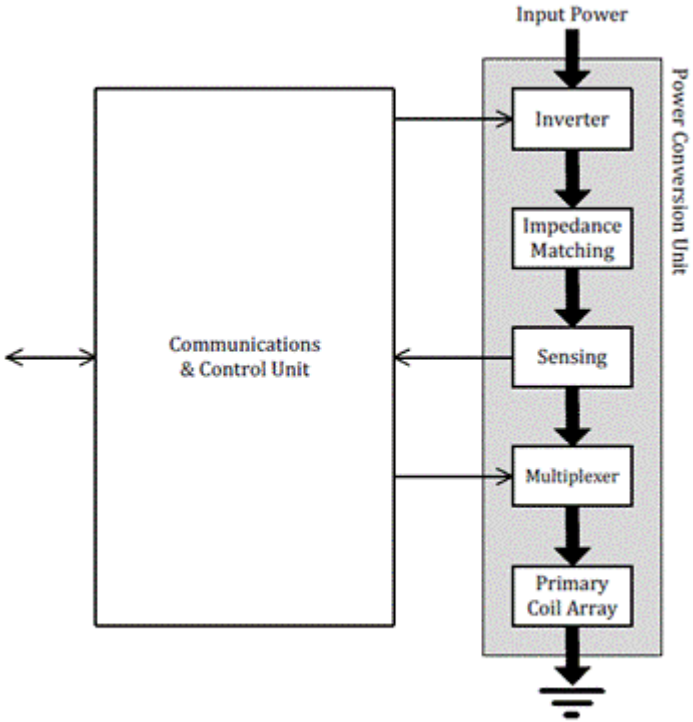
Claim Limitation	Exemplary Prior Art Disclosures
	switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. In a unidirectional device (receiver) 454 , ***a half bridge passive diode rectifier*** 460 is particularly suitable with regard to low voltage/high current charging of a battery 462 (e.g. Li-Ion). Half bridge passive diode rectifier 460 transforms the low load resistance of battery 462 into higher impedance enabling an antenna tank circuit with a realizable L-C ratio for improving receiver efficiency. Cook, ¶¶54-57.

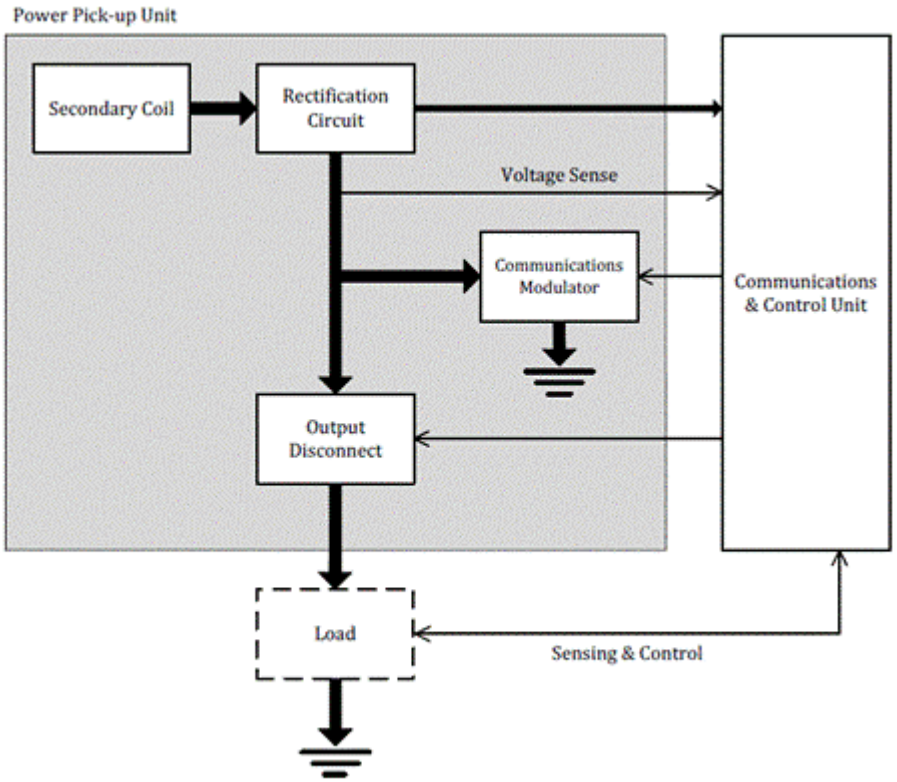
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 9 Cook, Fig. 9. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional ***power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings***. The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna 306T, L1 and C1, to

Claim Limitation	Exemplary Prior Art Disclosures
	eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting capacitor C1. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, ***a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratin***gs. The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶61. ***In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier*** and switches are controlled based on sensed voltage. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶63. Third, Cook discloses “a first circuitry comprising: . . . filter capacitor.” For example: FIG. 2 shows a simplified schematic diagram of a wireless power transmission system. The transmitter 104, driven by input power 102, includes an oscillator 122, a power amplifier or power stage 124 and a ***filter*** and matching circuit 126. The oscillator is configured to generate a desired frequency, which may be adjusted in response to adjustment signal 123. The oscillator signal may be amplified by the

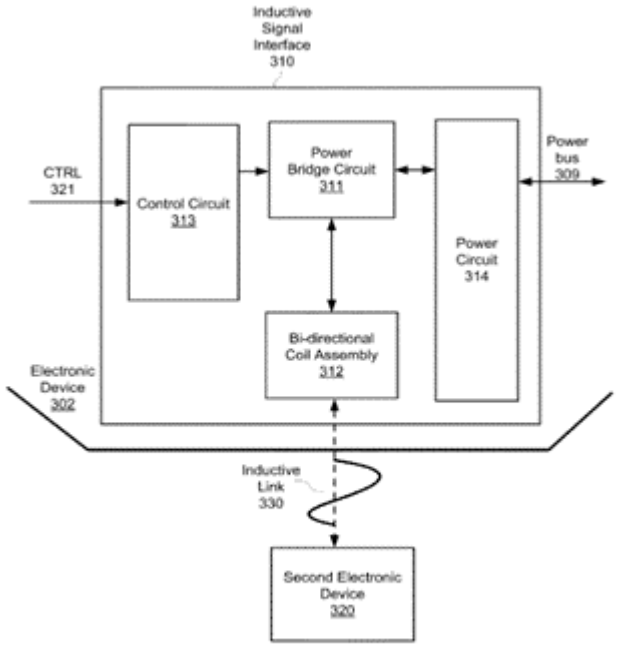
Claim Limitation	Exemplary Prior Art Disclosures
	power amplifier 124 with a power output responsive to control signal 125. The filter and matching circuit 126 may be included to ***filter out harmonics or other unwanted frequencies*** and match the impedance of the transmitter 104 to the transmit antenna 114. Cook, ¶ 30. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), odd ***harmonics filtering in form of a series resonant L-C circuits*** e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶56. Though even harmonics are potentially suppressed by the symmetric topology (push-pull), ***odd harmonics filtering in form of a series resonant L-C circuits e.g. tuned to 3rd harmonic may additionally be useful. This may be accomplished using additional series resonance, illustrated as harmonic filter 458T***, tuned to harmonic frequencies across the tank circuit of transmit antenna, L1 and C1. Cook, ¶60; *see also id.* ¶62. **WPT** For example:

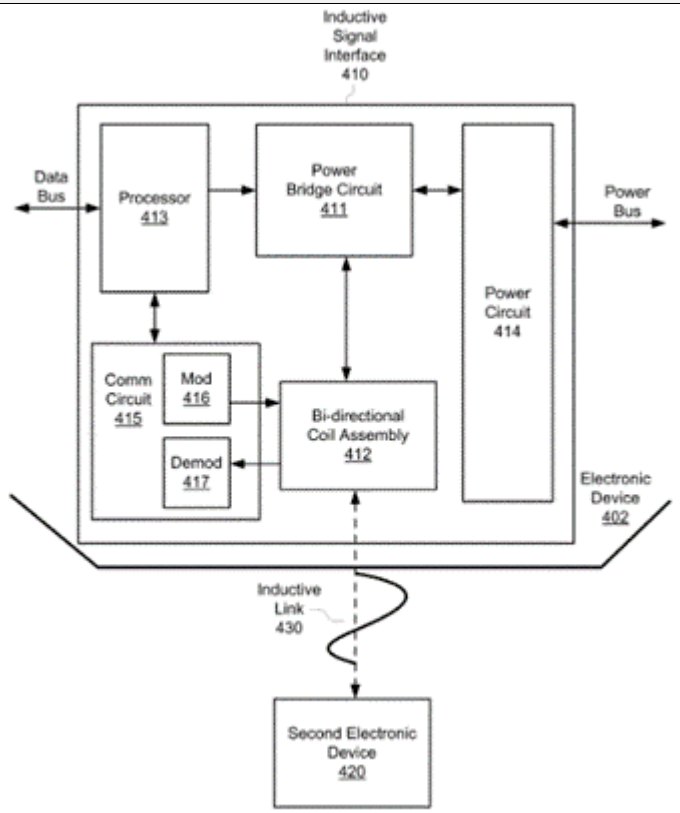
Claim Limitation	Exemplary Prior Art Disclosures
	As shown in Figure 3-12, Power Transmitter design B1 uses a half-bridge inverter to drive the Primary Coil array. In addition, Power Transmitter design B1 uses a multiplexer to select the position of the Active Area. The multiplexer shall configure the Primary Coil array in such a way that one, two, or three Primary Coils are connected—in parallel—to the driving circuit. The connected Primary Coils together constitute a Primary Cell. As an additional constraint, the multiplexer shall select the Primary Coils such that each selected Primary Coil has an overlap with every other selected Primary Coil; see Figure 3-10(c) for an example.  **Figure 3-12: Electrical diagram (outline) of Power Transmitter design B1**

Claim Limitation	Exemplary Prior Art Disclosures
	Within the Operating Frequency range $f_{op} = 105 \ldots 113$ kHz, the assembly of Primary Coil array and Shielding has an inductance of $8.1^{\pm 1}$ µH for each individual Primary Coil in layer 1 (closest to the Interface Surface), $8.7^{\pm 1}$ µH for each individual Primary Coil in layer 2, and $9.6^{\pm 1}$ µH for each individual Primary Coil in layer 3. The capacitances and inductance in the impedance matching circuit are, respectively, $C_{m1} = 300^{\pm 5\%}$ nF, $C_{m23} = 200^{\pm 5\%}$ nF,and $L_m = 3.8^{\pm 5\%}$ µH. The capacitances C_1 and C_2 in the half-bridge inverter both are 68 µF. The switch S is open if the Primary Cell consists of a single Primary Coil; otherwise, the swich S is closed. (Informative) *The voltage across the capacitance C_m can reach levels exceeding 36 V pk-pk.* WPT, 23.  **Figure 3-9: Functional block diagram of Power Transmitter design B1**

Claim Limitation	Exemplary Prior Art Disclosures
	WPT, 20.  Figure 4-1: Example functional block diagram of a Power Receiver WPT, 29.

Claim Limitation	Exemplary Prior Art Disclosures
	A.1.2 Electrical details At the secondary resonance frequency $f_S = 100$ kHz, the assembly of Secondary Coil, Shielding and magnet has inductance values $L_s = 15.3^{\pm 1}$ µH and $L'_s = 18.4^{\pm 1}$ µH. The capacitance values in the dual resonant circuit are $C_S = 137^{\pm 1\%}$ nF and $C_d = 1.6^{\pm 5\%}$ nF. As shown in Figure A-3, the rectification circuit consists of four diodes in a full bridge configuration and a low-pass filtering capacitance $C = 20$ µF. WPT, 62.
[1c] a second circuitry comprising: a control logic circuit; and a modulator/demodulator circuit;	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.,* https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html. To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the following references. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses a control circuit including e.g. a processor and a communication circuit. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3

Claim Limitation	Exemplary Prior Art Disclosures
	 **FIG. 4** Chatterjee, Figs. 3, 4, 5. First, Chatterjee discloses or renders obvious "a second circuitry comprising: a control logic circuit." Chatterjee discloses a processor that controls the operation of the circuitry the inductive signal interface. For example: The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to***

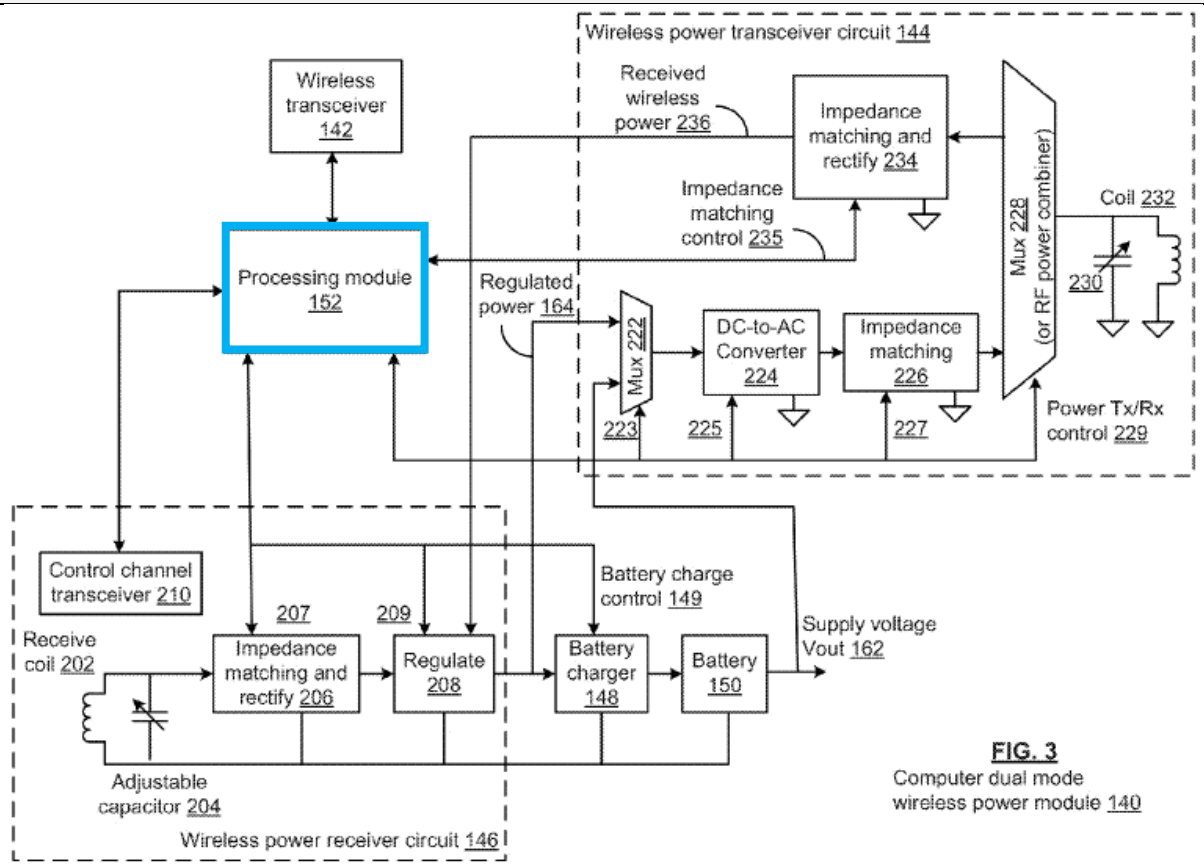
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Claim Limitation	Exemplary Prior Art Disclosures
	determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 51. The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. ***The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. The power bridge circuit 610 is operable in both the power receive and transmit modes of an inductive signal interface, such as the inductive signal interface 410 of FIG. 4. ***The operation of the power bridge circuit 610 is controlled by the signals G1-G6, which are transmitted by control logic coupled the switches 621-626***. Referring back to FIGS. 3 and 4, for example, ***the control logic may be the control element 313 or processor 413***. Chatterjee, ¶ 63. In the power transmit mode, the sync bridge branch 613 is turned off and the current path through the bi-directional coil assembly 632 is the series combination of the capacitor C2 and the inductive coil L3. In the power receive mode, the H-bridge branch 611 is turned off and the current path through the bi-directional coil assembly 632 is the inductive coil L3. Chatterjee, ¶ 69. As shown by an embodiment of FIG. 11, the MCD 1110 has a housing shell 1112 having a thickness (t). The housing shell 1112 may be used to retain internal components of the MCD 1110, such as ***a***

Claim Limitation	Exemplary Prior Art Disclosures
	circuit board, processor, memory, or components of a display assembly. The MCD 1110 may be structured so that a primary facade 1115 (e.g. the back panel) of the housing shell 1112 rests on a receiving surface 1125 of the dock 1120. Chatterjee, ¶ 94. Second, Chatterjee discloses and/or renders obvious a "a second circuitry comprising: . . . modulator/demodulator circuit." For example: The communication circuit **415** is coupled to the bi-directional coil assembly **412** in order to transmit and receive data over the inductive link **430**. ***The communication circuit includes a modulator 416 and a demodulator 417. The modulator 416 is configured to output an outgoing modulated data signal to the bi-directional coil assembly 412 to transmit the modulated data signals to the second electronic device via the inductive link 420. The demodulator 417 is coupled to the bi-directional coil assembly 412 to receive an incoming modulated data signal received over the inductive link 430***. According to embodiments, the modulation and demodulation schemes used by the modulator **416** and the demodulator **417**, respectively, may implement modulation schemes such as amplitude modulation, frequency modulation, digital modulation (such as frequency-shift keying (FSK) modulation, or phase-shift keying (PSK) modulation). The incoming modulated data signal received over the inductive link 420 is transmitted to the demodulator 417, which performs demodulation to generate a demodulated data signal. The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402. Outgoing data may be received over the data bus by the processor **413**. Alternatively, the outgoing data may originate from the processor **413**. The processor **413** transmits the outgoing data to the communication circuit **415**. ***The modulator 416 modulates the outgoing data with a carrier wave to generate the outgoing modulated data signal which is transmitted to the second electronic device via the inductive signal interface 430***. Chatterjee, ¶¶ 51-54. **Van Der Lee**

Claim Limitation	Exemplary Prior Art Disclosures
	First, Van Der Lee discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Van Der Lee discloses a processing module. For example: ***The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode based upon power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit or a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 56. Moreover, the processing module **142 [sic]** provides a power selection signal **223** to the MUX **222** between the regulated power **164** and the supply voltage Vout **162** for wireless power transmission via the wireless power transceiver circuit **144**. Moreover, ***the processing module 132 implements a battery charge control 149, a regulate control 209, an impedance matching circuit control 207, 227, and 235, a DC-to-AC control 225***, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures



Van Der Lee, Fig. 3; *see also id.* ¶¶ 53, 55, 65, Fig. 4.

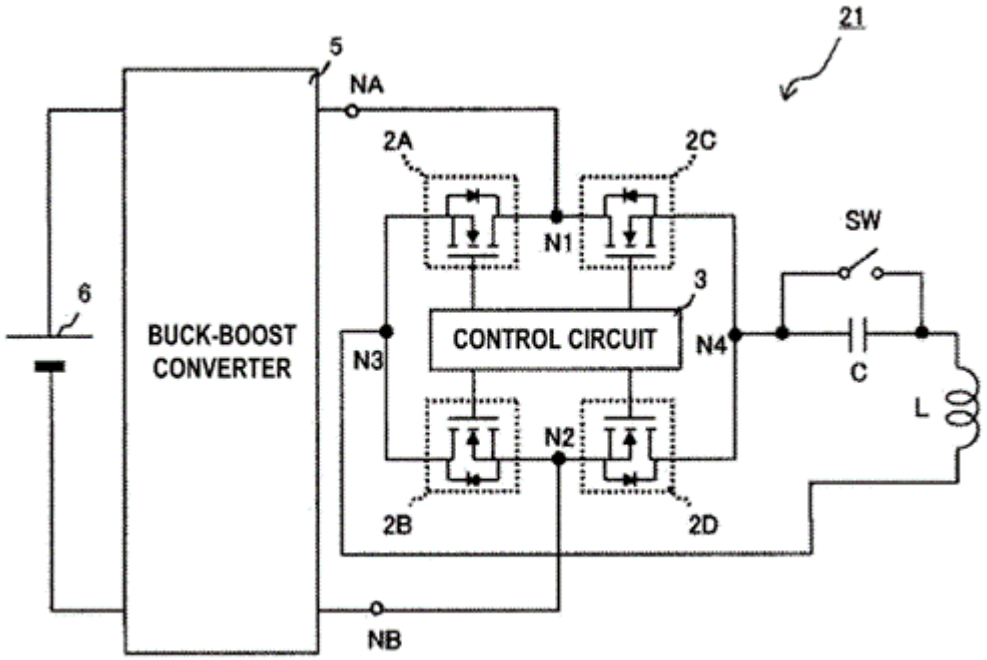
Second, Van Der Lee discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." Van Der Lee discloses that a wireless communication link and a wireless power link may be established over the same inductive link.

For example:

> ***The peripheral devices***, such as cell phone 104, smart phone 102, and personal A/V player 108 may be wirelessly powered concurrently from the computer 100 and/or sequentially. Each of the peripheral

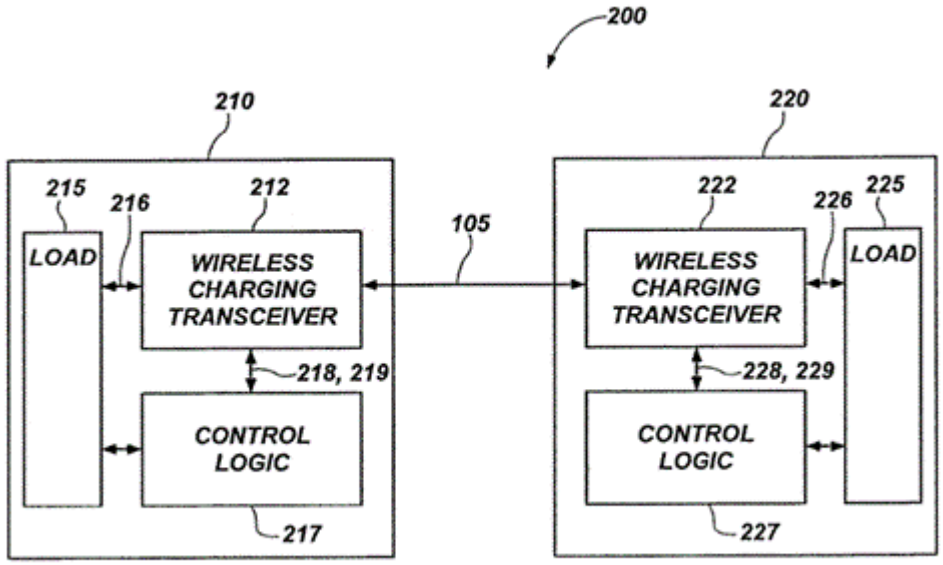
Claim Limitation	Exemplary Prior Art Disclosures
	devices 102, 104, and 108, ***wirelessly communicates via control and communication links with the computer 100 using*** conventional wireless communication protocols (such as Bluetooth) and or use ***a wireless power control channel***. The foregoing method may further include establishing the wireless power link. The wireless power link may be established based on inductive (or non-resonant) coupling or on resonant inductive coupling. ***The wireless communication link and the wireless power link may also be established via the same inductive link***. The foregoing method may further include monitoring an amount of power wirelessly transferred to the portable electronic device and charging a user of the portable electronic device based on the monitored amount. Van Der Lee, ¶¶ 25, 8. **Shinoda** First, Shinoda discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Shinoda discloses a control unit or control circuit. For example: In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power transmission mode of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, ***the control circuit 3***

Claim Limitation	Exemplary Prior Art Disclosures
	changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the FETs 2A to 2D function as a full-bridge inverter circuit. Shinoda, 3:52-62. For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, ***the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; for power reception thereof, the ***control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. Second, Shinoda discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." For example: For a power transmission mode of the wireless power transfer terminal 21, authentication communication is carried out and a response from a partner device is awaited (step S1). This ***authentication communication can be carried out by, for example, amplitude-modulating*** voltage in power transmission with constant periods using, for example, identification code or device code and detecting a response from the partner device from a change in voltage between the opposed ends of the

Claim Limitation	Exemplary Prior Art Disclosures
	coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). ***This determination is made by, for example, demodulating the response from the partner device*** and detecting code specifying the power specification. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Shinoda, 6:55-7:5. ***The partner device may preferably respond by the load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and using various kinds of code set in the partner device. Therefore, ***the wireless power transfer terminal 21 may preferably be provided with a load modulating unit*** in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-20. **Singh-203** Sing-203 describes second circuity in which control logic 217 is a control logic circuit and a modulator / demodulator circuit is included for communicating with other devices. For example: FIG. 2 is a schematic block diagram of an inductive wireless power transfer system 200 according to an embodiment of the present disclosure. The inductive wireless power transfer system 200 includes a first wireless power enabled device 210 and a second wireless power enabled device 220. The first wireless power enabled device 210 may include a wireless charging transceiver 212, a load 215, and control logic 217. Similarly, the second wireless power enabled device 220 may include a wireless charging transceiver 222, a load 225, and control logic 227. Singh-203, 5:3-12. The control logic 217, 227 may be configured to determine which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. The control signals 218, 219, 228, 229 may be transmitted to the wireless charging transceivers 212, 222 to drive the desired operations.

Claim Limitation	Exemplary Prior Art Disclosures
	As an example, the control logic 217, 227 may include a processor (e.g., microcontroller) that is configured (e.g., programmed) to determine whether the respective wireless charging transceiver 212, 222 is to operate in transmit mode or receive mode. The control logic 217, 227 may further include computer-readable media (e.g., memory) storing computing instructions for execution by the processor related to performing processes of the embodiments of the present disclosure. Memory may include volatile and non-volatile memory. The loads 215, 225 may include energy storage devices (e.g., batteries), system components of the wireless power enabled devices 210, 220, or both. Thus, the output power signals 216, 226 may be a charging signal for an energy storage device, or a system power signal for the various system components. Singh-203, 5:31-51. In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. Singh-203, 6:5-24; *see also id.*, 7:7-9 ("The plurality of switches 335, 336, 337 may be controlled by control signals 219 from the control logic 217 (FIG. 2)."). The wireless charging transceiver 212 may include a plurality of switches 331, 332, 333, 334 that are controllable by the control signals 218 from the control logic 217 (FIG. 2). Thus, the control logic 217 may control the operation of the plurality of switches 331, 332, 333, 334 to operate in either a transmit mode or a receive mode. As a result, the inductive coil 314 may act as either a transmit coil or a receive coil depending on the mode of operation of the wireless power enabled device 210.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, 7:23-31.  FIG. 2 Singh-203 also discloses a modulator / demodulator. For example, > The embodiments shown in FIG. 2, as well as in FIGS. 3A through 3D, are shown to demonstrate a wireless power enabled device being configured to operate in either a transmit mode or a receive mode, such as for wireless OTG charging. It should be recognized that the wireless power enabled device may include additional components to perform other features not specifically described herein. For example, the wireless power enabled device may include a modulator and/or a demodulator for communicating with other devices, foreign object detection modules, I/O modules for interfacing with a user, memory for storing instructions and data, various sensors, among other components. Singh-203, 9:26-37. **Singh-624**

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624 describes an analogous system and shows how the modulator/demodulator may be employed. For instance:

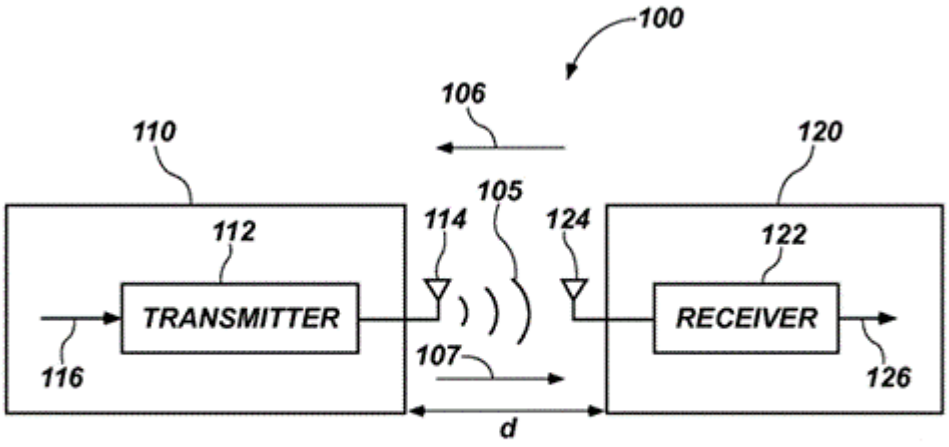
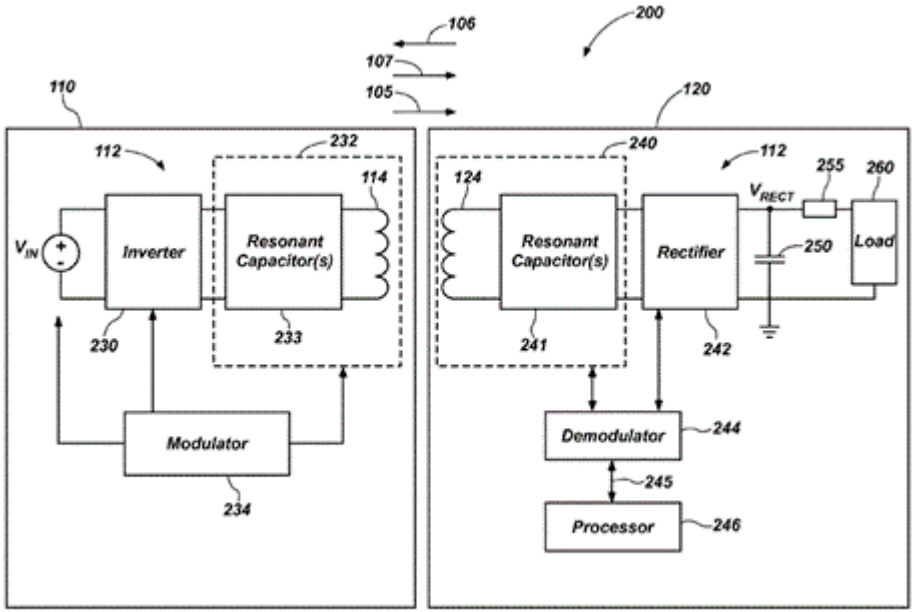


FIG. 1

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Claim Limitation	Exemplary Prior Art Disclosures
	 *FIG. 2* Singh-624, FIGS. 1-2; *see also id.*, FIG. 7. An inductive wireless power transfer device comprises a transmitter that comprises a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. An inductive wireless power receiving device comprises a receiver that comprises a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Related inductive wireless power transfer systems and methods for back-channel communication from the transmitter to the receiver of an inductive wireless power transfer system are disclosed. Singh-624, Abstract.

Claim Limitation	Exemplary Prior Art Disclosures
	During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. Embodiments of the present disclosure include an inductive wireless power transfer device. The inductive wireless power transfer device comprises a transmitter that includes a transmit coil configured to generate a wireless power signal to a coupling region in response to an input voltage, and a modulator configured to modulate the wireless power signal and encode data with the wireless power signal to establish a back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power receiving device. The inductive wireless power receiving device comprises a receiver having a receive coil configured to generate a time varying signal in response to receiving a modulated wireless power signal from a transmitter in a coupling region, and a demodulator configured to demodulate the modulated wireless power signal from an established back-channel communication link from the transmitter to a receiver. Another embodiment of the present disclosure includes an inductive wireless power transfer system. The inductive wireless power transfer system comprises a transmitter having a transmit coil configured to generate a modulated wireless power signal in a coupling region for wireless power transfer, and a receiver having a receive coil configured to couple with the transmit coil by receiving the modulated wireless power signal and to generate an output signal in response thereto to provide power to a load, wherein the modulated wireless power signal includes characters. Another embodiment of the present disclosure includes a method for communicating between a transmitter to a receiver in an inductive wireless power transfer system. The method comprises generating a wireless power signal through a transmit coil of a transmitter to a receive coil of a receiver, and modulating the wireless power signal on the transmitter side for communicating data over the wireless power signal from the transmitter to the receiver.

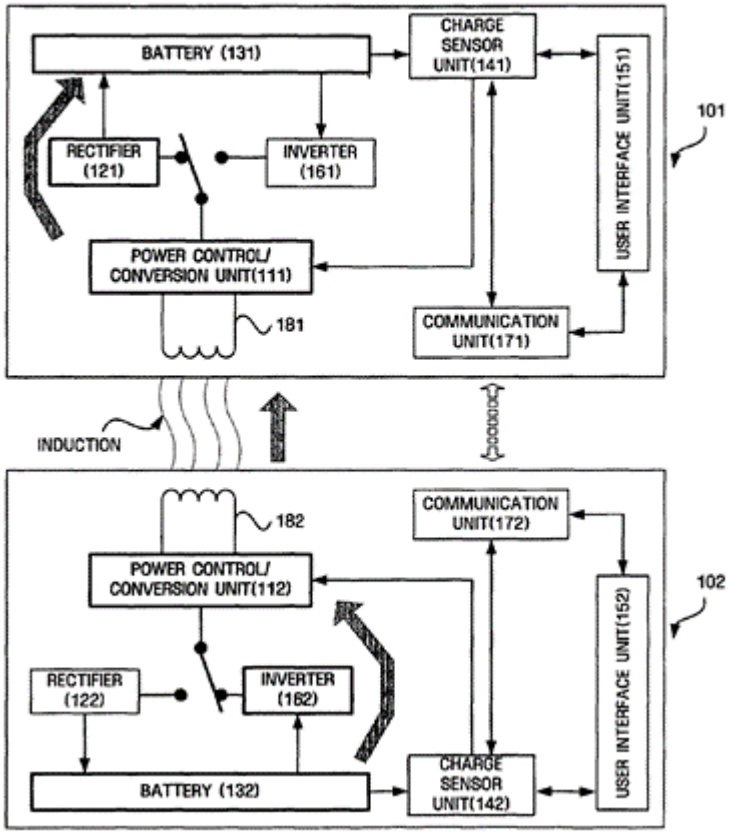
Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624, 1:56-2:25. Embodiments of the present disclosure include a back-channel communication link 107 to transmit data from the transmitter 112 to the receiver 122. The transmitter 112 may be configured to establish the back-channel communication link 107 by modulating the wireless power signal 105. In particular, the conversion gain of the wireless power signal 105 may be modulated, which may be detected responsive to the wireless power signal 105 being received and demodulated by the receiver 122. While the back-channel communication link 107 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105, it should be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils (through transmit coil 114 and receive coil 124). Thus, the wireless power signal 105 carries the communication data of the back-channel communication link 107 when the wireless power signal 105 is modulated as described herein. The arrow for the back-channel communication link 107 is merely shown separately for the purpose of indicating a direction of communication data flow. Similar to conventional wireless power transfer systems, embodiments of the present disclosure may further include a forward-channel communication link 106 for transmitting data from the receiver 122 to the transmitter 112, such as via backscatter modulation. As discussed above, conventional wireless power transfer systems may be limited to one-way communication from the receiver 122 to the transmitter 112, or else require separate RF coils for transmitting data separately from the transmit coil 114 and receive coil 124. Like the back-channel communication link 107, the forward-channel communication link 106 is shown in FIG. 1 (among other figures) as a separate arrow from the wireless power signal 105; however, it should also be appreciated that the communication signal is transmitted with the wireless power signal 105 through the same coils. Thus, the wireless power signal 105 carries the communication data of the forward-channel communication link 106 when the wireless power signal 105 is modulated according to the conventional principles of back scatter modulation. The arrow for the forward-channel communication link 106 is also shown separately for the purpose of indicating a direction of communication data flow. Singh-624, 5:38-6:11. The transmitter 112 may further include an inverter 230, a resonant tank 232, and a modulator 234. The resonant tank 232 may include one or more capacitors (e.g., resonant capacitor(s) 233) coupled with an inductor (e.g., the transmit coil 114). The capacitors and inductors may be configured in an LC

Claim Limitation	Exemplary Prior Art Disclosures
	network, such as being coupled in series or parallel. The inverter 230 is coupled between the input voltage (VIN) and the resonant tank 232. The modulator 234 may be coupled with one or more of the inverter 230, the resonant tank 232, and the input voltage (VIN) in order to modulate the wireless power signal 105 such that communication may be achieved from the transmitter 112 to the receiver 122, as will be described in more detail below. The transmitter 112 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions such as power monitoring, foreign object detection, etc. It will also be appreciated that the transmitter 112 may include a demodulator for receiving and demodulating communication received from the receiver 122. The receiver 122 may further include a resonant tank 240, a rectifier 242, a demodulator 244, and a processor 246. The resonant tank 240 may include an inductor (e.g., receive coil 124) coupled with one or more capacitor (e.g., resonant capacitor(s) 241). The resonant tank 240 is coupled with the rectifier 242, which may further be coupled to the load 260. The demodulator 244 may be coupled with one or more of the resonant tank 240, the rectifier 242, and the processor 246 in order to demodulate the received wireless power signal 105 and transmit a demodulated signal 245 to the processor 246 for analysis or other processing. The receiver 122 may include additional elements (e.g., power sense element) that are not shown herein, that may perform functions, such as power monitoring, foreign object detection, etc. It will also be appreciated that the receiver 122 may include a modulator for modulating communication to the receiver 122. Singh-624, 6:55-7:22. **Sagoo** First, Sagoo discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Sagoo discloses a power control/conversion unit and/or a communication unit that controls, e.g. which mode the mobile device operates in and the input/output levels of AC and DC voltages. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside***; setting an inductive coil coupled with the power

Claim Limitation	Exemplary Prior Art Disclosures
	control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device***; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:35-55. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy.

Claim Limitation	Exemplary Prior Art Disclosures
	The charge sensor unit 140 checks the charge state of the battery 130 and supplies the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:34-5:4. ***The communication unit 170*** performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and ***controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. Second, Sagoo discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." For example: ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices***. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied.

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, 5:5-21. An example of a process in which the two mobile devices share energy in a non-contact manner will now be described. A user having the first device 101 is informed through a user interface unit 151 that the battery does not have enough charge. The charge sensor unit 141 measures the charge state of the battery and communicates with the communication unit about the charge state of the battery. Rechargeable batteries such as the battery 131 of the first device 101 can be installed in devices, such as a notebook computer, a PDA, an MP3 player, and a game console, and have different voltages, currents, and capacities. The battery can be formed of, for example, a nickel metal hydride (NiMH) battery or a lithium-ion battery. When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a neighboring device and outputs the received information to the user interface unit 151***. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:4-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, the communication units can perform authentication with respect to each other such that charging is performed between authenticated devices. Sagoo, 6:43-48.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 4  Sagoo, Fig. 4; *see also id.* Figs. 3-7. **Schuessler**

Claim Limitation	Exemplary Prior Art Disclosures
	First, Schuessler discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Schuessler discloses a control mechanism that determines the mode for the bi-directional charging device and provides adjustment. For example: ***Control mechanism 225 represents the control hardware, firmware, and/or software that determines the mode for the bi-directional charging device 105, for example, a power receiving mode or a power delivering mode***. As discussed above, there may be multiple concurrent modes. ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown) to receive information or to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and ***control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer***. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215.

Claim Limitation	Exemplary Prior Art Disclosures
	Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. Bi-directional charging device 105 may include combinations of discrete and integrated components. For example, ***control mechanism 225 may include a processor implemented on a semiconductor device, and discrete input/output circuitry for the processor***. Further, multiple functions or portions of functions may be integrated within one or more semiconductor devices. For example, portions of

Claim Limitation	Exemplary Prior Art Disclosures
	selection mechanism 210, external connection interface 220, control mechanism 225, external indicator interface 230, and external communication interface 235 may all be integrated within one semiconductor device. Schuessler, 7:20-30. Second, Schuessler discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." For example: The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices, and controls whether the mobile device can be charged by any one of the other mobile devices. When the communication unit is made to further perform an authentication process, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Schuessler, 5:5-21. One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding charging needs and status. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. wherein the wireless communication mechanism is selected from Bluetooth, WiFi, other public or proprietary wireless protocols, ***modulation on the energy transfer itself, modulating a low frequency***

Claim Limitation	Exemplary Prior Art Disclosures
	protocol on a high frequency energy transfer, by modulating a high frequency protocol on a low frequency energy transfer or an infrared interface; Schuessler, cl. 1. **Yeh** Yeh discloses a logic control unit that controls the operation of a bi-directional wireless charging and discharging device. For example: The logic control unit 1 comprises first to sixth control pins 11-16, a power pin 17, and a detection pin 18. The remaining pin that is not labeled is a grounding pin. The wireless receiving and transmitting unit 2 comprises a transmission terminal 21 and a test terminal 22. ***The test terminal 22 is electrically connected to the detection pin 18 of the logic control unit 1***. The step-up/step-down unit 3 comprises a first voltage regulation terminal 31, a second voltage regulation terminal 32, and two control terminals 33, 34. The second voltage regulation terminal 32 is electrically connected to the transmission terminal 21 of the wireless receiving and transmitting unit 2. ***The two control terminals 33, 34 are respectively and electrically connected to the first and second control pins 11, 12 of the logic control unit 1***. The power pin 17 of the logic control unit 1 is electrically connected to the second voltage regulation terminal 32 and the transmission terminal 21 that are connected to each other. Preferably, the step-up/step-down unit 3 is a step-up/step-down unit 3 that features synchronous rectification and is of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) synchronous rectification. Referring to both FIGS. 1 and 2, the step-up/step-down unit 3 featuring synchronous rectification comprises an inductor 37 and two serially-connected and identically-directed first and second MOSFETs 35, 36. ***The first and second MOSFETs 35, 36 each have a control terminal (not labeled), and the two control terminals are respectively and electrically connected to the two control terminals 33, 34 of the step-up/step-down unit 3***. A terminal of the serially-connected first and second MOSFETs 35, 36 is electrically connected to the second voltage regulation terminal 32 and an opposite terminal grounded. The inductor 37 has an end electrically connected to the first voltage regulation terminal 31 and an opposite end electrically connected between the first and second MOSFETs 35, 36.

Claim Limitation	Exemplary Prior Art Disclosures
	The first reverse current protector 4 comprises an input terminal 41, an output terminal 42, and a control terminal 43. The input terminal 41 and the output terminal 42 are respectively and electrically connected to the discharging terminal 931 of the battery 93 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the third control pin (for transmission identification) 13 of the logic control unit 1***. Preferably, the fourth control pin 14 of the logic control unit 1 is electrically connected, in a circuit form, to the third control pin 13, namely the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 shown in the drawings. ***The control switch 5 has an end electrically connected to the discharging terminal 931 of the battery 93 and an opposite end electrically connected to the control terminal 43 of the first reverse current protector 4 and the third control pin 13 of the logic control unit 1***, wherein the connection of said opposite end of the control switch 5 with the control terminal 43 of the first reverse current protector 4 forms a second node 431. Preferably, the control switch 5 is an automatic returning switch. The second reverse current protector 4a also has an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first voltage regulation terminal 31 of the step-up/step-down unit 3. ***The control terminal 43 is electrically connected to the fifth control pin 15 of the logic control unit 1***. Yeh, 3:51-4:47. Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. ***The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not***. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging

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	device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. The transmission mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to the transmission mode, the control switch 5 is actuated to effect switching. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. ***Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode***. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. ***When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition***. ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2***:

Claim Limitation	Exemplary Prior Art Disclosures
	if there is no load: the transmission is stopped; if there is a load: ***the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3***. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current. During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 5:37-6:44. The receiving mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion.

Claim Limitation	Exemplary Prior Art Disclosures
	The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18. In the bidirectional wireless charging and discharging device according to the second embodiment of the present invention, ***the second node 431 of the first reverse current protector 4 is electrically connected to the signal output terminal 911 in order to receive the control signal supplied from the signal output terminal 911 to switch the logic control unit 1 (via the third control pin 13) to the transmission mode***. Yeh, 7:38-44. Yeh also discloses a wireless receiving and transmitting unit that may comprise a built-in antenna that can detect whether a second electronic device to be charged exist on the opposite side of the wireless charging and transmitting unit. For example: ***The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in***

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	antenna. If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2: Yeh, 6:4-10; *see also id.* Figs. 1-3. **Cook** First, Cook discloses and/or renders obvious "a second circuitry comprising: a control logic circuit." Cook discloses a frequency generation and control circuit that controls the operation of the bidirectional wireless power transceiver. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1.

Claim Limitation	Exemplary Prior Art Disclosures
	Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1′***. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all***. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to

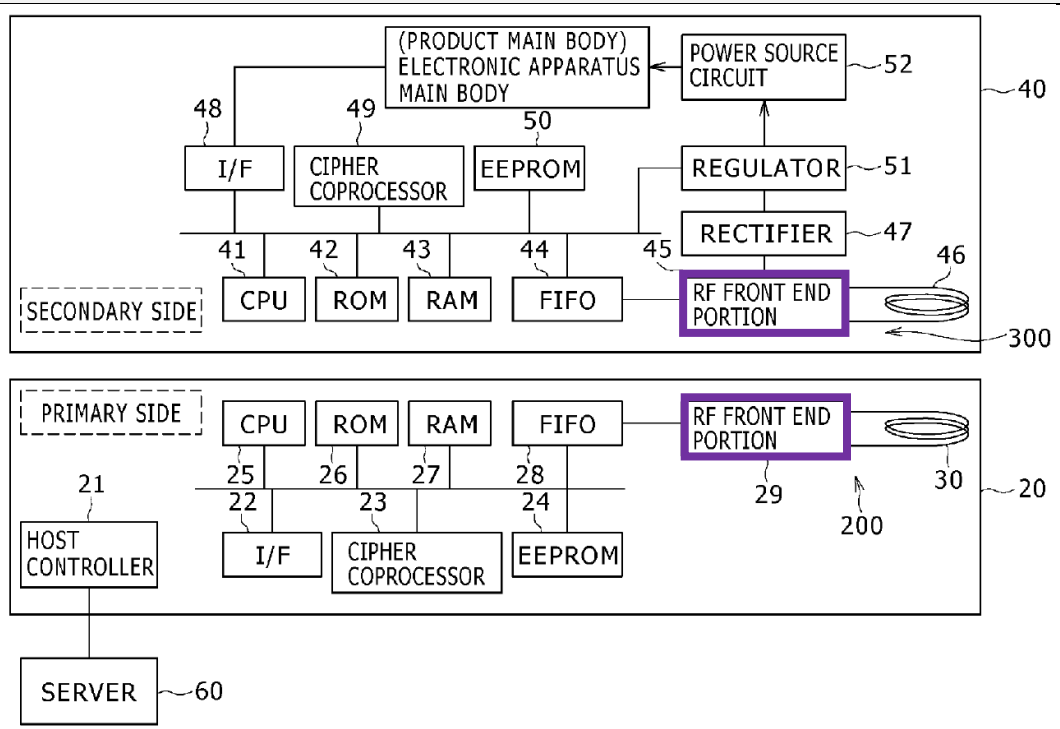
Claim Limitation	Exemplary Prior Art Disclosures
	rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. Second, Cook discloses and/or renders obvious "a second circuitry comprising: . . . a modulator/demodulator circuit." Cook discloses a communication channel that is combined with magnetic field between the transmitter and receiver. For example: A communication channel 119 may also exist between the transmitter 104 and the receiver 108. As described herein, the communication channel 119 may be of the form of Near-Field Communication (NFC). In one exemplary embodiment described herein, communication channel 119 is implemented as a separate channel from magnetic field 106 and in another exemplary embodiment, ***communication channel 119 is combined with magnetic field 106***. Cook, ¶32. **Corbridge** For example: On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. Corbridge, ¶55.

Claim Limitation	Exemplary Prior Art Disclosures
	On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate

Claim Limitation	Exemplary Prior Art Disclosures
	some data from the incoming signal 721 over the data bus 742 to the device (e.g. the device's CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0" values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received

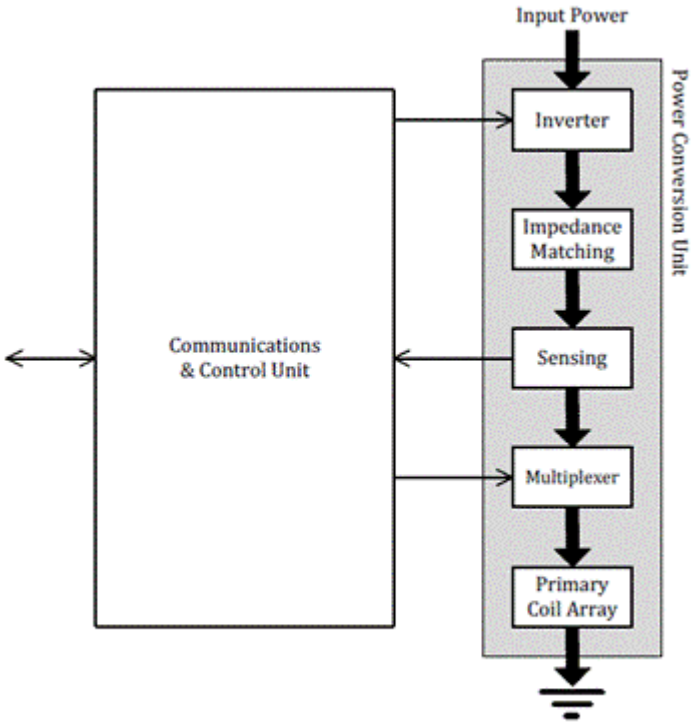
Claim Limitation	Exemplary Prior Art Disclosures
	at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signal's timing and voltage levels. Corbridge, 95. **Teramoto** For example, Teramoto discloses: Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶ 52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight saving of an

Claim Limitation	Exemplary Prior Art Disclosures
	electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17. **WPT** For example:  Figure 3-9: Functional block diagram of Power Transmitter design B1 WPT, 20.

Claim Limitation	Exemplary Prior Art Disclosures

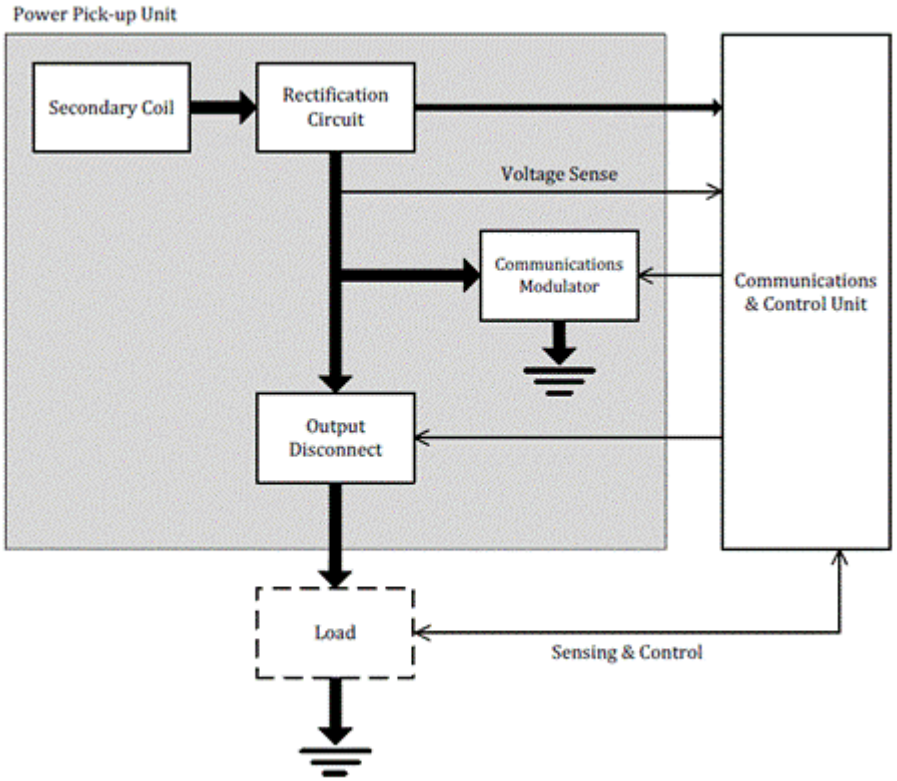


Figure 4-1: Example functional block diagram of a Power Receiver

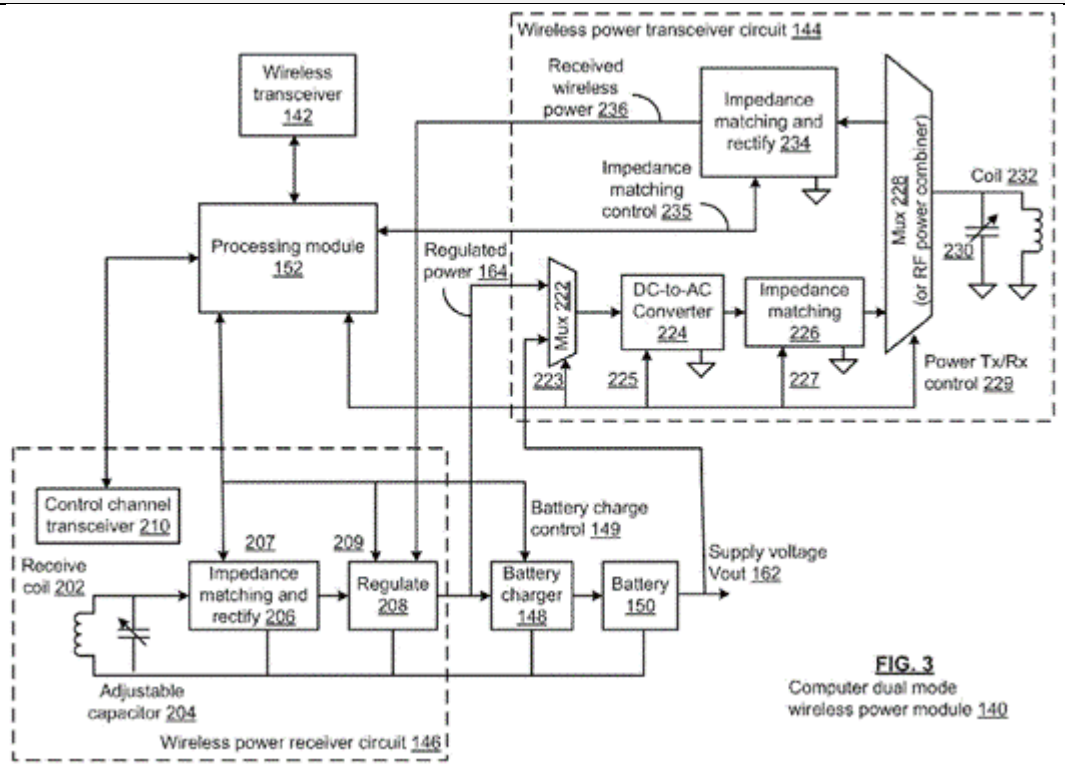
WPT, 29.

> The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes.

WPT, 12; *see also id.* Fig. 3-1.

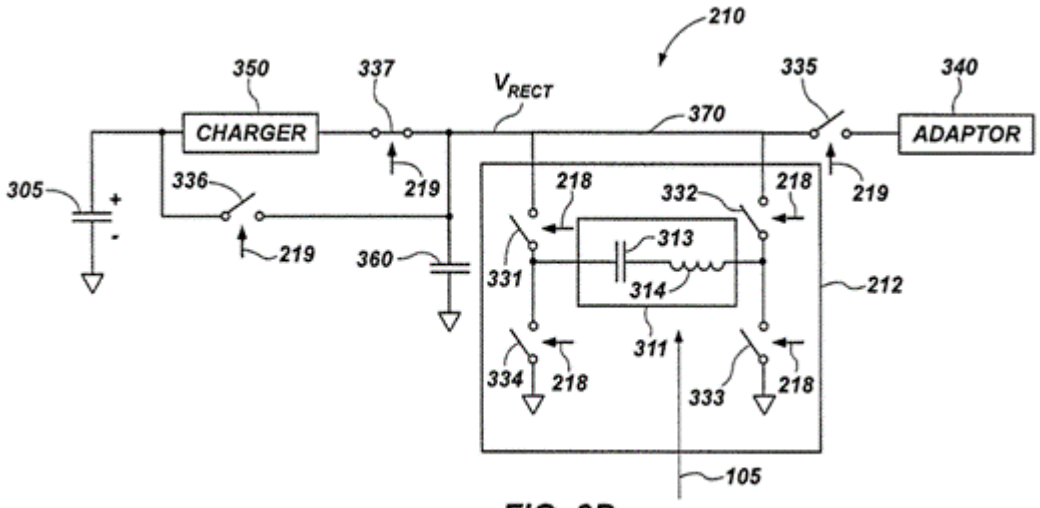
Claim Limitation	Exemplary Prior Art Disclosures
	A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, ***the communications modulator typically consists of a capacitor in series with a switch*** (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver.*** WPT, 33; *see generally* WPT, § 6.2.1 ("Modulation scheme").
[1d] said first circuitry configured to receive said power from a wireless power transmitter;	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.,* https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html. To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the following references. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for

Claim Limitation	Exemplary Prior Art Disclosures
	wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses a power receive mode. For example: ***During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420. The power signal is transmitted in modulated form over the power bridge circuit 411, which performs rectification to output a DC current to the power circuit 414***. The power circuit 414 is configured to clamp current levels, regulate voltage levels, and perform other functions to transmit an outgoing power signal in the power receive mode. According to embodiments, ***the resulting power signal is a DC signal and is routed to: (i) charge a rechargeable battery within the electronic device 402, and/or (ii) provide power to circuit elements within the electronic device***. **Van Der Lee** Van Der Lee discloses a wireless power receive mode. For example: ***When in a wireless power receive mode, the wireless power transceiver circuit 144 receives an electromagnetic field*** that is electromechanically coupled to the wireless power transceiver circuit 126 of the peripheral device dual mode wireless power module 122. ***The wireless power transceiver circuit 144 converts the wireless power link into a voltage delivered to the battery charger 148, which in turn charges the battery 150***. Van Der Lee, ¶ 46.

Claim Limitation	Exemplary Prior Art Disclosures
	 Van Der Lee, Fig. 3; *see also id.* ¶ 43, Fig. 4. **Shinoda** Shinoda discloses a power reception mode for the wireless power transfer terminal. For example: FIG. 1 is a circuit diagram of a traditional wireless power transfer terminal 101 to which Patent Literature 1 is refers. This wireless power transfer terminal 101 includes a coil 102 used for both transmitting and receiving power via a respective power transmission circuit 103 and a power reception circuit 104. The power transmission circuit 103 includes an inverter for converting an input voltage from, for example, a battery, into an alternating-current output. The coil 102 used, for both

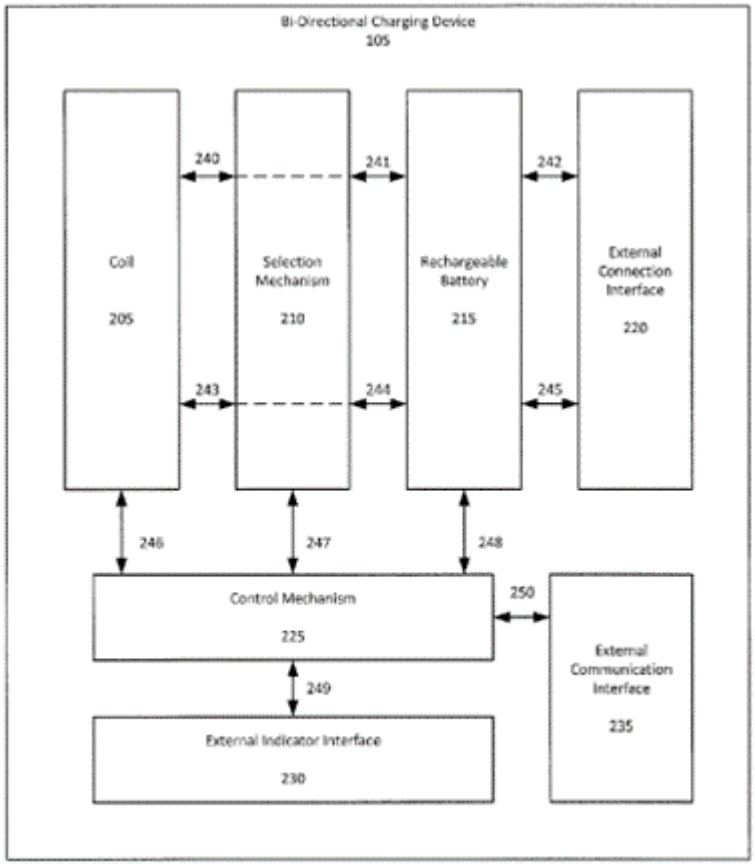
Claim Limitation	Exemplary Prior Art Disclosures
	transmission and reception, transmits power to a partner device over an electromagnetic field excited in the coil 102 by application of an alternating-current output from the power transmission circuit 103, and receives power from the partner device over an electromagnetic field output from the partner device. ***The power reception circuit 104 includes a rectifier circuit for converting an alternating-current that has been excited (input) in the coil 102 into an output voltage***. Shinoda, 1:31-46. FIG. 3A illustrates a state in which a positive voltage is excited at one end of the coil L that is connected to the node N3 and a negative voltage is excited at another end of the coil L that is connected to the node N4 in a half period of an alternating-current input. ***In this state, a current from one end of the coil L at which the positive voltage is excited passes through the node N3, FET 2A, node N1, and input/output node NA and enters a power reception load. The current flowing from the power reception load passes through the input/output node NB, node N2, FET 2D, and node N4 and returns to one end of the coil L at which the negative voltage is excited***. Therefore, the positive voltage from the input/output node NA and the negative voltage from the input/output node NB are applied to the power reception load. Shinoda, 4:34-47. FIG. 3B illustrates a state in which a negative voltage is excited at one end of the coil L that is connected to the node N3 and a positive voltage is excited at another end of the coil L that is connected to the node N4 in a half period of an alternating-current input. ***In this state, a current from one end of the coil L at which the positive voltage is excited passes through the node N4, FET 2C, node N1, and input/output node NA and enters the power reception load. The current flowing from the power reception load passes through the input/output node NB, node N2, FET 2B, and node N3 and returns to one end of the coil L at which the negative voltage is excited***. Therefore, the positive voltage from the input/output node NA and the negative voltage from the input/output node NB are applied to the power reception load. Shinoda, 4:52-65. For a ***power reception mode*** of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited

Claim Limitation	Exemplary Prior Art Disclosures
	in the coil L. In this state, the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. **Singh-203** Singh-203 discloses and renders obvious this limitation. For instance, in Singh-203, the first circuitry 210 operates in receive mode to receive power signal 105 from a wireless transmitter. For example: Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG. 3D Singh-203, 8:51-9:5, FIG. 3D. **Sagoo** Sagoo discloses that the mobile device receives power wirelessly in a load mode. For example: > The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that ***the mobile device 100 can be supplied with energy from another device (the load mode)*** or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. Sagoo, 4:56-64. > The ***inductive coil 180 performs the function of the secondary coil when the mobile device is in the load mode***, and performs the function of the primary coil when the mobile device is in the source mode.

Claim Limitation	Exemplary Prior Art Disclosures
	Sagoo, 5:27-30. In order to charge the battery 131 by receiving energy from the selected second device 102, the power control/conversion unit 111 and the rectifier 121 of the first device are connected with each other to supply energy to the battery 131. ***An inductive coil 181 coupled with the power control/conversion unit 111 serves as a secondary coil of a transformer. The first device is switched to the load mode***. Sagoo, 6:26-32; *see also* Sagoo, Figs. 2-5. When the selected mobile device (hereinafter, referred to as a source device) can operate in the source mode, the mobile device to be charged is switched to the load mode (S270). ***When the mobile device to be charged is switched to the load mode, the rectifier is connected to the battery and the power control/conversion unit such that energy can be received from the outside. Further, the inductive coil is set as the secondary coil (S280). Energy is received from the secondary coil and the primary coil of the source device (S290).*** The charge state of the battery can be checked while the energy is being received such that the battery is prevented from being excessively charged. Sagoo, 7:34-45; *see also id.* Figs. 6, 8. **Schuessler** Schuessler discloses that a bi-directional wireless charger receives power wirelessly in, for example, a power-receiving mode. For example: ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively causes power to be delivered from the coil to the battery*** and selectively causes power to be delivered from the battery to the coil, and a control mechanism. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the coil to the battery***, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the battery to the coil. Schuessler, Abstract. ***A bi-directional charging device may wirelessly receive power*** and wirelessly deliver power. When the bi-directional charging device is in the vicinity of a charging bay it may receive power from the

Claim Limitation	Exemplary Prior Art Disclosures
	charging bay to recharge an internal battery. When the bi-directional charging device is in the vicinity of a rechargeable electronic device it may deliver power to the electronic device for recharging an internal battery of the electronic device. Thus, the bi-directional charging device may be kept near rechargeable electronic devices to recharge batteries in the electronic devices, for example throughout the day. The bi-directional charging device may itself be recharged when it is placed in the vicinity of a charging bay, for example overnight. Schuessler, 1:41-53. ***Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode*** or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60.

Claim Limitation	Exemplary Prior Art Disclosures
	 Fig. 2 Schuessler, Fig. 2 **Yeh** Yeh discloses that a bi-directional wireless charging and discharging device receives power wirelessly in a load mode.

Claim Limitation	Exemplary Prior Art Disclosures
	For example: The ***receiving mode*** of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, ***the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to ***set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93*** of the portable electronic device 9. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; ***when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18; *see also* Yeh, Figs. 1-3. **Cook**

Claim Limitation	Exemplary Prior Art Disclosures
	Cook discloses that the bi-directional wireless power transceiver receives power wirelessly in a power receive mode. For example: FIG. 5A and FIG. 5B illustrate a bidirectional wireless power device, in accordance with an exemplary embodiment. Bidirectional wireless powering and charging of electronic devices (e.g. mobile phones, head sets, MP3 players, etc.) is disclosed in which ***electrical energy can be wirelessly transferred, as illustrated in FIG. 5A, from a power conversion circuit 220 and transmit antenna 214 of a power base 302 (e.g. charging pad) to a bidirectional wireless power transceiver 318 including a transceiver antenna 306 and a bidirectional power conversion circuit 308 of an electronic device 300 as illustrated in FIG. 5B. Then, as illustrated with reference to FIG. 5B, the wirelessly transmitted power is stored in a load illustrated as battery 310.*** The stored power in battery 310 is then donated through the bidirectional power conversion circuit 308 and transceiver antenna 306 of electronic device 300 to a receive antenna 312 and a power conversion circuit 314 of another electronic device 304 for consumption or storage in load or battery 316. Cook, ¶ 44. FIG. 7 illustrates a block diagram of ***an electronic device configured for bidirectional wireless power transmission, in accordance with an exemplary embodiment. The electronic device 300 includes an antenna 306, a bidirectional power conversion circuit 308 and a switch 326 for supplying power to the battery 310 or directly to the host device electronics 324***. Bidirectional power conversion circuit 308 includes an active rectifier, an example of which is a synchronous rectifier 320, and can be operated in at least two quadrants of the VI-plane. Cook, ¶ 50. FIG. 10 illustrates a circuit diagram of a wireless power transmission system, in accordance with another exemplary embodiment. This exemplary embodiment enables exchange of energy from one battery operated device to another battery operated device equally in both directions. A wireless power transmission system 500 includes a bidirectional wireless power transceiver 318T (where "T" indicates a Transmitter configuration or transmit mode) and a bidirectional wireless power transceiver 318R (where "R" indicates a ***Receiver configuration or receive mode***). Cook, ¶58.

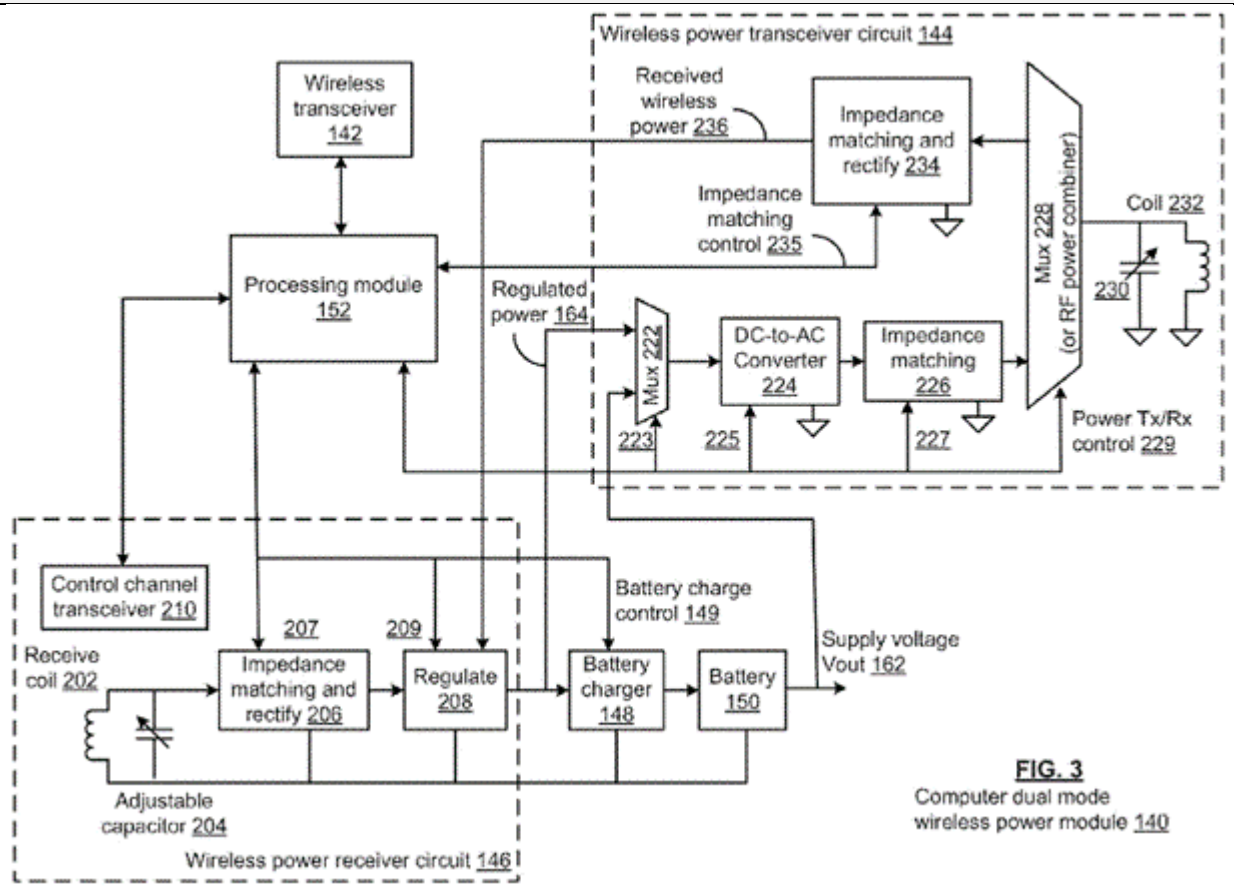
Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 11 illustrates a flowchart of a method for transceiving wireless power, in accordance with an exemplary embodiment. Method 600 for transceiving wireless power is supported by the various structures and circuits described herein. Method 600 includes step 602 for ***receiving an induced current from an antenna resonating in response to a magnetic near-field and rectifying the induced current into DC power through a bidirectional power conversion circuit when the bidirectional power conversion circuit is configured in receive mode***. Method 600 further includes step 604 for generating an induced current at a resonant frequency into the antenna from stored DC power through the bidirectional power conversion circuit and generating a magnetic near-field from the antenna when the bidirectional power conversion circuit is configured in transmit mode. Cook, ¶64. *See also* Figs. 1-10. *See generally* Limitation [1b] and [1p].
[1e] said first circuitry, based on an input from said control logic circuit, configured to change impedance of said impedance network and topology of said switch network to obtain a modified form of said received power, and apply said modified form of said power to said load device;	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.,* https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html. To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the following references. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **WPT** For example:

Claim Limitation	Exemplary Prior Art Disclosures
	The Communications and Control Unit on the left-hand side of Figure 3-9 comprises the digital logic part of the design. This unit receives and decodes messages from the Power Receiver, configures the multiplexer to connect the appropriate parts of the Primary Coil array, executes the relevant power control algorithms and protocols, and drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver. The Communications and Control Unit also interfaces with the other subsystems of the Base Station, e.g. for user interface purposes. WPT, 20. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30. **Chatterjee** Chatterjee discloses a processor that controls the electronic device to operate in a power receive mode. For example: The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. The processor **413** may be configured to process identification and status information transmitted over the inductive signal interface **430** to determine a mode of operation of the inductive signal interface **410**. ***The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH) Chatterjee, ¶ 55. The same power bridge circuit **311** may be used for implementations in which first device **302** can only receive power over the inductive link **330**. ***The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in*** both power receive and ***power***

Claim Limitation	Exemplary Prior Art Disclosures
	transmit modes, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may (i) ***link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode***; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. In usages when inductive signal interface **310** is in a power receive mode, the power signal is received from the second electronic device **320** over the inductive link **330**. The inductive signal interface **310** may be coupled to a power storage element, such as a rechargeable battery. The inductive signal interface **310** may be configured to charge the power storage element or to provide power to other circuitry within the first electronic device through the voltage supply line. The power circuit **314** receives current transmitted from the power bridge circuit **311** and is configurable to perform voltage and current regulation in order to charge the power storage element or provide power to other circuitry. The bi-directional coil assembly **312** receives power inductively from the second electronic device **320**, ***the power bridge circuit 311 converts AC current received inductively at the bi-directional coil assembly 312 to DC current*** to be transferred to the power circuit via the power bus. Chatterjee, ¶ 40. During the power receive mode of the inductive signal interface 410, the bi-directional coil assembly 412 receives power over the inductive link 430 from the second electronic device 420. Chatterjee, ¶ 46; *see also id.* Figs. 3-10. **Van Der Lee** Van Der Lee discloses that the processing module controls the wireless power module to operate in a power receive mode. For example: ***The processing module 152 places the wireless power transceiver circuit 144 in either of*** a wireless power transmit mode or ***a wireless power receive mode*** based upon power information from the dual mode wireless power module 122, via the processing module 132 and memory 134 of the peripheral

Claim Limitation	Exemplary Prior Art Disclosures
	device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. When in a wireless power receive mode, such as when the computer dual mode wireless power module 140 does not receive wireless power via the wireless power receiver circuit 146, as indicated through the power Tx/Rx control 229 from the processing module 152, the coil 232 of the wireless power transceiver circuit 144 receives a wireless power signal transmitted by the coil another device having a peripheral device dual mode wireless power module. In this mode, ***the impedance matching and rectify circuit 234 converts the AC voltage into a received wireless power 236, which is rectified to a DC voltage***. ***The DC voltage is regulated via the regulate circuit 208 for the battery charger 148, which in turn charges the battery 150***. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in*** either of a wireless power transmit or ***a wireless power receive mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶¶ 55–56. Moreover, the processing module 142 [sic] provides a power selection signal 223 to the MUX 222 between the regulated power 164 and the supply voltage Vout 162 for wireless power transmission via the wireless power transceiver circuit 144. Moreover, the processing module 132 implements a battery charge control 149, a regulate control 209, an impedance matching circuit control 207, 227, and 235, a DC-to-AC control 225, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures



Van Der Lee, Fig. 3; *see also id.* Fig. 4.

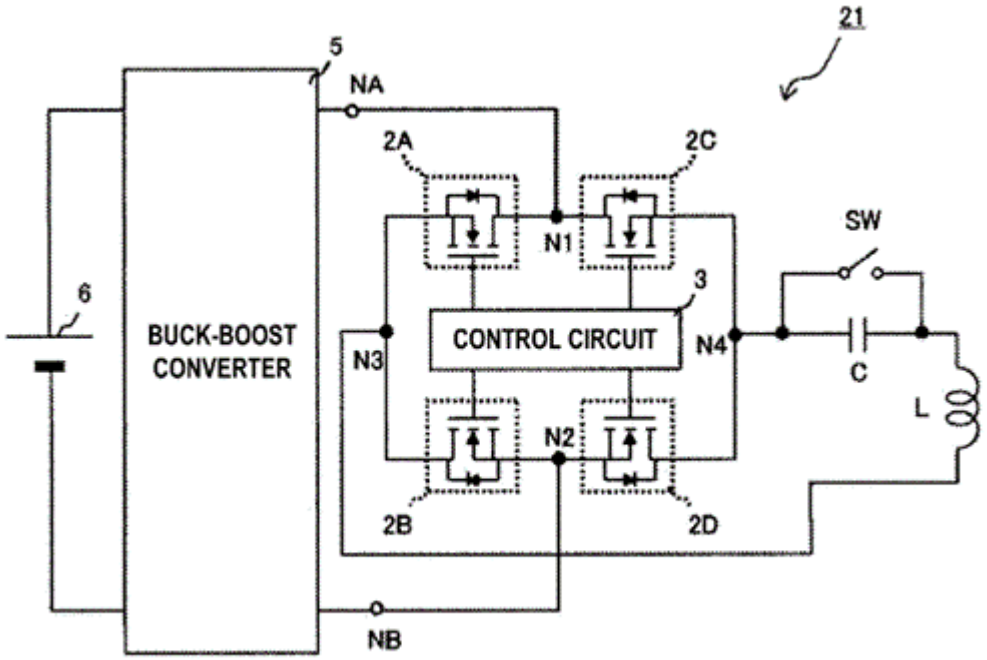
Shinoda

Shinoda discloses a control unit or control circuit that controls the switches to operate in a power reception mode.

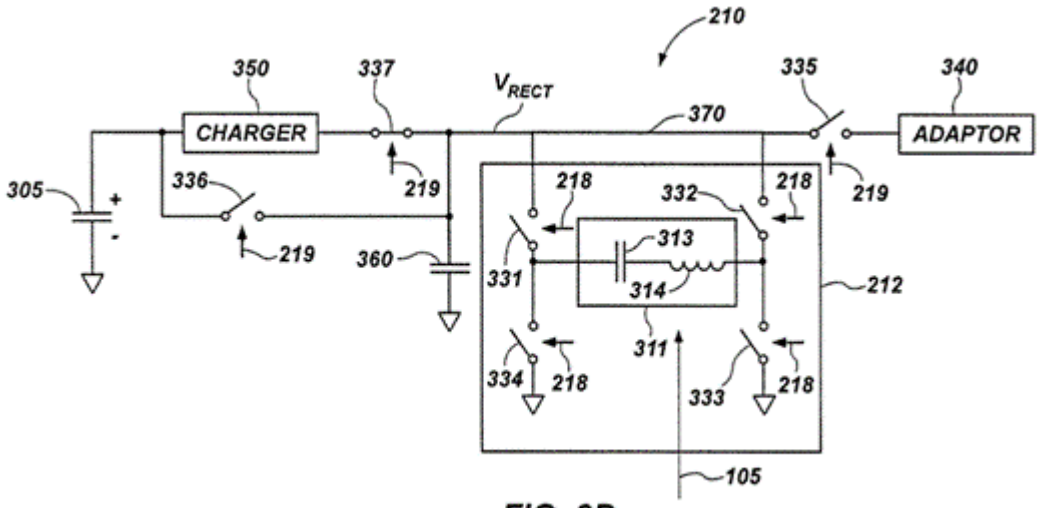
For example:

> In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel

Claim Limitation	Exemplary Prior Art Disclosures
	between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power reception mode of the wireless power transfer terminal 1 illustrated in FIGS. 3A and 3B, a partner device in power transmission mode is arranged in the vicinity of the coil L, the coil L is coupled to a near electromagnetic field of the partner device, and an alternating-current input is excited in the coil L. In this state, ***the control circuit 3 controls the gate control voltage such that the FETs 2A to 2D remain in the off state, and makes the parallel circuit of the FETs 2A to 2D function as a full-wave rectifier circuit*** using a parasitic diode between the drain and the source of each of the FETs 2A to 2D. Shinoda, 4:23-33. For a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series; ***for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C***. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** Singh-203 explains that control logic 217 generates control signal 218 to configure switches 331-334 as a full-bridge rectifier. The voltage at the output of the rectifier is a rectified DC voltage that is provided to a load device 215 (e.g., battery 305). For example: Referring specifically to FIG. 3D, the wireless power enabled device 210 is shown as being operated in a receive mode according to another embodiment of the present disclosure. In order to receive wireless power, the wireless power enabled device 210 may be placed in the coupling region of a wireless

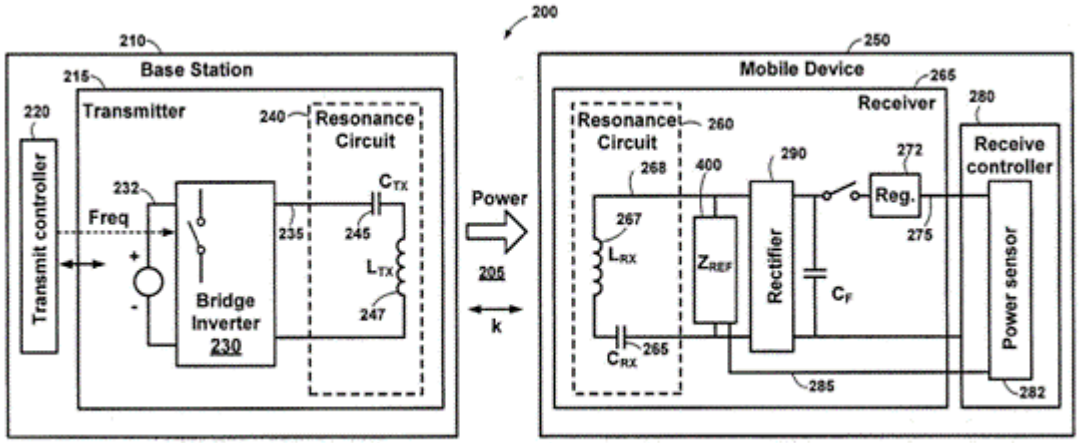
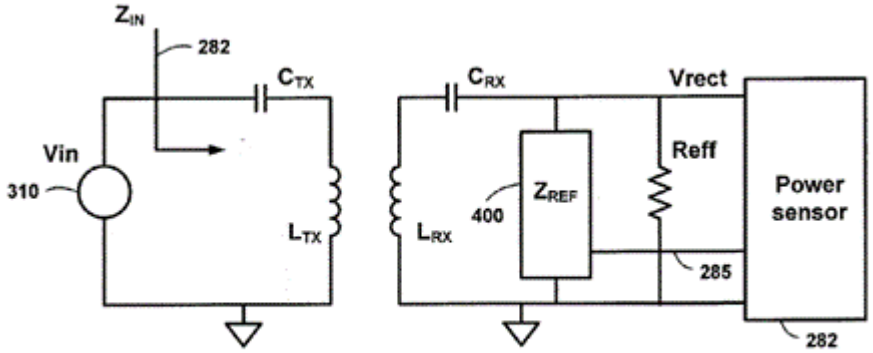
Claim Limitation	Exemplary Prior Art Disclosures
	power transmitting apparatus such that inductive coupling may be achieved. As a result, the wireless charging transceiver 212 may receive the wireless power signal 105 and generate an AC current responsive thereto. In order for the power to be used by the wireless power enabled device 210, the AC current may be converted to a DC current. As a result, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge rectifier. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate a DC current from the AC current flowing through the resonant tank 311. As a result, the voltage at node 370 is a rectified voltage (VRECT) that is provided to the load 215 (FIG. 2), such as the energy storage device 305 (for charging), system components of the wireless power enabled device 210 (for system power), or a combination thereof. Singh-203, 8:51-9:5. If the receive mode is determined to be the desired mode of operation, the wireless power enabled operates in the receive mode at operation 430. While in receive mode, control logic may transmit control signals to the wireless charging transceiver. The control signals may control operation of the full-bridge circuit coupled with the resonant tank of the wireless charging transceiver to operate as a full-bridge rectifier. The wireless charging transceiver may receive an incoming wireless power signal and generate an AC current through the resonant tank through inductive coupling. The incoming wireless power signal may be generated by a wireless power transmitting apparatus, such as a wireless power charger. In some embodiments, the wireless power transmitting apparatus may likewise be a wireless power enabled device having multiple modes of operation. The wireless charging transceiver operating as a full-bridge rectifier receives the AC current generated by the resonant tank generates a DC current to be output to a load. Therefore, at operation 435, power may be generated from the energy transfer to provide power to a load. For example, the load may include an energy storage device (e.g., battery), system components of the wireless power enabled device, or other power consuming devices. Singh-203, 10:13-36.

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	 FIG. 3D **Singh-624** Singh-624 discloses "backscatter modulation in which the load is modulated on the receiver side," which WiPQTUS contends meets the limitation of "change impedance of said impedance network." (*See, e.g.*, Infringement Contentions, Ex. 2 at 29-33.) For example: > During power transfer from the transmitter to the receiver, data may be communicated between the transmitter and the receiver. Conventional methods of communication include one-way communication via a communication link from the receiver to the transmitter that is based on backscatter modulation in which the load is modulated on the receiver side. As a result, using conventional methods, only the receiver has the ability to send data to the transmitter. Other conventional methods that achieve two-way communication include separate RF coils, which require additional components that may increase cost, area, and complexity. Singh-624, 1:42-52. **Singh-167**

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-167 teaches a receive impedance adjuster 400 that is configured to adjust a resonant frequency of the receive resonance circuit "by selectively modifying an impedance of the receive impedance adjuster." For example: The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a

Claim Limitation	Exemplary Prior Art Disclosures
	voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265.

Claim Limitation	Exemplary Prior Art Disclosures
	A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.

Claim Limitation	Exemplary Prior Art Disclosures
	 *FIG. 2* Singh-167, Fig. 2.  *FIG. 3* Singh-167, Fig. 3.

Claim Limitation	Exemplary Prior Art Disclosures
	Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN. Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above. Singh-167, ¶¶ 48-49. FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below.

Claim Limitation	Exemplary Prior Art Disclosures
	In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance circuit 240 may be larger and appear like line 520. This larger impedance will result in less power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-

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	peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7. **Sagoo** Sagoo discloses a power control/conversion unit that is selectively coupled to a rectifier and controls the input/output levels of the AC and DC voltages. For example: According to another aspect of the invention, there is provided a method of wirelessly loading power by induction, the method including detecting devices capable of operating in a source mode by using a local communication unit; instructing a first device of the detected devices to operate in the source mode; ***connecting a rectifier to a battery and a power control/conversion unit and switching to a load mode for receiving energy from the outside***; setting an inductive coil coupled with the power control/conversion unit as a secondary coil; and receiving energy from the inductive coil of the first device set as the primary coil. Sagoo, 2:35-45. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power

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	control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:40-5:4. **Schuessler** Schuessler discloses that a control mechanism controls the coil circuitry and selection mechanism to direct power from a coil to a rechargeable battery. For example: ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown)*** to receive information or ***to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and control mechanism 225 may use the information received to determine whether conditions are

Claim Limitation	Exemplary Prior Art Disclosures
	appropriate to begin or continue energy transfer. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then ***tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215. Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225***. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device,

Claim Limitation	Exemplary Prior Art Disclosures
	and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30. ***Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode*** or directing power from rechargeable battery 215 in a power delivering mode. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. **Yeh** Yeh discloses a logic control unit that controls the operation of a bidirectional wireless charging and discharging device in a power receive mode to charge the battery. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	Preferably, the bidirectional wireless charging and discharging device according to the first embodiment of the present invention further comprises a third reverse current protector 4b. The third reverse current protector 4b also comprises an input terminal 41, an output terminal 42, and a control terminal 43. The output terminal 42 and the input terminal 41 are respectively and electrically connected to the power receiving terminal 921 of the protection circuit 92 of the circuit device 91 and the first node 61. The control terminal 43 is electrically connected to the sixth control pin 16 of the logic control unit 1, whereby ***a control signal supplied through the sixth control pin 16 of the logic control unit 1 can be used to control ON/OFF state of the third reverse current protector 4b and thus control charging the battery 93 or not***. In addition, it is possible to further comprise a second supercapacitor (not shown). The second supercapacitor is connected in parallel to the battery 93. It is apparent that the supercapacitors arranged in the bidirectional wireless charging and discharging device of the present invention can include only the first supercapacitor 6 or only the second supercapacitor (not shown), or the first supercapacitor 6 and the second supercapacitor are both included. Yeh, 4:54-5:8. The receiving mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows: When a portable electronic device 9 that is equipped with a bidirectional wireless charging and discharging device according to the present invention receives electrical power transmitted from an opposite side of the wireless receiving and transmitting unit 2 thereof, the electrical power flows first through the power pin 17 to the logic control unit 1, and then, ***the received electrical power is transmitted through the step-up/step-down unit 3 for stepping down conversion***. ***The logic control unit 1 uses the transmission sustaining circuit 19 to set the first reverse current protector 4 in an OFF condition and uses a control signal supplied from the fifth control pin 15 of the logic control unit 1 to set the second reverse current protector 4a in an ON condition, so that the stepped-down power is applied through the second reverse current protector 4a and the first supercapacitor 6 that absorbs the surges (preferably further flowing through the third reverse current protector 4b) to thereby supply to the battery 93 of the portable electronic device 9***. It is apparent that the protection circuit 92 may provide protection by limiting the range of charging of the battery 93 within a preset range (such as 4-6V DC). When the battery 93 is fully charged, the

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	protection circuit 92 stops the charging, and if the electronic device on the opposite side detects no loading, it automatically shuts down the discharging operation. (Even in a discharging operation, if the power remaining in the battery of its own is lower than a preset level, the discharging will be terminated.) When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition; ***when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition***. Yeh, 6:48-7:18. **Cook** Cook discloses that the frequency generation and control circuit controls the bidirectional wireless circuit to operate in a power receive mode. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode***. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318R includes a bidirectional power conversion circuit 308R and an antenna 306R. In bidirectional power conversion circuit 308R, a half bridge active rectifier includes switches Q2 and Q2′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q2 and Q2′ are driven and accurately controlled by a frequency generation and control circuit 322R as further monitored by sensors 470 for sensing***

Claim Limitation	Exemplary Prior Art Disclosures
	voltage and current on both FET switches Q2 and Q2′. The drive waveforms may be continuously adjusted in the manner of a phase-locked-loop to reach frequency and phase synchronization with the antenna induced current such to provide maximum or the desired DC power output. As opposed to transmit mode requirements on tuning of the tank circuit of receive antenna, L2 and C2, in receive mode is less critical and some offset from resonance may be tolerated. Thus adjustment e.g. of capacitor C2 may be less accurate or not be used at all. Cook, ¶ 61. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. **WPT** For example: The Communications and Control Unit on the left-hand side of Figure 3-9 comprises the digital logic part of the design. This unit receives and decodes messages from the Power Receiver, configures the multiplexer to connect the appropriate parts of the Primary Coil array, executes the relevant power control algorithms and protocols, and drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver. The Communications and Control Unit also interfaces with the other subsystems of the Base Station, e.g. for user interface purposes. WPT, 20. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery.

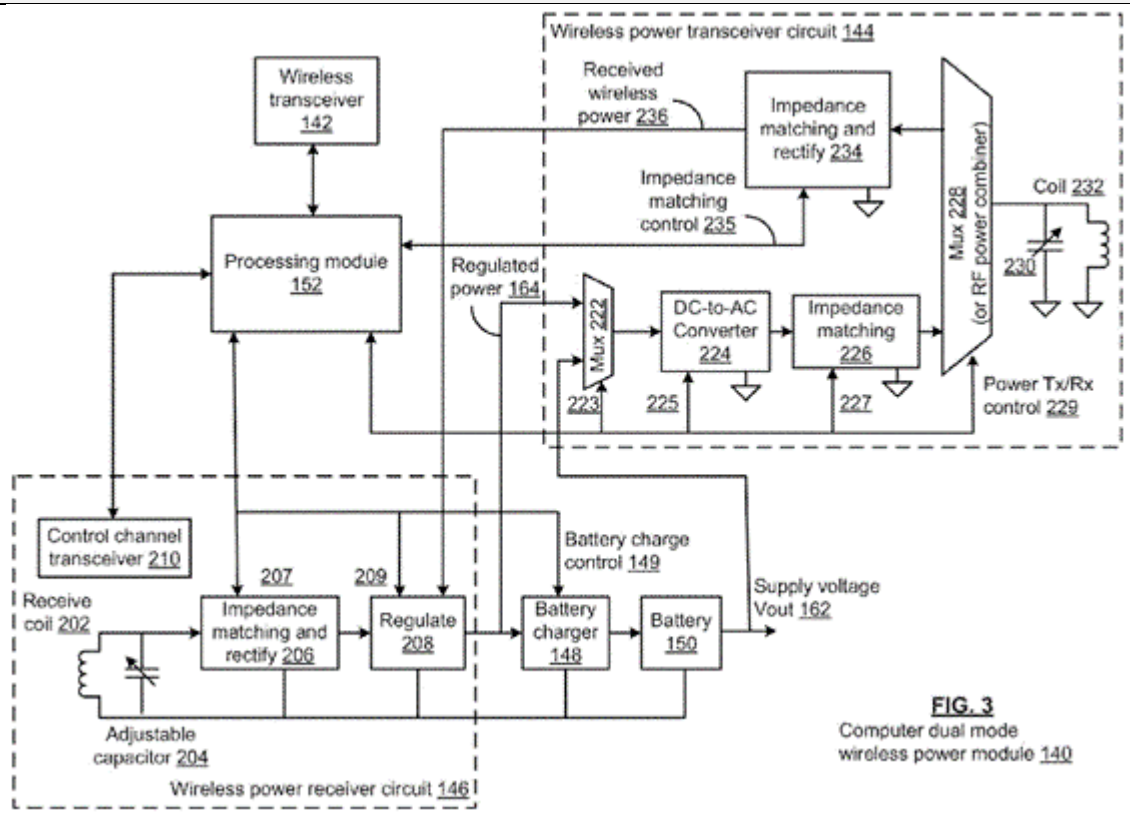
Claim Limitation	Exemplary Prior Art Disclosures
	WPT, 30. *See also* Limitations [1b], [1c].
[1f] said first circuitry, based on an input from said control logic circuit, configured to change said topology of said switch network and said impedance of said impedance network to transmit at least part of said stored power to said secondary wireless power receiver to power-up said secondary wireless power receiver;	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.*, https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html. To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the references cited in limitations [1b], [1c] and additional disclosures below. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses a processor that controls the electronic device to operate in a power transmit mode. For example: > The communication circuit **415** is coupled to the processor **413** to transmit and receive data which is transferred via the data bus to and from the processor **413**. The processor **413** may be configured to process identification and status information transmitted over the inductive signal interface **430** to determine a mode of operation of the inductive signal interface **410**. ***The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation***. The processor **413** may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH) Chatterjee, ¶ 55. > The same power bridge circuit **311** may be used for implementations in which first device **302** can only receive power over the inductive link **330**. ***The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive*** and power transmit modes, depending on, for example, a type identification of the second electronic device **320**. In such implementations, for example, a mobile computing device may ***(i) link with a dock to receive***

Claim Limitation	Exemplary Prior Art Disclosures
	power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. ***The power bridge circuit 311 is coupled to the power circuit 314 to (i) convert signals from DC to high-frequency form over inductive link 330 when the inductive signal interface 310 is in the power transmit mode***, or (ii) from high-frequency form to DC when the inductive signal interface 310 is in the power receive mode. According to embodiments described herein, the power bridge circuit 311 corresponds to a circuit element that is used by the inductive signal interface 310 when in both power transmit and power receive modes. More specifically, the power bridge circuit 311 forms separate circuits for when the inductive signal interface 310 is in the power transmit mode and in the power receive mode. In particular, the circuit elements include some circuit elements that are shared and used

Claim Limitation	Exemplary Prior Art Disclosures
	in both modes, and other circuit elements that are dedicated for a particular one of the two modes. In some embodiments, the circuit elements are provided as branches, where two branches combine to route incoming and outgoing current over the inductive link 330. In one embodiment, the power bridge circuit 311 has a three-legged formation, which provides a shared branch that combines with (i) a second branch in order to transmit power over the inductive link 330, and (ii) a third branch in order to receive power over the inductive link 330. As described below, the three branches combine to effectively form an H-bridge and synchronous bridge rectifier combination for use with the inductive link 330. Chatterjee, ¶ 37; *see also id.* Figs. 3-10. **Van Der Lee** Van Der Lee discloses a processing module that controls the electronic device to operate in a power transmit mode. For example: ***When in a wireless power transmit mode, as dictated by the power Tx/Rx control 229 from the processing module 152, the wireless power transceiver circuit 144 is powered*** by two possible sources, the first being the regulated power 164 (that is, a regulated rail voltage) when receiving wireless power from wireless power receiver circuit 146, and the second being ***the battery 150 via the supply voltage Vout 162 when the computer is in a battery operated mode (further presuming the battery 150 has sufficient energy to charge other devices***, as is discussed later in further detail with respect to FIGS. 5 and 6). In the wireless power transmit mode, the DC-to-AC converter 224 converts the regulated power 164 to an AC voltage that is provided to the coil 232 via the impedance matching circuit 226 and MUX 228. The DC-to-AC converter 224 includes a full bridge inverter topology to excite the coil 232. ***The DC-to-AC control signal 225 generates the switching signals to drive the DC-to-AC converter 224*** at a desired frequency. In an alternate embodiment, the DC-to-AC converter 224 may include a half bridge inverter topology. ***The impedance matching circuit 226, based upon the impedance control 227, adjusts the impedance of the capacitor 230 and/or coil 232*** to a desired resonance and/or quality factor. As an example, the impedance matching circuit 226 may tune the capacitor 230 and coil 232 to resonate at the switching frequency of the DC-to-AC converter 224, to be an under-damped circuit, or

Claim Limitation	Exemplary Prior Art Disclosures
	an over-damped circuit. ***The coil 232 generates a wireless power link that is received by the coil of a peripheral device dual mode wireless power module.*** Van Der Lee, ¶¶ 53, 54. Moreover, the processing module 142 [sic] provides a power selection signal 223 to the MUX 222 between the regulated power 164 and the supply voltage Vout 162 for wireless power transmission via the wireless power transceiver circuit 144. Moreover, the processing module 132 implements a battery charge control 149, a regulate control 209, ***an impedance matching circuit control*** 207, ***227***, and 235, ***a DC-to-AC control 225***, and provide for RF/MMW and/or NFC baseband processing. Van Der Lee, ¶ 56. ***The processing module 142 [sic] provides a power Tx/Rx control signal 229 to the MUX 228 to place the wireless power module 122 in either of a wireless power transmit*** or a wireless power receive ***mode of operation***. The MUX 228 may transmit or receive wireless power in a staggered fashion, in which the wireless power transceiver circuit 144 either receives or transmits wireless power. Van Der Lee, ¶ 58.

Claim Limitation	Exemplary Prior Art Disclosures



Van Der Lee, Fig. 3.

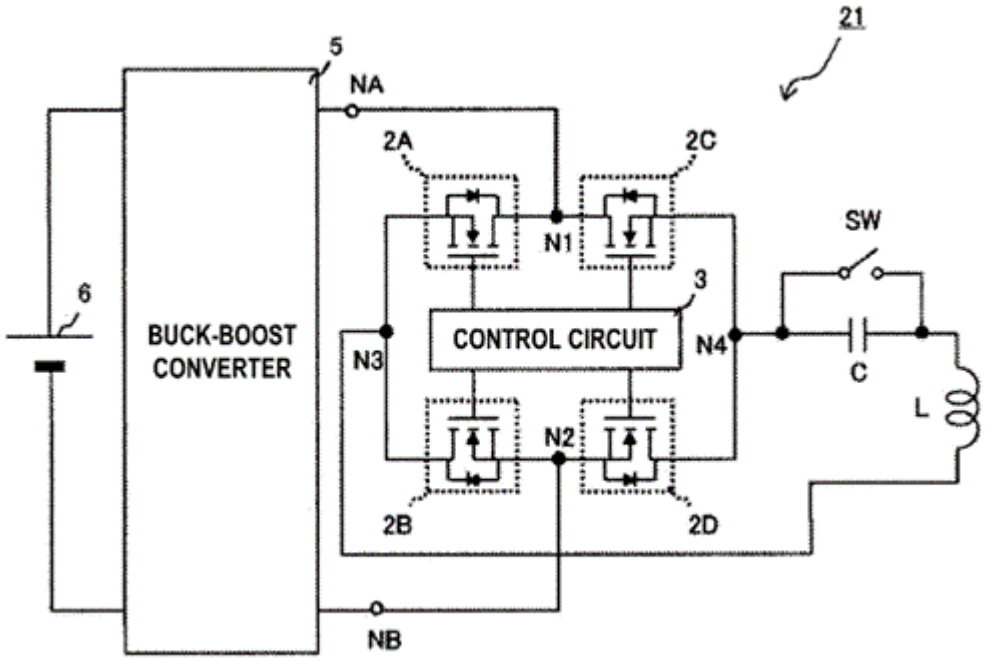
Shinoda

Shinoda discloses a processor that controls the switches to operate in a power transmission mode.

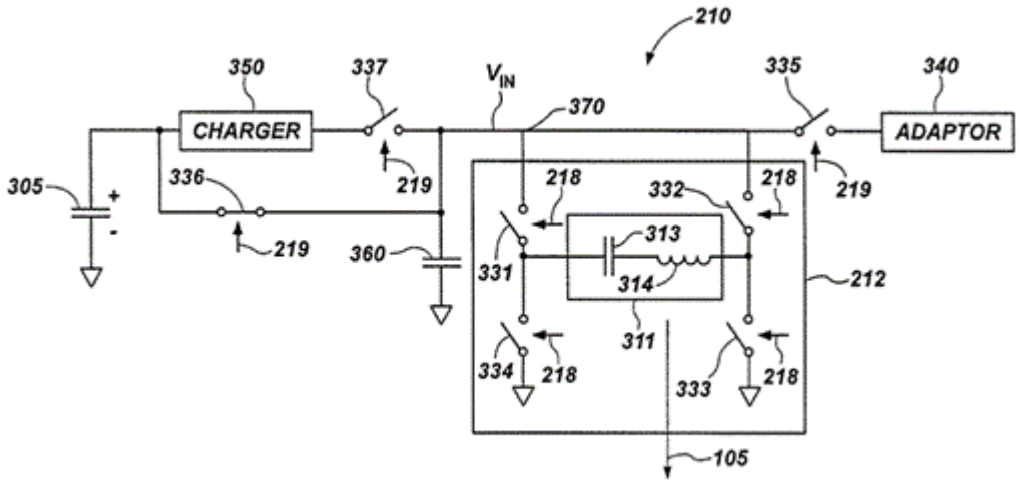
For example:

> In an aspect of the disclosure, a wireless power transfer terminal includes a parallel circuit, a coil, and a control unit. The parallel circuit includes first and second series circuits connected in parallel between opposed ends of the parallel circuit. The first series circuit includes first and second semiconductor switching elements connected in series to each other. The second series circuit includes

Claim Limitation	Exemplary Prior Art Disclosures
	third and fourth semiconductor switching elements connected in series to each other. The coil is connected between a connection point of the first semiconductor switching element and the second semiconductor switching element and a connection point of the third semiconductor switching element and the fourth semiconductor switching element. ***The control unit is configured to perform switching control of at least the first to fourth semiconductor switching elements***. Shinoda, 1:55-2:2. For a power transmission mode of the wireless power transfer terminal 1 illustrated in FIGS. 2A and 2B, a positive voltage is applied from the input power source to the input/output node NA and a negative voltage is applied from the input power source to the input/output node NB. A partner device in power reception mode is arranged in the vicinity of the coil L. In this state, ***the control circuit 3 changes the gate control voltage of each of the FETs 2A to 2D at predetermined periods***. Specifically, the FETs 2A and 2D and the FETs 2B and 2C are alternately turned on and off such that the FETs 2A to 2D function as a full-bridge inverter circuit. Shinoda, 3:52-62. For ***a power transmission mode of the wireless power transfer terminal 11, the control circuit 3 turns off (i.e., opens) the switch SW and connects the resonant capacitor C and the coil L in series***; for power reception thereof, the control circuit 3 turns on (i.e., closes) the switch SW and bypasses the resonant capacitor C. Therefore, for power transmission of the wireless power transfer terminal 11, the coil L and the resonant capacitor C can resonate in series, this can increase circuit electromagnetic stored energy, and the capability of supplying electricity can be enhanced and the efficiency of power transmission can be improved. Shinoda, 5:59-6:2.

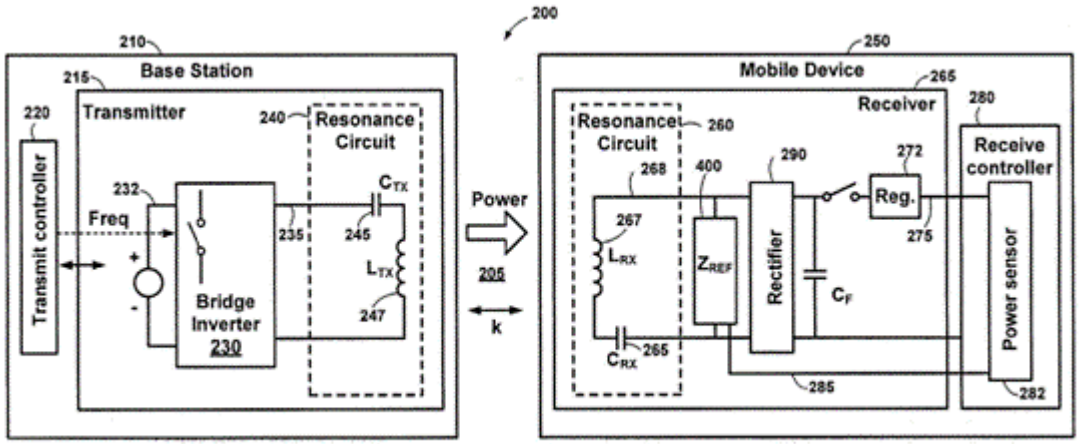
Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.5 Shinoda, Fig. 5; *see also id.* Figs. 1-5, 7. **Singh-203** Singh-203 explains that control logic 217 generates control signal 218 to configure switches 331-334 as a full-bridge inverter and may vary switching frequency, duty cycle of the switching, and phase of the switching, etc. The switch network thus generates an AC current through tank 331 to transmit power from battery 305 to power up device 220. For example: Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit

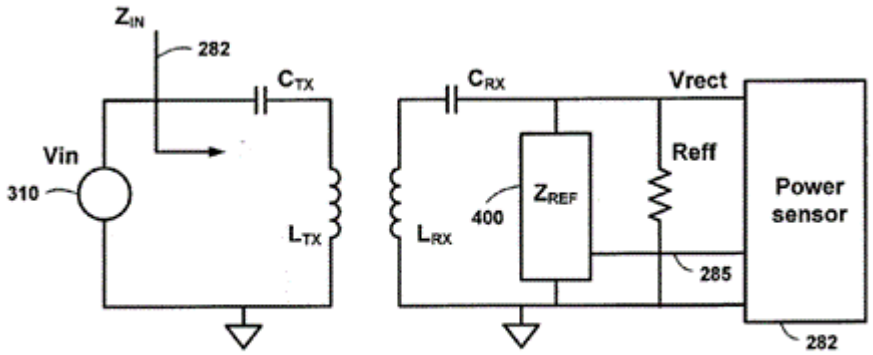
Claim Limitation	Exemplary Prior Art Disclosures
	wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. In this example, the power used to generate the wireless charging signal can be provided by the energy storage device 305 rather than through the adaptor 340. Thus, the fifth switch 335 may be open to disconnect the wireless charging transceiver 212 from the adaptor 340, and the sixth switch 336 may be closed to connect the energy storage device 305 to the wireless charging transceiver 212. In addition, the seventh switch 337 may be opened so that current may not flow through the charger 350 to the energy storage device 305. As a result, the voltage at node 370 may be the input signal (VIN) to the wireless charging transceiver 212 for enabling current flow through the resonant tank 311 to generate the wireless power signal 105. Capacitor 360 may be coupled to node 370 may act as an input capacitor during transmit mode. Singh-203, 7:51-8:27. If the transmit mode is determined to be the desired mode of operation, the wireless power enabled operates in the transmit mode at operation 420. While in transmit mode, control logic may transmit control signals to a wireless charging transceiver. The control signals may control operation of a full-bridge circuit coupled with a resonant tank of the wireless charging transceiver to operate as a full-bridge inverter. The wireless charging transceiver operating as a full-bridge inverter receives a DC

Claim Limitation	Exemplary Prior Art Disclosures
	input signal and generates an AC current through the resonant tank. Therefore, at operation 425, the wireless power signal may be generated for energy transfer to a wireless power receiving device. The wireless power receiving apparatus may be an electronic device that is configured to receive the wireless power signal. In some embodiments, the wireless power receiving apparatus may likewise be a wireless power enabled device having multiple modes of operation. Singh-203, 9:63-10:12.  FIG. 3B **Singh-167** Singh-167 teaches adjusting "the resonant frequencies of the transmit resonance circuit 240." The power-receiving device, includes a receive resonance circuit that generates a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation when within a coupling region of the transmit coil and a receive capacitor in combination with the receive coil. The rectifier converts the receive resonance signal to a rectified signal. The signal sensor senses at least one of a voltage or a current on the rectified signal to generate a power indicator signal. The

Claim Limitation	Exemplary Prior Art Disclosures
	receive impedance adjuster modifies a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, Abstract. Embodiments of the present disclosure include a power-receiving device including a receive resonance circuit configured to generate a receive resonance frequency, a rectifier, a signal sensor, and a receive impedance adjuster. A receive coil of the receive resonance circuit is for receiving near-field electromagnetic radiation at a coupling frequency when within a coupling region of a transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal at a substantially Direct Current (DC) level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Embodiments of the present disclosure also include a method of receiving power, including stimulating a receive resonance circuit including a receive coil and a receive capacitor to generate a receive resonance signal at a receive resonance frequency by positioning the receive coil in a coupling region of a transmit coil generating a near-field electromagnetic radiation at a coupling frequency. The receive resonance signal is rectified to a rectified signal at substantially a DC level. At least one of a voltage on the rectified signal or a current on the rectified signal is sensed to generate a power indicator signal. A resonant frequency of the receive resonance circuit is adjusted responsive to the power indicator signal by selectively modifying an impedance of a receive impedance adjuster operably coupled to the receive resonance circuit. Singh-167, ¶¶ 6-7. The power-receiving device, includes a receive resonance circuit, a rectifier, a signal sensor, and a receive impedance adjuster. The receive resonance circuit is configured to generate a receive resonance frequency and includes a receive coil for receiving the near-field electromagnetic radiation at a

Claim Limitation	Exemplary Prior Art Disclosures
	coupling frequency when within a coupling region of the transmit coil. A receive capacitor of the receive resonance circuit is operably coupled to the receive coil and is configured to operate in combination with the receive coil to generate a receive resonance signal at the receive resonance frequency when the receive coil is stimulated by the near-field electromagnetic radiation. The rectifier is operably coupled to the receive resonance signal and is configured to convert the receive resonance signal to a rectified signal substantially at a DC level. The signal sensor is operably coupled to the rectified signal and is configured to sense at least one of a voltage on the rectified signal or a current on the rectified signal to generate a power indicator signal. The receive impedance adjuster is operably and selectively coupled to the receive resonance circuit and is configured to adjust a resonant frequency of the receive resonance circuit responsive to the power indicator signal by selectively modifying an impedance of the receive impedance adjuster. Singh-167, ¶ 8. The transmit resonance circuit 240 is coupled to the power-transmit frequency 235 and includes a transmit coil 247 (LTX) coupled to a transmit capacitor 245 (CTX). The transmit resonance circuit 240 is configured to develop a coupling frequency (may also be referred to herein as a transmit resonance frequency) determined by impedances of the transmit coil 247 and the transmit capacitor 245. Singh-167, ¶ 32. The receive resonance circuit 260 includes a receive coil 267 (LRX) coupled to a receive capacitor 265 (CRX). The receive resonance circuit 260 is configured to develop a receive resonance signal 268 at a receive resonance frequency determined by impedances of the receive coil 267 and the receive capacitor 265. A receive impedance adjuster 400 (denoted as Z_{REF} in FIG. 2) is coupled to the receive resonance circuit 260 and is configured to adjust the impedance of the wireless power receiver 255 as is explained more fully below in connection with FIG. 4. Singh-167, ¶¶ 36-37. In some embodiments, the rectifier 290 may be used to convert the receive resonance signal 268 to substantially a DC signal. The filter and regulator 272 may be used in some embodiments to further

Claim Limitation	Exemplary Prior Art Disclosures
	smooth the DC signal and set it to an appropriate DC voltage as a rectified signal 275 (may also be referred to herein as VRECT or a power output 275) for use by the receive controller 280. The receive controller 280 includes a signal sensor 282 configured to sense at least one of a voltage or a current on the rectified signal 275 to generate a power indicator signal 285. The receive controller 280 may include a processor (e.g., microprocessor) and other peripherals (e.g., memory). Memory may include non-volatile memory (e.g., ROM) and volatile memory (e.g., RAM). In some embodiment, the receive controller 280 may sample signals such as the rectified signal 275. Analysis of the rectified signal 275 may be used to form a control loop to adjust the impedance of the receive impedance adjuster 400 via the receive resonance control signal 295. As a non-limiting example, the control loops may include a linear feedback control system, such as, for example, a proportional integral derivative controller. Of course, other feedback/control topologies may also be used. In some embodiments, the signal sensor 282 may more directly control the feedback loop to the power indicator signal 285 with no need for sampling or detailed analysis by a microcontroller within the receive controller 280. Singh-167, ¶¶ 38-40.  FIG. 2

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-167, Fig. 2.  *FIG. 3* Singh-167, Fig. 3. Referring to FIGS. 2 and 3, the resonant frequencies of the transmit resonance circuit 240 and the receive resonance circuit 260 may be separately adjusted. Resonances may be adjusted such that the resonant frequencies between the transmit side and the receive side are very close to optimize power transfer. However, in embodiments of the present disclosure, resonance of the receive resonance circuit 260 may be modified by modifying the impedance of the receive impedance adjuster 400 to create a frequency mismatch between the transmit resonance circuit 240 and the receive resonance circuit 260. This frequency mismatch creates a change in perceived input impedance Z_{IN} into the transmit resonance circuit 240. Stated another way, impedance of the receive resonance circuit 260 gets reflected over to the transmit resonance circuit 240, which is manifest as a change in input impedance ZIN. Adjustments to the impedance of the receive impedance adjuster 400 cause changes to the resonant frequency of the receive resonance circuit 260, responsive to the power indicator signal 285 coupled to the power sensor 282 as discussed above. Singh-167, ¶¶ 48-49.

Claim Limitation	Exemplary Prior Art Disclosures
	FIGS. 4A-4C are circuit diagrams of example receive impedance adjusters 400 that may be used in the wireless power receiver 255 (FIG. 2) according to one or more embodiments of the present disclosure. Reference will be made to FIGS. 2 and 4A-4C to describe the receive impedance adjusters 400. FIGS. 4A-4C illustrate examples of some receive impedance adjusters 400A-400C. Of course, many other configuration of receive impedance adjusters 400 are possible and may include capacitive, inductive, resistive, and active components. In a non-limiting simple form illustrated in FIG. 4A, the receive impedance adjuster 400A may be a simple variable inductor between terminal 410A and terminal 420A. In this form, the variable inductor may be set responsive to the power indicator signal 285A to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4B, the receive impedance adjuster 400B may be a simple variable capacitor between terminal 410B and terminal 420B. In this form, the variable capacitor may be set responsive to the power indicator signal 285B to modify the resonant frequency of the receive resonance circuit 260 as explained more fully below. In another non-limiting form illustrated in FIG. 4C, the receive impedance adjuster 400C may be a network between terminal 410C and terminal 420C that is controlled by the power indicator signal 285C. In this form, the network may include active components configured as switches to selectively switch a corresponding LC circuits (LC1, LC2, and LC3) in to the network to create a variable impedance for the receive impedance adjuster 400C. As a non-limiting example, the switches may be configured as transistors, such as Metal Oxide Semiconductor (MOS) transistors. The LC circuits (LC1, LC2, and LC3) may be combinations of inductors, capacitors, or both to create a variety of different impedances that can be selectively switched in to the network. Singh-167, ¶¶ 50-53. FIG. 5 is a graph of a small-signal representation of input impedance of a wireless power transmitter 215 wirelessly coupled to a wireless power receiver 255 before and after modifying an impedance of the wireless power receiver 255 according to one or more embodiments of the present disclosure. With closely matched resonant frequencies between the transmit resonance circuit 240 and the receive resonance circuit 260, the impedance (ZIN) seen by the transmit resonance circuit 240 may appear like line 510. If the resonant frequency of the receive resonance circuit 260 is modified by modifying the impedance of the receive impedance adjuster 400, the impedance (ZIN) seen by the transmit resonance

Claim Limitation	Exemplary Prior Art Disclosures
	circuit 240 may be larger and appear like line 520. This larger impedance will result in less power being emitted by the transmit resonance circuit 240, which will result in less power being received by the receive resonance circuit 260. Singh-167, ¶¶ 54. With reference to FIGS. 2 and 6, when the voltage output 610 reaches about 19 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to drop to about 2 volts. When the voltage output 610 reaches about 18 volts, the power indicator signal 285 modifies the impedance of the receive impedance adjuster 400, which causes a change to the resonant frequency of the receive resonance circuit 260. This change in resonant frequency of the receive resonance circuit 260 causes an input impedance change to the transmit resonance circuit 240, which causes the peak-to-peak current on the current input 620 to rise to about 4 volts. This cycle is repeated in a feedback loop that keeps the voltage output 610 within a tolerance range of about 18 to 19 volts. Of course, FIG. 6 is one example. Other voltages on the voltage output 610 and currents on the current input 620 may be used, depending on system considerations. Singh-167, ¶¶ 56-57. If the rectified signal 275 is not within tolerance, operation block 714 indicates that the impedance of the receive impedance adjuster 400 (i.e. ZREF) is adjusted to modify the resonant frequency of the receive resonance circuit 260. The process then loops to decision block 710 to test whether the rectified signal 275 is within a desired tolerance levels. Singh-167, ¶¶ 61; *see also id.* Fig. 7. **Sagoo** Sagoo discloses a power control/conversion unit that is selectively coupled to an inverter and controls the input/output levels of the AC and DC voltages. For example:

Claim Limitation	Exemplary Prior Art Disclosures
	According to still another aspect of the invention, there is provided a method of wirelessly supplying power by induction, the method including receiving data instructing to operate in a source mode from a first device through a local communication unit; ***connecting an inverter to a battery and a power control/conversion unit and switching to the source mode for supplying energy to the first device***; setting an inductive coil coupled with the power control/conversion unit as a primary coil; and transmitting energy to an inductive coil of the first device set as a secondary coil. Sagoo, 2:46-55. The mobile device 100 includes the battery 130, a rectifier 120, an inverter 160, a power control/conversion unit 110, a charge sensor unit 140, a communication unit 170, and a user interface unit 150. The battery 130, the rectifier 120, the inverter 160, and the power control/conversion unit 110 perform operations related to charging. The rectifier 120 is an electrical circuit element or device for converting an alternating voltage into a DC voltage. In FIG. 3, the rectifier 120 is provided with an AC voltage through the power control/conversion unit 110 and provides a DC voltage to the battery 130, thereby charging the battery 130. Rectifiers are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. The inverter 160 is an electrical circuit element or device for converting a DC voltage into an AC voltage. In FIG. 3, the inverter 160 is supplied with a DC voltage through the battery 130 and provides an AC voltage to the power control/conversion unit 110. As a result, it is possible to charge a battery of another mobile device. Inverters are generally used in transformers and are well known to those skilled in the art. Therefore, a detail description thereof will be omitted. ***The power control/conversion unit 110 is coupled to one of the rectifier 120 and the inverter 160 so that the mobile device 100 can be supplied with energy from another device (the load mode) or provide energy to another device (the source mode). The power control/conversion unit 110 controls input and output levels of AC and DC voltages***. Further, the power control/conversion unit 110 operates in the load mode when the mobile device 100 is to be supplied with energy or in the source mode when the mobile device 100 is to supply energy. ***The charge sensor unit 140 checks the charge state of the battery 130 and supplies*** the user interface unit 150 with information on whether the battery 130 needs to be charged or whether the battery has

Claim Limitation	Exemplary Prior Art Disclosures
	enough charge to supply energy to another device and ***information on whether the power control/conversion unit 110 will be coupled with the rectifier 120 or the inverter 160***. Sagoo, 4:34-5:4. *See also* Limitations [1b], [1c]. **Schuessler** Schuessler discloses that a control mechanism controls the coil circuitry and selection mechanism to direct power from a coil to a rechargeable battery. For example: ***Control mechanism 225 may be coupled via connection 246 to coil 205 or the circuitry around coil 205 (not shown)*** to receive information or ***to provide adjustment***. For example, control mechanism 225 may include a circuit for reading the voltage at a node of coil 205, or for reading the current through coil 205. Other information may also be received from coil 205 or the circuitry around coil 205, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if current in coil 205 crosses a low or high threshold, control mechanism 225 may determine that there is a failure in the coil 205 or associated circuitry and that energy transfer should be terminated. ***Control mechanism 225 may provide adjustment to coil 205***, for example, by using coil 205 to determine the frequency of an external device such as charging bay 110 or rechargeable electronic device 115, then ***tuning coil 205 and/or the associated circuitry to the determined frequency for better power delivery***. Control mechanism 225 may be coupled via connection 248 to rechargeable battery 215 to receive information or provide adjustment. For example, control mechanism 225 may include a circuit for reading the voltage across a cell of rechargeable battery 215. Other information may also be received from rechargeable battery 215, and control mechanism 225 may use the information received to determine whether conditions are appropriate to begin or continue energy transfer. For example, if control mechanism 215 determines that the battery state of charge is low, then control mechanism 215 may prevent an attempted energy transfer from rechargeable battery 215.

Claim Limitation	Exemplary Prior Art Disclosures
	Control mechanism 225 may provide adjustment to rechargeable battery 215, for example, adjusting the rate of charge transfer to or from rechargeable battery 215. ***Control mechanism 225 may be coupled via connection 247 to selection mechanism 210 to control the direction of energy flow between coil 205 and rechargeable battery 215. For example, in an implementation in which selection mechanism 210 contains FETs to couple coil 205 to rechargeable battery 215, the FETs may be turned on and off by electrical signals from control mechanism 225***. Control mechanism 225 may be additional to an external selection option such as a switch accessible on the outside of the housing of bi-directional charging device 105. In an implementation with such an external switch, control mechanism 225 may monitor the conditions of coil 205 and rechargeable battery 215 and determine if energy transfer should be discontinued. For example, when rechargeable battery 215 is fully recharged, battery 215 may be disconnected from coil 205 regardless of the state of the external switch. Schuessler, 5:39-6:26. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform handshaking with an external device, and then ***inform control mechanism 225 of an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215***. Schuessler, 6:62-7:6. ***External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies***. An external device may notify bi-directional charging device 105 that charging is complete, and ***control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215***. Schuessler, 7:13-30.

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	Selection mechanism 210 selects the direction of energy transfer, either directing power to rechargeable battery 215 in a power receiving mode or ***directing power from rechargeable battery 215 in a power delivering mode***. In a bi-directional charging device 105 with multiple coils and/or multiple rechargeable batteries 215, there may be multiple concurrent modes such that selection mechanism 210 may direct power from/to multiple coils 205 concurrently, or from/to multiple rechargeable batteries 215 concurrently, or between multiple coils 205 and multiple rechargeable batteries 215 concurrently. For an example of the latter selection, selection mechanism 210 may select power to one or more rechargeable batteries 215 from one or more coils 205 receiving power from an external charging station while selection mechanism 210 concurrently selects power delivery from one or more rechargeable batteries 215 to one or more coils 205 to deliver power to one or more rechargeable electronic devices 115. Schuessler, 4:35-60. ***A bi-directional charging device includes a rechargeable battery, a coil coupled to the rechargeable battery, a selection mechanism that selectively*** causes power to be delivered from the coil to the battery and selectively ***causes power to be delivered from the battery to the coil, and a control mechanism***. Upon determining that the coil is to provide power to the battery, the control mechanism causes the selection mechanism to selectively cause power to be delivered from the coil to the battery, and upon determining that the coil is to receive power from the battery, the control mechanism causes the selection mechanism to ***selectively cause power to be delivered from the battery to the coi***l. Schuessler, Abstract. **Yeh** Yeh discloses a logic control unit that controls the operation of a bidirectional wireless charging and discharging device in a power transmission mode to transmit power from the battery to the wireless receiving and transmission unit to charge another device. For example: The transmission mode of the bidirectional wireless charging and discharging device according to the first embodiment of the present invention is described as follows:

Claim Limitation	Exemplary Prior Art Disclosures
	The bidirectional wireless charging and discharging device is normally set in the receiving mode, so that to switch to the transmission mode, the control switch 5 is actuated to effect switching. Presumably, a portable electronic device 9 that includes a bidirectional wireless charging and discharging device according to the present invention intends to transmit its own power in a wireless manner to another electronic device equipped with the bidirectional wireless charging and discharging device. The control switch 5 is pressed down to make it conducting. Electrical power from the battery 93 flows through the control switch 5 and then the third control pin (namely transmission identification control pin) 13 to allow the logic control unit 1 to identify that it has been switched to the transmission mode. When the control switch 5 is set conducting, the first reverse current protector 4 is also set conducting so that the electrical power of the battery 93 that was previously blocked by the first reverse current protector 4 is now allowed to pass, and then flow through the first MOSFET 35 of the step-up/step-down unit 3 to be applied to the power pin 17 of the logic control unit 1 to realize supply of power to the logic control unit 1. Further, the second reverse current protector 4a blocks the electrical power of the battery 93 from charging back. ***When the logic control unit 1 identifies the switching to the transmission mode, the transmission sustaining circuit (which is provided to maintain the transmission mode) 19 to make the fourth control pin 14 maintaining supplying a transmission sustaining signal to the third control pin 13 to achieve the effect of sustaining the transmission thereby maintaining in a transmission condition***. The detection pin 18 of the logic control unit 1 detects if an electronic device to be charged exists in the opposite side of the wireless receiving and transmitting unit 2 that may comprise a built-in antenna. ***If no detection is found, then the logic control unit 1 stops the transmission. The detection is realized by having the detection pin 18 detecting if a load exists in the opposite side of the wireless receiving and transmitting unit 2:*** ***if there is no load: the transmission is stopped;*** ***if there is a load: the logic control unit 1 uses the first and second control pins 11, 12 to output a PWM (Pulse Width Modulation) signal that drives the first and second MOSFETs 35, 36 of the step-up/step-down unit 3***. With such a PWM signal, the first and second MOSFETs 35, 36 can be successively and alternately set on and off with an extremely high frequency. When the second MOSFET 36 is on and the first MOSFET 35 is off, since both the second MOSFET 36 and the battery 93 have an end grounded, thereby forming a closed loop, so that electrical power of the battery 93 can

Claim Limitation	Exemplary Prior Art Disclosures
	flow through the first reverse current protector 4 and the inductor 37 of the step-up/step-down unit 3 to further flow through the second MOSFET 36, and thus charging the inductor 37. When the first MOSFET 35 is on and the second MOSFET 36 is off, the electrical power of the battery 93, after flowing through the inductor 37, passing the first MOSFET 35, so that the charged inductor 37 may discharge through the wireless receiving and transmitting unit 2. In other words, the alternate on and off states and the alternate off and on states of the first and second MOSFETs 35, 36 may respectively charge the inductor 37 and discharge the inductor 37. ***When an electrical current flow through an internal winding of the wireless receiving and transmitting unit 2, the winding generates magnetic lines of force and the electronic device on the opposite side receives and converts the magnetic lines of force into an electrical current***. ***During transmission, the route from the battery 93 to the wireless receiving and transmitting unit 2 passes the first and second MOSFETs 35, 36 contained in the step-up/step-down unit 3***, and this is stepping up (such as stepping from 3.6-4.2V DC to around 5V AC); on the contrary, it is stepping down from the wireless receiving and transmitting unit 2 to the battery 93. Yeh, 5:37-6:44. ***When the logic control unit 1 is switched to the transmission mode, the fourth control pin 14 continuously supplies a transmission sustaining signal to maintain the first reverse current protector 4 in an ON condition***; when the logic control unit 1 is switched to the receiving mode, the fifth control pin 15 continuously supplies a receiving sustaining signal to maintain the second reverse current protector 4a in an ON condition. Yeh, 7:11-18. **Cook** Cook discloses that a frequency generation and control circuit controls a bidirectional wireless circuit to operate in a power transmit mode. For example: Bidirectional power conversion circuit 308 further includes ***a frequency generation and control circuit 322 for generating the switch waveforms 328 required to operate synchronous rectifier 320 in the desired (transmit or receive) mode and to control the extent to which the electronic device***

Claim Limitation	Exemplary Prior Art Disclosures
	shares its power stored in battery 310 while in donor mode. Frequency generation and control circuit 322 is controlled by control within the host device electronics 324 which also performs battery management and provides a user interface for selection of donor mode. Furthermore, synchronous rectifier 320 may also provide power to frequency generation and control circuit 322 during receive mode when power from battery 310 is depleted or otherwise unavailable. Cook, ¶51. Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1. Cook, ¶55 Bidirectional wireless power transceiver 318T includes a bidirectional power conversion circuit 308T and an antenna 306T. In bidirectional power conversion circuit 308T, a half bridge active rectifier includes switches Q1 and Q1′, such as a pair of matched Field Effect Transistors (FETs) with adequate voltage and current ratings. ***The FET switches Q1 and Q1′ are driven and accurately controlled by a frequency generation and control circuit 322T as further monitored by sensors 470 for sensing voltage and current on both FET switches Q1 and Q1***′. ***Furthermore, low loss zero voltage switching, also relies upon accurate tuning of the tank circuit of transmit antenna, L1 and C1, to eliminate any phase shift between tank voltage and the FETs rectangular current waveform. In an exemplary embodiment this tuning may be performed by adjusting the capacitor C1***. Cook, ¶59. In receive or absorbing mode, the bidirectional power conversion circuit 308 acts as a synchronous rectifier and ***switches are controlled based on sensed voltage***. The exemplary embodiments may also

Claim Limitation	Exemplary Prior Art Disclosures
	include shunt diodes (not shown) across switches Q1 and Q1′. These switches Q1 and Q1′ ensure that the circuit is self recovering in the event the battery is depleted. Specifically, the circuit begins to rectify received high frequency power to provide power to the frequency generation and control circuit 322. Cook, ¶ 63. **WPT** For example: The Communications and Control Unit on the left-hand side of Figure 3-9 comprises the digital logic part of the design. This unit receives and decodes messages from the Power Receiver, configures the multiplexer to connect the appropriate parts of the Primary Coil array, executes the relevant power control algorithms and protocols, and drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver. The Communications and Control Unit also interfaces with the other subsystems of the Base Station, e.g. for user interface purposes. WPT, 20. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30. *See also* Limitations [1b], [1c].
[1g] said second circuitry, on power-up of said secondary wireless power receiver, configured to identify a type of said secondary wireless	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.*, https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html. To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the references cited in limitation [1c] and additional disclosures below. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and

Claim Limitation	Exemplary Prior Art Disclosures
power receiver and identify a wireless power protocol of said secondary wireless power receiver;	configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **Chatterjee** Chatterjee discloses that the processor receives and process data from the second electronic device, including a type identification and communication protocol of the second electronic device. For example: > The selective operation of the inductive signal interface may be determined: (i) in real-time based on, for example, an identification or mode of operation of the type of the other coupled device, and/or (ii) at a time of manufacturing based on the power consumption and/or transmission capabilities of the manufactured device. Chatterjee, ¶ 31. > The same power bridge circuit **311** may be used for implementations in which first device 302 can only receive power over the inductive link 330. The ability to use the power bridge circuit 311 in either fashion may also enable the first device 302 to operate in both power receive and power transmit modes, depending on, for example, ***a type identification of the second electronic device 320***. In such implementations, for example, a mobile computing device may (i) link with a dock to receive power, in which case the inductive signal interface operates in a power receiving mode; and (ii) link with another mobile computing device or headset that requires power, in which case the inductive signal interface operates in a power transmit mode. Chatterjee, ¶ 35. > In some embodiments, the mode of operation for the inductive signal interface 310 is set by control signals. The control signals may originate from (i) stored or hardwired parameters that designate the device as a power receiver or transmitter, or (ii) by identification of the second electronic device 320 in instances when the first electronic device 302 is ambidextrous. In implementations when the mode designation can be designated by control signals, the control signals 321 may be received or identified over a signal line CTRL (which may be coupled to receive information via the inductive link 330). As such, the signal line CTRL may identify the mode of operation of the inductive signal interface 310. Chatterjee, ¶ 36.

Claim Limitation	Exemplary Prior Art Disclosures
	The power circuit 314 is coupled to the power bus 309 to handle current received in either mode (power receive or power transmit) of operation. The power circuit 314 may serve to clamp current levels, regulate voltage levels or perform other treatment functions for incoming (power transmit mode) and outgoing power signal (power receive mode). The power circuit 314 is coupled to the power bridge circuit 311 to (i) receive the power signal communicated over the inductive link 330, and/or (ii) transmit the power signal received from a power source (e.g. battery, wall outlet) of the first electronic device 302. The power circuit 314 includes one or more of: (i) voltage sensors, (ii) current sensors, (iii) voltage regulators, (iv) current regulators, or (v) current clamps to regulate the voltage and current of the DC power signal. In the power receive mode, the power circuit 314 outputs power received over the inductive link to another component that is on the first electronic device 302, or alternatively connected to the electronic device (e.g. rechargeable battery). ***In the power transmit mode, the power circuit 314 handles incoming power signal originating from a power source (e.g. wall adapter), the incoming power signal being used to transmit the power to the second electronic device 320 over the inductive link 330***. In either the power receive or power transmit mode, one implementation provides the power circuit 314 to handle Direct Current power signals. Thus, in the power transmit mode, the power circuit 314 may handle a DC signal that was treated by other circuits to handle, for example, the alternating current signal from a wall outlet. In the power receive mode, the inductive link 330 handles the power signal in a modulated form, and this power signal is converted into DC for handling as output by the power circuit 314. Chatterjee, ¶ 37. Similar to the inductive signal interface 310 of FIG. 3, certain implementations of the inductive signal interface 410 is able to operate in power transmit and receive modes. The mode of operation of the inductive signal interface 410 may be based on an identification and/or a status of the second electronic device 420. In particular, the inductive signal interface 410 may be configured to (i) operate in the power transmit mode if it is identified that the second electronic device 420 is configurable to receive power inductively via the inductive link 430; (ii) in the power receive mode if it is determined that the second electronic interface 420 is a dock or a charger. The transfer of identification and status information may occur as data transmission via the inductive link 430. According to some embodiments, the mode of operation of the inductive signal interface 410 also depends on a status of the electronic device 402. For example, if a status of a rechargeable battery (not shown) on the electronic device 402 indicates that the rechargeable battery is not fully charged, the

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	inductive signal interface 410 can be configured to operate in a power receive mode, when it would otherwise operate in the power transmit mode. Chatterjee, ¶¶ 42-43. In some embodiments, inductive signal interface **410** is configurable to transfer data as well as power via the inductive link **430**. ***In an embodiment, data transmitted over the inductive link 430 includes data that corresponds to identification or status information of the electronic device 402 and/or the second electronic device 420***. As described above, the identification and status information may be used to control the mode of operation of the inductive signal interface **410**. Data transmitted over the inductive link **430** may also include commands from the electronic device **402** to the second electronic device **420**, or vice-versa. As an example, the electronic device **402**, which is a mobile computing device, includes an embodiment of the inductive signal interface **410**, and the second electronic device **420** is a dock. The inductive signal interface **410** is configured to exchange data corresponding to identification and status information of the dock and/or the mobile computing device via the inductive link **430**. Upon processing the data, the mobile computing device transmits commands over the inductive link **430** to cause the dock to enter the power transmit mode of operation. The mobile computing device also executes commands to cause the inductive signal interface **410** to enter the power receive mode of operation. In some embodiments, the inductive signal interface **410** is used to transmit or receive power signal requirements. In power receive mode, the electronic device **402** may transmit out its power supply requirements so as to enable the other computing device to adjust the level of the transmitted power signal to fit the needs of the power receiving device. ***In power transmit mode, the electronic device 402 may signal data to enable a data loop in which the second device (as the power receiver) to signal back real-time information about its power needs***. Specific examples of the type of data that can be communicated over using the inductive signal interface is described in U.S. patent application Ser. No. 12/478,766, entitled "Inductive Signal Transfer System for Computing Devices"; the aforementioned application being hereby incorporated by reference in its entirety for all purposes. As described, the data that may be send over inductive link **430** may include a specific format and structure, under an inductive communication protocol that both devices share. As part of a communication protocol, ***the inductive signal interface 410 may be used to signal data to implement parts of the communication protocol, such as detecting presence of the second device, authenticating itself and/or the second device, and enumerating itself***.

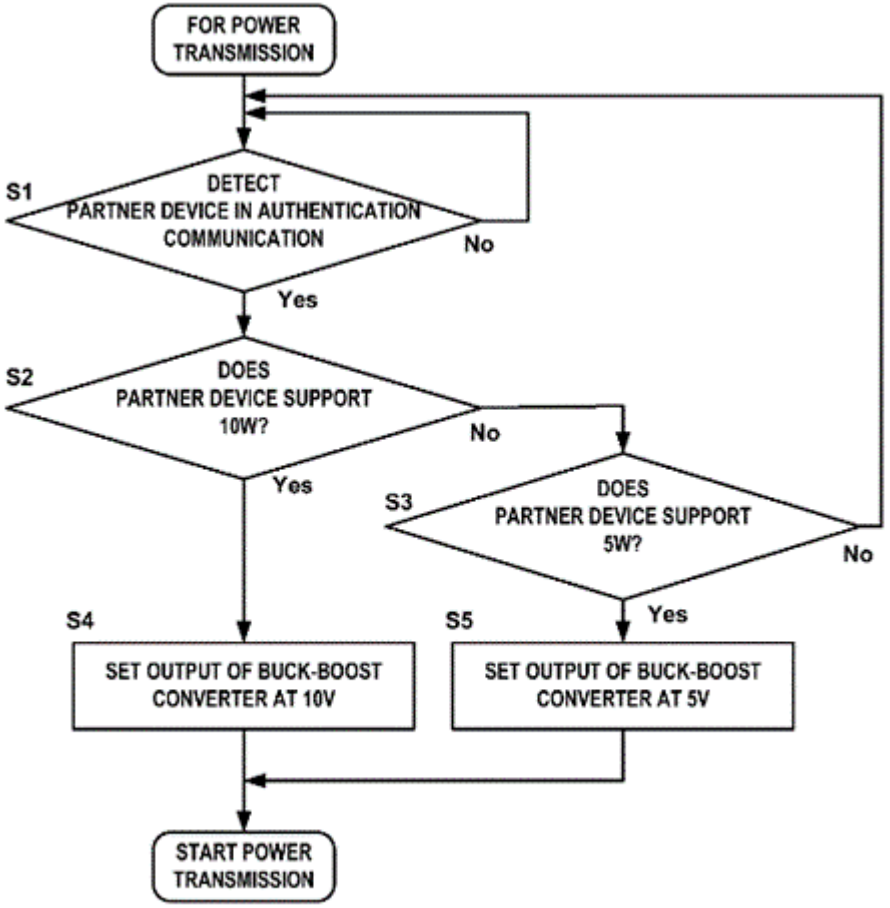
Claim Limitation	Exemplary Prior Art Disclosures
	Chatterjee, ¶ 48. In some embodiments, the data transfer between the inductive signal interface 410 and the second electronic device 420 occurs in a half-duplex fashion. In other embodiments, the data transfer between the inductive signal interface and the second electronic device occurs in a full-duplex manner, wherein outgoing and incoming modulated data signals use different carrier frequencies. ***The incoming modulated data signal is received inductively via the inductive link 430***, and the outgoing modulated data signal is transmitted to the second electronic device via the inductive link 430. According to certain embodiments, outgoing data is modulated by the power signal from the power bridge circuit 411 to become the outgoing modulated data signal. As an addition or alternative, outgoing data may be modulated by carrier waves having different frequencies compared with the power signal. Filters may be employed within the inductive signal interface 410 to separate the modulated data signals from the power signal. Chatterjee, ¶ 50. ***The communication circuit 415 is coupled to the bi-directional coil assembly 412 in order to transmit and receive data over the inductive link 430***. The communication circuit includes a modulator **416** and a demodulator **417**. The modulator **416** is configured to output an outgoing modulated data signal to the bi-directional coil assembly **412** to transmit the modulated data signals to the second electronic device via the inductive link **420**. The demodulator **417** is coupled to the bi-directional coil assembly **412** to receive an incoming modulated data signal received over the inductive link **430**. Chatterjee, ¶ 51. The incoming modulated data signal received over the inductive link **420** is transmitted to the demodulator **417**, which performs demodulation to generate a demodulated data signal. ***The communication circuit 415 transmits the demodulated data signal to the processor 413 for processing or transmission to other components of the electronic device 402***. Chatterjee, ¶ 53. ***The communication circuit 415 is coupled to the processor 413 to transmit and receive data which is transferred via the data bus to and from the processor 413. The processor 413 may be configured to process identification and status information transmitted over the inductive signal interface 430 to***

Claim Limitation	Exemplary Prior Art Disclosures
	determine a mode of operation of the inductive signal interface 410. The processor is also coupled to the power bridge circuit 411 to control the operation of the power bridge circuit 411 based on the determined mode of operation. The processor 413 may also be configured to process communication data received from over the inductive link, or from other communication mediums (e.g. BLUETOOTH). Chatterjee, ¶ 55. Chatterjee discloses and/or renders obvious that identifying "a type of said secondary wireless power receiver" and "wireless protocol of said secondary wireless power receiver" happens "on power-up of said secondary wireless power receiver" because a POSA would have understood or found it obvious that data is communicated over the power link by modulating the wirelessly transmitted power (*see e.g.* claim limitation [1c]), and thus can only happen when the power link exists. **Van Der Lee** Van Der Lee discloses that a processing module receives information including, for example, the identifier, the power capability, and the power priority, as well as the communication protocol, from another wireless power module. For example: A dual mode wireless power module for a device includes a wireless transceiver and a wireless power transceiver circuit. ***The wireless transceiver circuit is operable to communicate peripheral power information indicating a wireless power configuration***. The wireless power transceiver circuit is operable to determine, based upon the power information, a power status of another device identified by the peripheral power information. When the power status of the another device is favorable, the wireless power transceiver circuit is placed in a wireless power receive mode in which the wireless power transceiver circuit converts wireless power into a voltage. When the power status of the another device is unfavorable, the wireless power transceiver circuit is placed in a wireless power transmit mode in which the wireless power transceiver circuit converts a power source of the device into the wireless power. Van Der Lee, Abstract.

Claim Limitation	Exemplary Prior Art Disclosures
	The determination a power status of one of the devices, such as the smart phone 102, the cell phone 104, the personal A/V player 108, may be with regard to power information communicated via the control and communication link between the device. For example, ***the power information may include power source identifier for the peripheral device, a wireless power capability of the device, whether dual mode wireless power is enabled for the device, wireless power transmit capability, or wireless power receive capability. Moreover, the power information may include a device power priority giving precedence over lower prioritized devices for limited or discrete power resources in a battery-based system (that is, a system in which a power transmitter circuit 110 is unavailable to provide virtually bottomless power resources).*** For example, a device may be designated in a factory setting as having priority for finite power resources (such as a cell phone 104) in the need to communicate in emergencies, or lower based upon purely entertainment function (such as the personal A/V player 108). In other contexts, a user may configure the device power priority based upon their individual preferences, such as via a user interface for the device. ***The power information may further include at least one of a communication protocol, input data, input command, output data, and output command***. For example, with interaction with a user input device (such as a touch or tactile screen, keypad, mouse, keyboard, et cetera), the user input device may generate data and/or a command for execution by the display device, such as a display screen on the personal A/V player 108. As another example, if the device setup includes a memory device such as a wireless disk drive or flash drive, and the peripheral device is a user output device such as the display screen and speakers of the personal A/V player 108, the memory device provides data to the user output device for display of audible and/or visual data. Van Der Lee, ¶¶30-31. The processing module 152 places the wireless power transceiver circuit 144 in either of a wireless power transmit mode or a wireless power receive mode based upon ***power information from the dual mode wireless power module 122***, via the processing module 132 and memory 134 of the peripheral device. Moreover, the processing module 132 places the wireless power transceiver circuit 126 in a complementary mode of operation. Van Der Lee, ¶ 44. The power information indicates a wireless power configuration, including one or more of full battery capacity, charging history (e.g., times, durations, charge voltage, charge current, trickle charge

Claim Limitation	Exemplary Prior Art Disclosures
	reached, etc.), current battery life, current loading, loading history, etc. Moreover, the ***power information includes a power source identifier identifying the device or devices, wireless power capability (for example, whether dual mode capable, transmit capable, or receive capable)***; device power priority (indicating the power reception priority for conveying or receiving wireless power); and ***at least one of a communication protocol***, input data, input command, output data; and output command. Van Der Lee, ¶ 76. The foregoing method may further include establishing the wireless power link. The wireless power link may be established based on inductive (or non-resonant) coupling or on resonant inductive coupling. ***The wireless communication link and the wireless power link may also be established via the same inductive link***. The foregoing method may further include monitoring an amount of power wirelessly transferred to the portable electronic device and charging a user of the portable electronic device based on the monitored amount. Van Der Lee, ¶ 8. Van Der Lee discloses and/or renders obvious that identifying "a type of said secondary wireless power receiver" and "wireless protocol of said secondary wireless power receiver" happens "on power-up of said secondary wireless power receiver." Van der Lee discloses and/or renders obvious transmitting data over the same wireless power link as explained above in claim limitation [1c]. **Shinoda** Shinoda discloses a control unit or control circuit receiving and detecting code from the partner device, such as identification code, device code, and code specifying power specification, and that such code is sent from the partner device via load modulation. For example: In another more specific embodiment, ***the control unit may be configured to carry out mutual device authentication communication with a partner device*** coupled to the coil ***and variably control transmitting power or received power according to the partner device***. Shinoda, 2:52-56.

Claim Limitation	Exemplary Prior Art Disclosures
	FIG. 6 is a diagram that illustrates an operational flow for power transmission of the wireless power transfer terminal 21. For a power transmission mode of the wireless power transfer terminal 21, ***authentication communication is carried out and a response from a partner device is awaited (step S1)***. This authentication communication can be carried out by, for example, amplitude-modulating voltage in power transmission with constant periods using, for example, ***identification code or device code*** and detecting a response from the partner device from a change in voltage between the opposed ends of the coil. Therefore, the wireless power transfer terminal 21 may preferably be provided with a detector circuit, for example. Next, the power specification of the partner device is determined (steps S2 and S3). This determination is made by, for example, ***demodulating the response from the partner device and detecting code specifying the power specification***. Therefore, the wireless power transfer terminal 21 may preferably be provided with a demodulating circuit and a code analysis unit. Next, the output of the buck-boost converter is set such that it is voltage in power transmission corresponding to the power specification of the partner device, and power transmission is started under this setting (steps S4 and S5). The wireless power transfer terminal 21 transmits power according to the above-described operational flow. With this operation, even if there are a plurality of specifications for voltage in power transmission, power transmission supporting such various specifications can be achieved. Hence, the wireless power transfer terminal 21 can transmit and receive power to and from a plurality of partner devices having different specifications of power used in power transmission and power used in power reception. Shinoda, 6:52-7:5.

Claim Limitation	Exemplary Prior Art Disclosures
	 FIG.6 Shinoda, Fig. 6. The partner device may preferably respond by the ***load modulation method*** employing voltage in power transmission in authentication communication of the wireless power transfer terminal 21 and

Claim Limitation	Exemplary Prior Art Disclosures
	using various kinds of code set in the partner device. Therefore, the wireless power transfer terminal 21 may preferably be provided with a load modulating unit in order to make substantially the same response in authentication communication for power reception. Shinoda, 7:19-26. **Singh-203** Singh-203 discloses and renders obvious this limitation. On power-up of the secondary wireless power receiver, control logic 217 of device 210 determines the mode of operation according to a wireless power protocol, establishing a communication link. The protocol identifies the device type. For example, Singh-203 discloses: In operation, each of the control logic 217, 227 determines which mode of operation the respective wireless power enabled device 210, 220 is desired to operate in. This determination may be performed according to a protocol that determines which wireless power enabled device 210, 220 is to operate in transmit mode and which is to operate in receive mode. In other words, the control logic 217, 227 determines the relationship between the wireless power enabled devices 210, 220. For example, the first wireless power enabled device 210 may include a software application that a user may interface with to manually establish the relationship between the first wireless power enabled device 210 and a nearby second wireless power enabled device 220. The first wireless power enabled device 210 may establish a communication link with the second wireless power enabled device 220 to establish the desired relationship. In another embodiment, the user may set (e.g., with a software application, a physical switch, etc.) the first wireless power enabled device 210 to operate in transmit mode, which then generates the wireless power signal 105. The second wireless power enabled device 220 may simply detect the presence of the wireless power signal 105 and automatically enter receive mode. As a result, a communication link between the wireless power enabled devices 210, 220 may not need to be established. In some embodiments, the wireless power enabled devices 210, 220 may further include a protocol that automatically establishes a desired relationship responsive to detecting each other's presence. For example, a protocol may be set to determine that the wireless power enabled device 210, 220 that has the higher remaining battery charge should operate in transmit mode. Other applications, features, and protocols for manually and automatically establishing a relationship between the wireless power enabled devices 210, 220 are also contemplated.

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-203, 6:5-38. Referring now specifically to FIG. 3B, the wireless power enabled device 210 is shown as being operated in a transmit mode according to an embodiment of the present disclosure. In order to transmit wireless power, the control logic 217 (FIG. 2) may generate control signals 218 that operate the plurality of switches 331, 332, 333, 334 of the wireless charging transceiver 212 as a full-bridge inverter. As a result, the plurality of switches 331, 332, 333, 334 may open and close to generate an AC current through the resonant tank 311. For example, the control logic 217 may generate the control signals 218 to drive the plurality of switches 331, 332, 333, 334 to vary switching frequency, duty cycle of the switching, phase of the switching, the input voltage, or a combination thereof. As a result, the AC current flowing through the resonant tank 311 may generate a time-varying electromagnetic field having for transmitting the wireless power signal 105 to a wireless power receiving apparatus. Thus, the wireless power signal 105 may be a time-varying signal that is substantially sinusoidal, having a frequency based on the switching frequency of the wireless charging transceiver 212. The control logic 217 may control the plurality of switches 331, 332, 333, 334 to cause the wireless power signal 105 to have a frequency that is approximately the resonant frequency of the resonant tank 311. In some embodiments, the frequency of the wireless power signal 105 may differ from the resonant frequency of the resonant tank 311, such as to reduce the peak to peak current through the inductive coil 314. In this example, the power used to generate the wireless charging signal can be provided by the energy storage device 305 rather than through the adaptor 340. Thus, the fifth switch 335 may be open to disconnect the wireless charging transceiver 212 from the adaptor 340, and the sixth switch 336 may be closed to connect the energy storage device 305 to the wireless charging transceiver 212. In addition, the seventh switch 337 may be opened so that current may not flow through the charger 350 to the energy storage device 305. As a result, the voltage at node 370 may be the input signal (VIN) to the wireless charging transceiver 212 for enabling current flow through the resonant tank 311 to generate the wireless power signal 105. Capacitor 360 may be coupled to node 370 may act as an input capacitor during transmit mode. Singh-203, 7:51-8:27. **Singh-624**

Claim Limitation	Exemplary Prior Art Disclosures
	Singh-624 discloses identification of a device type and it would have been obvious to have Singh-203's circuitry identify the device type on power-up. For example, Singh-624 teaches: > Having two-way communication enables the transmitter 112 and the receiver 122 to establish a secure communication for a variety of different purposes, such as the transmitter 112 authenticating the type of receiver 122 that the transmitter 112 is talking to, or to authenticate a particular battery type to know that the battery of the receiver 122 is legitimate prior to generating the wireless power signal 105. Other data may be shared between the transmitter 112 and receiver 122 regarding the performance of the inductive wireless power transfer system 100, to assist with foreign object detection, among other reasons. Singh-624, 6:12-22. **Sagoo** Sagoo teaches that the communication unit receives information on the states of other mobile devices, authentication information, information on whether charging can be performed on a neighboring device, For example: > ***The communication unit 170 performs wireless communication, detects other mobile devices existing within a predetermined distance, receives information on the states of the other mobile devices***, and controls whether the mobile device can be charged by any one of the other mobile devices. When ***the communication unit is made to further perform an authentication process***, it is possible to prevent an unauthenticated device from being supplied with energy from another device. In order to detect devices existing within a predetermined distance, the communication unit can perform communication using radio frequency (RF) signals. For example, Near Field Communication (NFC), ultraviolet (UV) communication, Bluetooth, Zigbee, and other communication techniques can be applied. When NFC is used, it is possible to perform communication even in an environment in which there are many disturbing factors. Further, other RF techniques can be applied. Sagoo, 5:5-21. > When informed that the amount of charge in the battery is not enough, the user can charge the battery. ***The communication unit 171 receives information on whether charging can be performed by a***

Claim Limitation	Exemplary Prior Art Disclosures
	neighboring device and outputs the received information to the user interface unit 151. Alternatively, it is possible to automatically select a specific device to be used for charging. The device selection and output can be realized in software, and each device can be detected according to the output power of an RF signal of a communication unit. Sagoo, 6:17-25. ***The communication unit 171 of the first device 101 and the communication unit 172 of the second device 102 transmit and receive data required for charging***. Further, ***the communication units can perform authentication with respect to each other*** such that charging is performed between authenticated devices. Sagoo, 6:43-48. **Schuessler** Schuessler teaches receiving communication from the second electronic device such as charging needs, status, handshaking, power deliver request, charging completion, and that such communication can be modulated on the energy transfer itself. For example: One or more of bi-directional charging device 105, charging bay 110, and rechargeable electronic device 115 may include wireless communication capability such that they may communicate regarding ***charging needs and status***. For example, communication may be through Bluetooth or WiFi or other public or proprietary wireless protocol. ***Communications may be for example modulated on the energy transfer itself, by modulating a low frequency protocol on a high frequency energy transfer, or by modulating a high frequency protocol on a low frequency energy transfer***. Communication may be via an infrared interface, as another example. Schuessler, 3:1-11. If communication capability is included in both bi-directional charging device 105 and rechargeable electronic device 115 as described above, then the devices may communicate with each other to coordinate energy transfer. ***Coordination of energy transfer may include beginning and ending energy transfer and status communication during energy transfer***.

Claim Limitation	Exemplary Prior Art Disclosures
	Schuessler, 3:56-61. External communication interface 235 may be coupled via connection 250 to control mechanism 225. For example, external communication interface 235 may perform ***handshaking*** with an external device, and then inform control mechanism 225 of ***an amount of charge needed and a preferred frequency to use for delivering power to the external device based on a power delivery request from the external device***. Control mechanism 225 in this example may then configure rechargeable battery 215 and coil 205 to deliver the appropriate charge at the appropriate frequency and may cause selection mechanism 210 to couple coil 205 to rechargeable battery 215. External communication interface 235 may be used by bi-directional charging device 105 to make requests to external devices for charging. For example, upon recognizing that a charging bay 110 is in the vicinity, bi-directional charging device 105 may request the charging bay 110 to begin delivering power. External communication interface 235 may receive information from control mechanism 225 to deliver to an external device, such as expected time required for charging, or available charging frequencies. An external device may notify bi-directional charging device 105 that charging is complete, and control mechanism 225 may then cause selection mechanism 210 to decouple coil 205 from rechargeable battery 215. Schuessler, 6:62-7:19. FIG. 3B illustrates briefcase 315, handbag 310, and backpack 320 removed from charging bay 305. If the bi-directional charging devices 105 within the bags are charged at least partially, they may be used to charge rechargeable electronic devices 115 within the bags, as well as charging other bi-directional charging devices 105. Bi-directional charging device 105 determines if it has enough charge to provide power to a rechargeable electronic device 115 or other bi-directional charging device 105, and may provide power as requested. ***A request may come, for example, from a rechargeable electronic device 115 or other bi-directional charging device 105 in the form of a communication through external communication interface 235, or by a signal emitted by rechargeable electronic device 115 indicating less than a full charge***. Schuessler, 8:7-21.

Claim Limitation	Exemplary Prior Art Disclosures
	Multiple bi-directional charging devices 105 may be within charging distance of each other. In such cases, one of the bi-directional charging devices 105 may charge another bi-directional charging device 105. A protocol may be implemented for determining which of multiple devices 105 is to provide charge and which is to receive charge. For example, a protocol may include a determination within one or more bi-directional charging devices 105 as to battery state of charge and expected battery life at the present rate of use and a further determination of whether a device 105 has reached a critical battery state of charge. A protocol may include a heuristic to automatically determine whether a device 105 should be used to charge another device 105. A protocol may include a user notification on a first device 105 that a second device 105 in the vicinity needs to be charged, and that the expected battery life of the first device 105 will be reduced by an amount if the first device 105 is used to charge the second device 105. A user interface on the first devices 105 may allow a user to direct that charge be provided to the second device 105, or direct that no charge be provided to the second device 105. Many other protocols may be implemented to address the situation in which multiple bi-directional recharging devices 105 are within charging distance of each other wherein each device 105 may have a different level of battery charge. Schuessler, 8:53-9:10. **Corbridge** Corbridge discloses transmitting and processing signals sent between a power transmitting device and a power receiving device using modulation concerning, for example, device identification, authentication, and enumeration, and power transfer. For example: FIG. 4 illustrates a simplified block diagram of a computing system that provides for inductive conveyance of power and/or data signals, under an embodiment. The computing system 400 includes MCD 410 and dock 420 that are structured to enable inductive signal transfer exchange, in accordance with numerous embodiments described herein. In an embodiment, the dock 420 includes a central processor 422, a power subsystem 424 and a communication subsystem 426. The MCD 410 includes a power subsystem 412, a signal processor 414, and a communication subsystem 416. Additionally, the MCD 410 (and optionally the dock 420) include numerous other components, such as a central

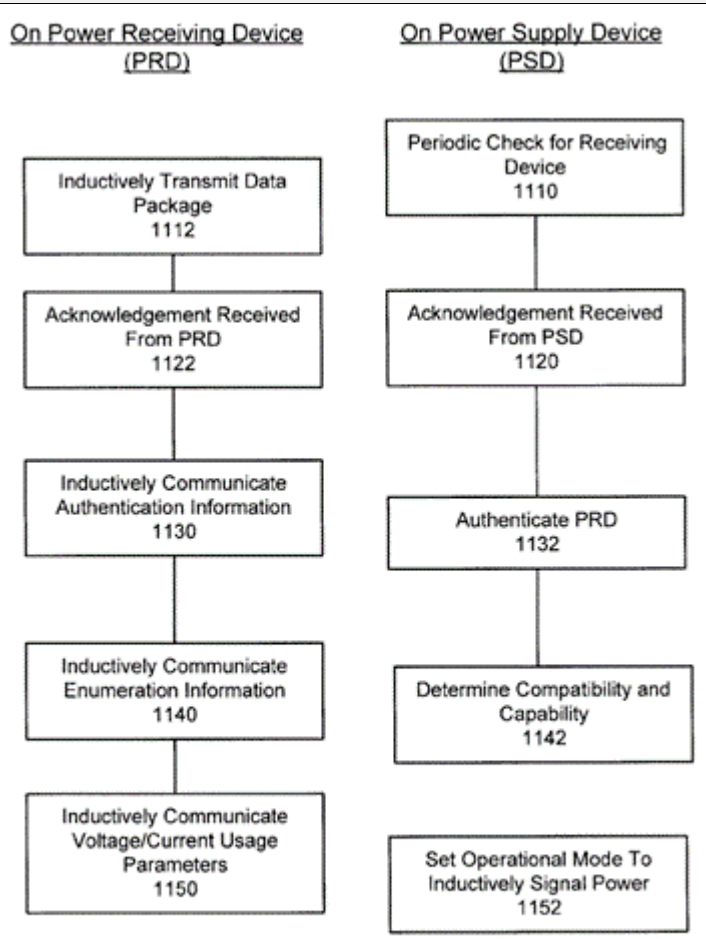
Claim Limitation	Exemplary Prior Art Disclosures
	processor and memory resources for enabling application executions, cellular and data communications, and numerous other functions that are part of the usage of the MCD 410. On the dock 420, the power subsystem 422 includes a connection to a continuous power supply 421, such as a wall outlet. Additionally, the power subsystem 422 includes components for converting and regulating the signals from the power supply into a form that is suitable for conveyance using, for example, an inductive medium. Additionally, the power subsystem 422 includes one or more coils for converting an electrical signal originating from the power supply 421 into an inductive signal. The communication subsystem 426 may include wireless or wireline port(s) to receive and send data to other devices, including with other computers or data sources (e.g. media feeds from other devices, such as set-top boxes) or media output devices. In an embodiment, the communication subsystem 426 also enables inductive data handling from data communicated by one of the inductive signal paths that extend between the two devices. As mentioned, such ***data may be conveyed by either modulating an inductive power signal*** or using a separate data signal path. ***The central processor 424 of the dock 420 may be configured to handle Incoming data signals from the communication subsystem 426***, whether from the other resource or from the MCD 410. Additionally, the central processor 404 may control data that is communicated out, either to the other resource or to the MCD 410 (using the inductive signal path). Corbridge, ¶54-55. On the MCD 410, an embodiment provides that the power subsystem 412 receives an incoming power signal 408 from the dock 420 and distributes the power signal in modified or regulated form to either other components or to the battery for recharge. The power signal 408 is signaled through an inductive path from the dock 420 to the MCD 410, in a unidirectional fashion. The communication subsystem 416 is configured to communicate with the dock 420 to receive and/or transmit data 409. One embodiment provides that the communication subsystem 416 may include resources to demodulate data carried on the power signal. In particular, the communication subsystem 416 may use its resources to implement one or more protocols, such as (i) a protocol for regulating the inductive delivery of power with exchange of data that communicates current/voltage information (e.g. use levels) on the receiving device, (ii) a credential protocol for retrieving and using credential information (e.g. preliminary data for establishing subsequent wireless communications) from characteristics of modulations in the power signal 408. One or both protocols may further provide for the

Claim Limitation	Exemplary Prior Art Disclosures
	communication subsystem 416 to switch to, for example, a standardized wireless communication medium (e.g. BLUETOOTH) using the credential information and/or other data communicated by the power signal 408. Still further, ***another embodiment may provide for the communication subsystem 416 to be enabled to generate modulated power or other signals to communicate to the dock 420 or other device. For example, as shown by FIG. 3B, two coils may be used on the dock, including one coil that communicates both power and data and another that receives data from the MCD 410. The communication subsystem 416 may perform functions of both retrieving data from the modulated data signal and communicating data out to the data receiving coil on the MCD 410.*** Corbridge, ¶57; *see also* Corbridge, Figs. 4-7. As mentioned, ***the incoming signal 721 may be modulated to carry data with delivery of power. The communication circuit 728 (portions of which may be distributed or integrated with the processor or elsewhere) may include a Frequency Shift Key (FSK) detector 716 to detect the signal modulation of the incoming signal 721 over a given duration. FSK modulation is just one type of modulation that can be implemented for the device. For example, the detector may be used to handle AM signal modulation, phase modulation, QAM, CDMA, pole position or various other forms of signal modulation. Such FSK modulation may be consistent with one or more protocols recited herein***. Incoming data 717, as detected from the detector is communicated to the processor 740. Incoming data 717 may include protocol data (data to initiate a sequence of protocol events to control power supplied from dock 600 to the MCD 500), or credential or usage data. The processor 740 may communicate some data from the incoming signal 721 over the data bus 742 to the device (e.g. the devic''s CPU). Other data may be handled to determine protocol responses, or provide/use feedback to tune the characteristics of the power signal 721. The processor 740 may signal data out across the inductive channel using AM modulation (or alternatively FM modulation). In one embodiment, the same coil 722 is used to transmit data out and receive data in on the MCD 500. More specifically, the data out may correspond to protocol data which (i) responds to protocol events, such as signals communicated from the dock 600; (ii) provide feedback, including power supply information (e.g. how much power is needed) or other data to enable the controlled regulation of the incoming power signal 721. Corbridge, ¶84. The power receiving components 810 include an output section 826 which generates a power signal that drives the power coil 830 to inductively signal PWM signal 831 to the MCD 500. The output

Claim Limitation	Exemplary Prior Art Disclosures
	section 826 thus includes circuitry to modulate the power signal from the power source. As described elsewhere, ***the modulation may be in form of Frequency Shift Keying (FSK) to communicate commands, responses and/or acknowledgements to the MCD consistent with a communication protocol such as described with one or more embodiments described herein.*** The logic for determining the specific commands are data bits originals from the processor 820, which communicates with the output section 826. In one implementation the modulation frequency (as provided by the output section 826) is 125 KHz and used to communicate data using "1" and "0" values that correspond to signal peaks. As described previously, MCD 500 (see FIG. 5) may be equipped to inductively receive the transmissions from the power coil 830. Corbridge, ¶90. FIG. 9C is a circuit-level diagram illustrating an exemplary circuit configuration of AM Receiver/Conditioning Circuits 850 of FIG. 9A. AM Receiver 850 includes Schottky Diode 861, comparator 862, diode 863, timer circuit 864, inverter 865, and input 866. AM receiver is coupled to receive modulated data signal from coil 840 of FIG. 9A. Received modulated data signal occupies a different frequency range than output signal transmitted from coil 830. According to one embodiment, received modulated data signal has a center frequency of 3 MHz. Coil 840 is positioned in relation to coil 830 to minimize, as much as possible, inductive coupling between the two coils in order to prevent attenuation to the received modulated data signal. According to one embodiment, coil 840 is a 6-turn coil positioned on the side of the top surface of the dock. The received modulated data signal received at input 866 which is coupled to coil 840. The received modulated data signal is then transmitted to Schottky diode 861 and diode 863. Schottky diode 861 generates low frequency signal derived from the amplitude of the received modulated data signal. This low frequency signal is compared with an averaged voltage level generated by diode 863, in conjunction with attached resistive and capacitive circuit elements. The comparison is performed by comparator 862 and the output of the comparator is a demodulated data signal. Before the demodulated data signal is transmitted to the signal processor 840, it is transmitted to a timer circuit 864 and then an inverter in order to adjust the demodulated data signa''s timing and voltage levels. Corbridge, 95; *see generally* Corbridge, Figs. 9A-9F. ***FIG. 11 illustrates steps performed on respective power supply and power receiving devices in enabling two such devices inductively link to one another under a controlled protocol or process***,

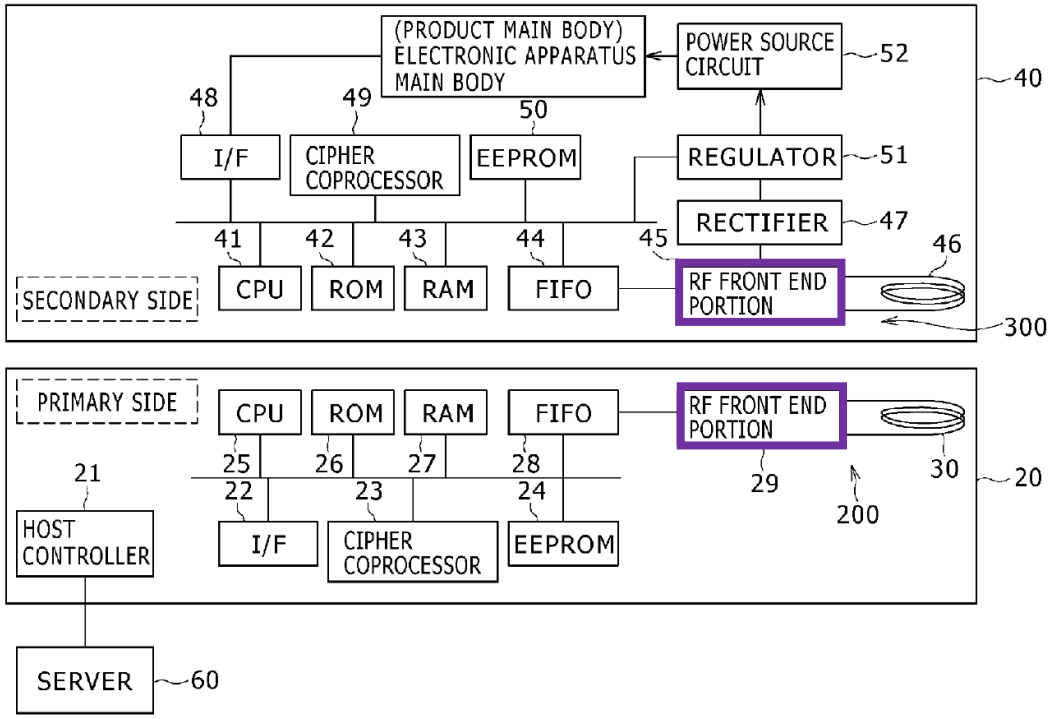
Claim Limitation	Exemplary Prior Art Disclosures
	according to an embodiment. An embodiment such as described may be implemented between, for example, a dock (power supply device) and MCD (power receiving device), or between two MCDs, or between a charged MCD (power supply device) and accessory device (power receiving device). As described, two devices are inductively linked, with a series of data communications or exchanges that are communicated across an inductive link in accordance with an inductive communication protocol. In step 1110, the power supply device makes a periodic check as to whether the power receiving device is inductively linked. For example, power supply device checks to see whether an inductively triggered charge has been triggered on its coil. The check by power supply device is made repeatedly in short periods (e.g. 400 ms), using a fraction (e.g. 25%) of the PWM set at a small interval (e.g. 20 ms). ***In step 1112, the power receiving device is placed on or near the power supply device, and the power receiving device triggers an inductive signal on the power supply device. As soon as the power receiving device is powered, it sends packets over the inductive communication link (e.g. three packets) until acknowledgement is received (step 1120)***. Step 1120, the power supply device acknowledges the other device, and the power receiving device processes the acknowledgment. In step 1130, ***the power receiving device inductively communicates authentication information to the power supply device***. Step 1132 provides that the power supply device signals back corresponding authentication information (precise timing can alternatively be reversed). For example, as described with other embodiments, power supply device may transmit a licensing agreement as part of the authentication information. The power receiving device transmits back acceptance or an accepted licensing agreement. In step 1140, ***the power receiving device communicates enumeration information using the inductive link***. Likewise, the power supply device communicates its enumeration information. The enumeration information may be used to identify hardware, firmware or software. The information may be used to identify whether compatibility issues exist between the two devices. ***The enumeration information may also enable one or both devices to identify the other device by type of kind***. ***This information may be used to enable devices to select performance level or operations, functionality, communication protocol or other aspects for the two devices to communicate or transfer power***. ***In step 1150, the power receiving device communicates information about its voltage/current usage***. In one implementation, the power receiving device uses a timer interrupt to check power and state parameters repeatedly at short intervals (e.g. 2.2 ms), then communicates this information to the power

Claim Limitation	Exemplary Prior Art Disclosures
	supply device using the inductive link. These measurements provide the power (or voltage, current) calculations made on the supply device in regulating or controlling power to the receiving device. Accordingly, ***in step 1152, the power supply device receives the information and regulates its power output based on identifying the needs or power levels of the power receiving device***. The exchange of information forms a feedback loop that enables the power receiving device to signal power across the inductive link under a process that is controlled based on information supplied from the power receiving device. In one embodiment, the information is communicated across the inductive link. In another embodiment, the information is communicated across other communication mediums, such as through a RF communication medium. Corbridge, ¶¶ 109-113.

Claim Limitation	Exemplary Prior Art Disclosures
	 **FIG. 11** Corbridge, Fig. 11; *see also id.* Fig. 10, 12-14.

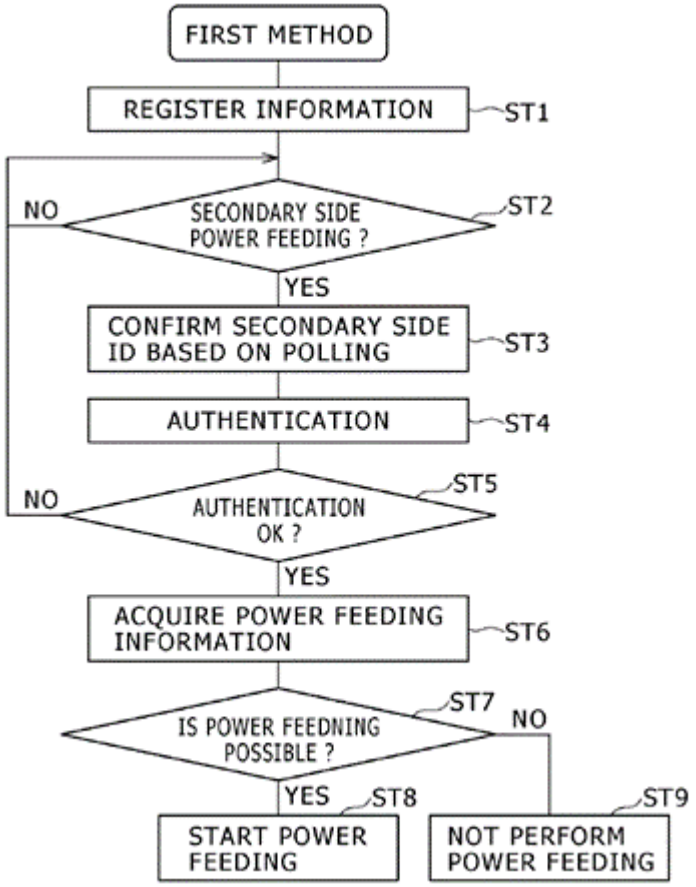
Claim Limitation	Exemplary Prior Art Disclosures
	Teramoto Teramoto discloses transmitting and processing signals sent between a primary side and a secondary side using modulation concerning, for example, device identification, authentication, and power feeding. For example: The wireless power feeding apparatus 20 on the primary side includes ***a host controller 21, and a communication interface (I/F) 22*** through which a communication with the host controller 21 is made. The wireless power feeding apparatus 20 includes a cipher coprocessor 23 and an EEPROM (non-volatile memory) 24. In this case, the cipher coprocessor 23 is used in exchange of authentication or secret information. Secret information such as a cipher key necessary to carry out the authentication, a personalized ID on the primary side, and the like are stored in the EEPROM 24. The wireless power feeding apparatus 20 includes ***a CPU (computer) 25 as a control grid***, a ROM (read only memory) 26, a RAM (random access memory) 27, and an I/F (interface) 28 including a FIFO (first in, first out) with an RF front end portion 29. In this case, ***firmware for controlling the authentication and the power feeding state, and the like are stored in the ROM 26***. Also, ***the wireless power feeding portion 20 includes an RF front end portion 29, and an antenna 30 for the power feeding and communication***. In this case, ***the RF front end portion 29 is composed of a circuit for data modulation and data demodulation*** in a phase of communication, an amplifier for driving the antenna, and the like. Teramoto, ¶¶ 49-52.

Claim Limitation	Exemplary Prior Art Disclosures



Teramoto, Fig. 1; *see also id.* ¶ 55, Figs. 10-12.

> In addition, in such a billing system as to rent such products, basically, only the management of products based on an operation can be carried out, and thus it may be impossible to limit a place where such a product is used. Therefore, there is the possibility that the product is stolen and is used in a different place.
>
> The present disclosure has been made in order to solve the problems described above, and ***it is therefore desirable to provide a wireless power feeding system which is capable of limiting a place and time at which an electronic apparatus on a power receiving side is used to allow a protection against theft to be realized***, and is capable of realizing miniaturization and weight saving of an

Claim Limitation	Exemplary Prior Art Disclosures
	electronic apparatus because the electronic apparatus needs not to be equipped with a large-capacity battery. Teramoto, ¶¶ 13, 14; *see also id*. ¶¶ 12-17.  Teramoto, Fig. 5; *see also id.* Figs. 6-9.

Claim Limitation	Exemplary Prior Art Disclosures
	Firstly, before start of the power feeding to the secondary side, ***power feeding information (information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST1). Next, ***when the secondary side power receiving apparatus 40 is held over (put on) the primary side wireless power feeding apparatus 20 at a distance at which the power feeding can be carried out (ST2)***, polling is carried out from the primary side power feeding apparatus 20 to the secondary side power receiving apparatus 40, thereby ***confirming the ID held on the secondary side (ST3).*** Next, ***the authentication (either one-way authentication from the primary side to the secondary side or the mutual authentication) is carried out between the primary side wireless power feeding apparatus 20 and the secondary side power receiving apparatus 40*** in accordance with the secret information stored in both the EEPROM 24 on the primary side and the EEPROM 50 on the secondary side (ST4). When the authentication is established, an operation proceeds to a subsequent processing flow (Yes; ST5). Then, ***the primary side wireless power feeding apparatus 20 acquires the power feeding information (the information on how many hours the power feeding will be carried out, by what time the power feeding will be carried out, how many times the power feeding will be carried out, and so forth)*** which is registered either in the server 60 or in the EEPROM 50 of the secondary side power receiving apparatus 40 in advance (ST6). After it has been confirmed that the power feeding can be carried out (ST7), the power feeding is started (ST8). Teramoto, ¶¶ 113-117. **WPT** For example: Section 6 defines the communications interface. On a physical level, ***communications from the Power Receiver to the Power Transmitter proceed using load modulation***. This means that the Power Receiver switches the amount of power that it draws from the Power Transmitter between two discrete

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	levels (note that these levels are not fixed, but depend on the amount of power that is being transferred). WPT, 9. The Communications and Control Unit on the left-hand side of Figure 3-1 comprises the digital logic part of the design. This ***unit receives and decodes messages from the Power Receiver, executes the relevant power control algorithms and protocols, and drives the frequency of the AC waveform to control the power transfer***. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes. WPT, 12; *see also id.* Fig. 3-1. A communications modulator (see Section 4.2.2.4). On the DC side of the Power Receiver, the communications modulator typically consists of a resistor in series with a switch. On the AC side of the Power Receiver, the communications modulator typically consists of a capacitor in series with a switch (not shown in Figure 4-1). WPT, 29-30; *see also id.* Fig. 4-1. The Communications and Control Unit on the right-hand side of Figure 4-1 comprises the digital logic part of the Power Receiver. This unit executes the relevant power control algorithms and protocols; drives the communications modulator; controls the output disconnect switch; and monitors several sensing circuits, in both the Power Pick-up Unit and the load—a good example of a sensing circuit in the load is a circuit that measures the temperature of, e.g., a rechargeable battery. WPT, 30; *see also id.* Fig. 4-1. 4.2.2.4 Communications modulator The Power Receiver shall have the means to modulate the Primary Cell current and Primary Cell voltage as defined in Section 6.2.1. 5 This version 1.0.3 of the System Description Wireless Power Transfer, Volume I, Part 1, leaves the specific loading method as a design choice to the Power Receiver. ***Typical example methods include modulation of a resistive load on the DC side of the Power Receiver, and modulation of a capacitive load on the AC side of the Power Receiver***. WPT, 33; *see generally* WPT, § 6.2.1 (“Modulation scheme”)

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	From a system control perspective, power transfer from a Power Transmitter to a Power Receiver comprises four phases, namely *selection*, *ping*, *identification & configuration*, and *power transfer*.*ping* In this phase, ***the Power Transmitter executes a Digital Ping, and listens for a response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping***. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase. *identification & configuration* In this phase, ***the Power Transmitter identifies the selected Power Receiver, and obtains configuration information*** such as the maximum amount of power that the Power Receiver intends to provide at its output. The Power Transmitter uses this information to create a Power Transfer Contract. This Power Transfer Contract contains limits for several parameters that characterize the power transfer in the power transfer phase. At any time before proceeding to the power transfer phase, the Power Transmitter may decide to terminate the extended Digital Ping—e.g. to discover additional Power Receivers. This reverts the system to the selection phase. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to ***control data that it receives from the Power Receiver***. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the selection phase. Finally, the system may also leave the power transfer phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the selection phase, or request to renegotiate the Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the identification & configuration phase. WPT, 35-36.

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6.3.1 Signal Strength Packet (0x01)

Table 6-4 defines the format of the message contained in a Signal Strength Packet

Table 6-4: Signal Strength

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Signal Strength Value							

6.3.2 End Power Transfer Packet (0x02)

Table 6-3 defines the format of the message contained in an End Power Transfer Packet.

Table 6-5: End Power Transfer

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	End Power Transfer Code							

6.3.3 Control Error Packet (0x03)

Table 6-7 defines the format of the message contained in a Control Error Packet.

Table 6-7: Control Error

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Control Error Value							

Control Error Value The (two's complement) signed integer value contained in this field ranges between –128...+127 (inclusive), and provides input to the Operating Point controller of the Power Transmitter. See Sections 5.2.3.1 and 5.3.4 for more details. Values outside the indicated range are reserved and shall not appear in a Control Error Packet.

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6.3.4 Rectified Power Packet (0x04)

Table 6-8 defines the format of the message contained in a Rectified Power Packet.

Table 6-8: Rectified Power

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Rectified Power Value							

Rectified Power Value The unsigned integer contained in this field contains the amount of power that the Power Receiver is providing at the output of the rectifier, expressed as a percentage of the Maximum Power (see Section 6.3.7). For clarity, the value 0 means that the Power Receiver does not provide power at the output of the rectifier, and the value 100 means that the Power Receiver provides an amount of power that is equal to the requested Maximum Power. (Informative) *It is not an error for the Rectified Power Value field to contain a value greater than 100. However, this could result in a removal of the Power Signal.*

6.3.5 Charge Status Packet (0x05)

Table 6-9 defines the format of the message contained in a Charge Status Packet.

Table 6-9: Charge Status

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	Charge Status Value							

Charge Status Value If the Mobile Device contains a rechargeable energy storage device, the unsigned integer contained in this field indicates the charging level of that energy storage device, as a percentage of the fully charged level. For clarity, the value 0 means an empty energy storage device, and the value 100 means a fully charged energy storage device. If the Mobile Device does not contain a rechargeable energy storage device, or if the Power Receiver cannot provide charge status information,[14] this field shall contain the value 0xFF. All other values are reserved and shall not appear in the Charge Status Packet.

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	6.3.7 Configuration Packet (0x51) Table 6-11 defines the format of the message contained in a Configuration Packet. **Table 6-11: Configuration** (b7 b6 b5 b4 b3 b2 b1 b0) B0: Power Class | Maximum Power B1: Reserved B2: Prop | Reserved | Count B3: Reserved B4: Reserved **Table 6-12: Identification** (b7 b6 b5 b4 b3 b2 b1 b0) B0: Major Version | Minor Version B1: (msb) Manufacturer Code B2: Manufacturer Code (lsb) B3: Ext | (msb) Basic Device Identifier ⋮ B6: Basic Device Identifier (lsb) WPT, 54-60; *see generally,* WPT, Section 6 (Communications Interface) and § 6.3 (Messages). *See supra* Limitation [1c].
[1h] said second circuitry, configured to receive and interpret data from said	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.*, https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html.

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secondary wireless power receiver in said identified wireless power protocol;	To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the references cited in limitation [1c] and [1g]. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. *See also supra* Limitations [1c], [1g].
[1i] said second circuitry, based on said interpretation, configured to perform a function associated with said transmitted power in conjunction with said first circuitry.	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.*, https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html. To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the references cited in limitation [1c], [1g], and additional disclosures below. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. **WPT** For example: **6.3.2 End Power Transfer Packet (0x02)** Table 6-3 defines the format of the message contained in an End Power Transfer Packet. **Table 6-5: End Power Transfer** | | b_7 | b_6 | b_5 | b_4 | b_3 | b_2 | b_1 | b_0 | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | B_0 | End Power Transfer Code | | | | | | | | WPT, 56.

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	The Communications and Control Unit on the left-hand side of Figure 3-9 comprises the digital logic part of the design. This unit receives and decodes messages from the Power Receiver, configures the multiplexer to connect the appropriate parts of the Primary Coil array, executes the relevant power control algorithms and protocols, and drives the frequency and input voltage to the inverter to control the amount of power provided to the Power Receiver. The Communications and Control Unit also interfaces with the other subsystems of the Base Station, e.g. for user interface purposes. WPT, 20. *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to control data that it receives from the Power Receiver. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer—returning the system to the *selection* phase. Finally, the system may also leave the *power transfer* phase on request of the Power Receiver. For example, the Power Receiver can request to terminate the power transfer—battery fully charged—reverting the system to the *selection* phase, or request to renegotiate the Power Transfer Contract—change to trickle charging the battery using a lower maximum amount of power—reverting the system to the *identification & configuration* phase. WPT, 36. *See also supra* Limitations [1c], [1h].
2. The dual mode wireless power receiver of claim 1, wherein said switch network of said first circuitry is configured as one of an inverter and a rectifier.	On information and belief, the Winstream Solution discloses this limitation. *See, e.g.*, https://www.youtube.com/watch?v=LENL8FH7h80; https://www.youtube.com/watch?v=s2pMXdOA3TY; https://www.youtube.com/watch?v=lwsTdYXpWxI; https://www.saydigi.com/2012/06/blog-post-7414.html. To the extent it is argued that the Winstream Solution does not disclose this limitation, it would have been obvious in view of one or more of the references cited in limitation [1b]. On information and belief, a POSA would have been motivated to combine the Winstream Solution with one or more of the following references because this limitation recites no more than well-known, conventional components and configurations that had been implemented for wireless power charging devices, and a POSA would have had a reasonable expectation of success in making the combination. *See also supra* Limitation [1b].