

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.
Petitioner

v.

MOJO MOBILITY INC.
Patent Owner

Patent No. 11,342,777

**DECLARATION OF R. JACOB BAKER, PH.D., P.E.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,342,777**

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I, R. Jacob Baker, Ph.D., P.E., declare as follows:

I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. (“Petitioner”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”) against Mojo Mobility Inc. (“Patent Owner”) regarding U.S. Patent No. 11,342,777 (“the ’777 patent”) (Ex. 1001).¹ I have been asked to consider whether the prior art discloses or suggests the features recited in claims 15, 17, and 20-23 (“the challenged claims”) of the ’777 patent. My opinions are set forth below.

2. I am being compensated at a rate of \$765/hour for my work in this proceeding. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

3. I presently serve as a Professor of Electrical and Computer Engineering at the University of Nevada, Las Vegas (UNLV). All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In

¹ Where appropriate, I refer to exhibits that I understand are to be attached to the petition for *Inter Partes* Review of the ’777 patent.

forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching regarding integrated circuit design and power electronics.

4. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted by Petitioner as Exhibit 1003. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

5. I have been teaching electrical engineering at UNLV since 2012. Prior to this position, I was a Professor of Electrical and Computer Engineering at Boise State University from 2000. Prior to my position at Boise State University, I was an Associate Professor of Electrical Engineering between 1998 and 2000 and Assistant Professor of Electrical Engineering between 1993 and 1998 at the University of Idaho. I have been teaching electrical engineering since 1991.

6. I received my Ph.D. in Electrical Engineering from the University of Nevada, Reno in 1993. I also received a MS and BS in Electrical Engineering from UNLV in 1988 and 1986, respectively.

7. As described in my CV, I am a licensed Professional Engineer and have more than 35 years of industry and academic experience, including extensive

experience in power electronics circuit design. My Ph.D. dissertation developed a way to stack power MOSFETs to increase the maximum voltage that they could switch in nanoseconds. The work from this dissertation was published in the paper “Transformerless Capacitive Coupling of Gate Signals for Series Operation of Power MOS Devices,” and published in the IEEE Transactions on Power Electronics. The work was well-received and it won the best paper award from this journal in 2000. Further, my research has focused on the design of inductors using novel fabrication techniques. One of my Master’s students fabricated a three-dimensional inductor using thru-vias to minimize the inductor’s size. This work was reported in the Thesis “Design Guide for CMOS Process On-Chip 3D Inductors using Thru-Wafer Vias” published in 2011. More recently I have been looking at ways to supply power to remote regions of the world. This effort resulted in a doctoral student finishing his dissertation entitled “Designing, Building, and Testing a Solar Thermoelectric Generation, STEG, for Energy Delivery to Remote Residential Areas in Developing Regions” published in 2015.

8. I have taught courses in integrated circuit design (analog, digital, mixed-signal, memory circuit design, etc.), linear circuits, microelectronics, communication systems, power electronics, and fiber optics. As a professor, I have been the main advisor to over 100 Master’s and Doctoral students.

9. I am the author of several books covering the area of integrated circuit design including: DRAM Circuit Design: Fundamental and High-Speed Topics (two editions), CMOS Circuit Design, Layout, and Simulation (four editions), and CMOS Mixed-Signal Circuit Design (two editions). I have authored, and coauthored, more than 100 papers and presentations in the areas of solid-state circuit design, and I am the named inventor on over 150 granted U.S. patents.

10. I have received numerous awards for my work, including the Frederick Emmons Terman (the “Father of Silicon Valley”) Award. The Terman Award is bestowed annually upon an outstanding young electrical/computer engineering educator in recognition of the educator’s contributions to the profession.

11. I am a Fellow of the IEEE for contributions to memory circuit design. I have also received the IEEE Circuits and Systems Education Award (2011).

12. I have received the President’s Research and Scholarship Award (2005), Honored Faculty Member recognition (2003), and Outstanding Department of Electrical Engineering Faculty recognition (2001), all from Boise State University. I have also received the Tau Beta Pi Outstanding Electrical and Computer Engineering Professor award four of the years I have been at UNLV.

13. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

III. MATERIALS REVIEWED

14. The opinions contained in this Declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding electrical engineering, and energy transfer systems and components, including inductive-based power transfer and related technologies.

15. In forming my opinions expressed in this Declaration, I reviewed the following materials and information:

Ex. 1001	U.S. Patent No. 11,342,777
Ex. 1004	Prosecution History of U.S. Patent No. 11,342,777
Ex. 1005	U.S. Patent No. 8,369,905 (“ <i>Sogabe</i> ”)
Ex. 1006	U.S. Patent No. 8,090,550 (“ <i>Azancof</i> ”)
Ex. 1007	U.S. Patent No. 8,390,249 (“ <i>Walley</i> ”)
Ex. 1008	U.S. Patent Application Publication No. 2010/0007307 (“ <i>Baarman</i> ”)
Ex. 1010	Wireless Power Consortium, System Description: Wireless Power Transfer, Volume 1: Low Power, Version 1.0.1 (October 2010)
Ex. 1011	D. van Wageningen, The Qi Wireless Power Standard, IEEE (October 2010)
Ex. 1012	U.S. Patent Application Publication No. 2011/0018360 (“ <i>Baarman II</i> ”)
Ex. 1013	U.S. Patent Application Publication No. 2011/0163713 (“ <i>Wang</i> ”)

Ex. 1014	U.S. Patent Application Publication No. 2009/0096413 (“ <i>Partovi</i> ”)
Ex. 1015	Leon Adams, Choosing the Right Architecture for Real-Time Signal Processing Designs, Texas Instruments (November 2002), accessed at https://www.ti.com/lit/wp/spra879/spra879.pdf .
Ex. 1017	Prosecution History of U.S. Patent No. 10,141,770
Ex. 1026	Microcontrollers, Pushpinder Singh, Massachusetts Institute of Technology, Sept. 25, 2009, accessed at https://web.archive.org/web/20090925183946/https://web.mit.edu/rec/www/workshop/microcontrollers.html .
Ex. 1027	U.S. Patent Application Publication No. 2008/0214211 (“ <i>Lipovski</i> ”)
Ex. 1028	U.S. Patent No. 5,798,828 (“ <i>Thomas</i> ”)
Ex. 1029	U.S. Patent No. 8,193,764 (“ <i>Jakubowski</i> ”)
Ex. 1033	U.S. Patent Application Publication No. 2011/0261907 (“ <i>Lee</i> ”)
Ex. 1034	U.S. Patent Application Publication No. 2011/0148578 (“ <i>Aloi</i> ”)
Ex. 1035	U.S. Patent No. 8,234,509 (“ <i>Gioscia</i> ”)
Ex. 1036	U.S. Patent Application Publication No. 2010/0084918 (“ <i>Fells</i> ”)
Ex. 1037	U.S. Patent No. 9,407,327 (“ <i>Kirby</i> ”)
Ex. 1038	Watson, J., Mastering Electronics, Third Ed., McGraw-Hill, Inc. (1990) (“ <i>Watson</i> ”)
Ex. 1039	Sedra, A., <i>et al.</i> , Microelectronic Circuits, Fourth Ed., Oxford University Press (1998) (“ <i>Sedra</i> ”)

Ex. 1040	Physics, Henry Semat et al., Rinehart & Co., Inc., 1958, Chapters 29-32 (“ <i>Semat</i> ”)
Ex. 1041	GB Patent Application Publication No. 2202414 (“ <i>Logan</i> ”)
Ex. 1042	U.S. Patent No. 7,226,442 (“ <i>Sheppard</i> ”)
Ex. 1043	U.S. Patent No. 6,489,745 (“ <i>Koreis</i> ”)
Ex. 1044	U.S. Patent No. 6,960,968 (“ <i>Odendaal</i> ”)
Ex. 1045	International Patent Application Publication No. WO1996040367 (“ <i>WangIP</i> ”)
Ex. 1046	International Patent Application Publication No. WO2003/096361 (“ <i>Cheng</i> ”)
Ex. 1047	U.S. Patent No. 6,366,817 (“ <i>Kung</i> ”)
Ex. 1048	AN710 Antenna Circuit Design for RFID Applications
Ex. 1049	U.S. Patent Application Publication No. 2006/0145660A1 (“ <i>Black</i> ”)
Ex. 1050	U.S. Patent No. 5,780,992 (“ <i>Beard</i> ”)
Ex. 1051	U.S. Patent Application Publication No. 2005/0068019 (“ <i>Nakamura</i> ”)
Ex. 1052	U.S. Patent No. 6,912,137 (“ <i>Berghegger</i> ”)
Ex. 1053	U.S. Patent No. 8,618,770 (“ <i>BaarmanIIP</i> ”)
Ex. 1054	U.S. Patent No. 8,884,468 (“ <i>Lemmens</i> ”)
Ex. 1055	U.S. Patent No. 8,305,951 (“ <i>Breau</i> ”)
Ex. 1056	U.S. Patent Application Publication No. 2006/0259616 (“ <i>Lester</i> ”)
Ex. 1057	U.S. Patent Application Publication No. 2010/0080231 (“ <i>Lala</i> ”)

Ex. 1058	U.S. Patent No. 7,133,375 (“ <i>Molla</i> ”)
Ex. 1059	U.S. Patent Application Publication No. 2005/0243786 (“ <i>Bae</i> ”)
Ex. 1060	U.S. Patent Application Publication No. 2004/0100924 (“ <i>Yam</i> ”)
Ex. 1061	U.S. Patent Application Publication No. 2004/0017829 (“ <i>Gray</i> ”)

16. I also reviewed any other materials I refer to in this declaration in support of my opinions.

17. My opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the state of the art, the prior art, and the claims and the specification of the ’777 patent at the time of the alleged invention.

18. I understand that the ’777 patent issued from Application No. 16/199,904, which was filed as a continuation-in-part of Application No. 14/929,315 (now U.S. Patent No. 10,141,770), which was filed as a continuation-in-part of Application No. 13/352,096 (now U.S. Patent No. 9,178,369), and claims priority to U.S. Provisional Application No. 61/546,316 (filed Oct. 12, 2011), U.S. Provisional Application No. 61/478,020 (filed Apr. 21, 2011), and U.S. Provisional Application No. 61/433,883 (filed Jan. 18, 2011). (Ex. 1001, Cover; *see also* Ex. 1004.)

19. For purposes of rendering my opinions, I have been asked to initially consider that the time of the alleged invention of the '777 patent is around October 18, 2010 to January 18, 2011 for claims 15, 17, and 20-23. My opinions reflect how one of ordinary skill in the art (which I described below) would have understood the '777 patent, the prior art to the patent, and the state of the art at the time of the alleged invention as I was asked to consider noted above.

20. Based on my experience and expertise, it is my opinion that the prior art discloses and/or suggests all the features recited in challenged claims 15, 17, and 20-23 of the '777 patent, as I discuss in detail below.

IV. PERSON OF ORDINARY SKILL IN THE ART AND THE TIME OF THE ALLEGED INVENTION

21. Based on my knowledge and experience, I understand what a person of ordinary skill in the art would have known at the time of the alleged invention, which I discussed above as being around October 18, 2010 to January 18, 2011 for claims 15, 17, and 20-23. My opinions herein are, where appropriate, based on my understandings as to a person of ordinary skill in the art at that time. In my opinion, based on the materials and information I have reviewed, and based on my experience in the technical areas relevant to the '777 patent, a person of ordinary skill in the art at the time of the alleged invention of the '777 patent would have had at least a master's degree in electrical engineering, or a similar discipline, and two or more years of experience with wireless charging systems, including, for example, inductive power transfer systems. More education can supplement practical experience and vice versa. I apply this understanding in my analysis herein.

22. All of my opinions in this declaration are from the perspective of one of ordinary skill in the art, during the relevant timeframe (*e.g.*, the time of the alleged invention) (around October 18, 2010 to January 18, 2011 for claims 15, 17, and 20-23). My opinions in this declaration are also applicable from the perspective of such a skilled person at other related timeframes (*e.g.*, early 2010 to early 2012

timeframes), and thus to the extent the time of the alleged invention was determined to be in such timeframes, my opinions in this declaration would not change.

V. TECHNICAL BACKGROUND

23. As I discuss further below in Sections VIII and IX, it is my opinion that the features recited in the '777 patent are disclosed or suggested in the prior art. Many of the claimed features relate to technologies/techniques that were conventional and known to persons of ordinary skill in the art at the time before the time of the alleged invention of the '777 patent.

24. Below, I present a brief overview of certain aspects of technologies/techniques/concepts that were known to a person of ordinary skill in the art prior to and at the time of the alleged invention of the '777 patent (*see* above at Section IV). The features, functionalities, and concepts I describe in this technical background section reflect the state of the art that a person of ordinary skill in the art would have had knowledge of and understood prior to and at the time of the alleged invention of the '777 patent. I rely on, and incorporate as applicable (even if not expressly mentioned below in Section IX), the following disclosures and opinions to support my opinions in this Declaration, including those opinions relating to how the prior art discloses and/or suggests the challenged claims of the '777 patent and how and why a person of ordinary skill in the art would have been motivated to consider and combine the disclosures and suggestions from one or more prior art

references as I explain below in Section IX. The concepts below would have been within the knowledge and mindset of a person of ordinary skill in the art at the time.

A. Electronic Circuits and Components

25. It was well known to a person of ordinary skill in the art prior to the alleged invention date that matter is made up of atoms, which include electrons orbiting a nucleus. (Ex. 1038, 7.) Free electrons, which are electrons that are not bound to any nucleus, are contained in large numbers in materials called conductors (e.g., metals such as copper), which conduct the flow of electrons in a uniform direction (this flow of electrons is called current, and is expressed in units of amperes). (*Id.*, 8-10.) On the other hand, “[m]aterials that are classed as insulators contain only a very few free electrons” and do not conduct current well. (*Id.*, 8.) It was well known in electrical engineering that current is at the heart of virtually all electrical principles and technologies.

26. A person of ordinary skill would have known that whereas current may flow continuously in one direction through a circuit (direct current), “[c]urrent that flows first one way and then the other is called *alternating current*, and a voltage source supplying such a current is called an *alternating voltage*.” (*Id.*, 12 (emphasis in original).) It was known that “[a]lternating current is used for all mains power supplies because a.c. [i.e., alternating current] permits the user of *transformers* to increase and decrease the voltage, so that the power can be transmitted from place

to place using efficient high-voltage transmission lines.” (*Id.* (emphasis in original).)

It was known that alternating current and alternating voltage are periodic, and “[t]he rate at which the voltage reverses is the *frequency* of the alternation.” (*Id.* (emphasis in original).)

27. A person of ordinary skill would have known that “[i]n addition to measuring the current flow, we also need to measure another factor, the potential difference between two points,” which “is the energy difference between” the two points. (*Id.*, 10.) The potential difference is also called voltage and is expressed in units of volts. (*Id.*)

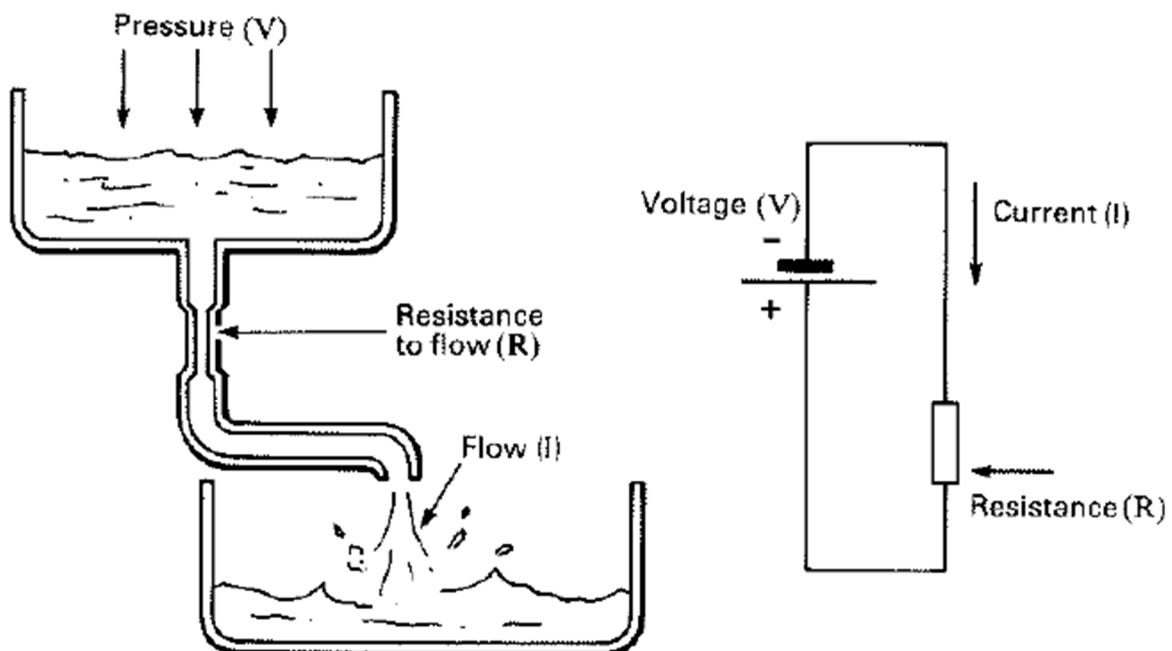
28. Additionally, a person of ordinary skill would have known that resistance is another fundamental concept involved in the flow of electrons. “Resistance is a property of all materials that reduces the flow of electricity through them,” so that “[t]he higher the resistance, the more difficult it is for current to flow.” (*Id.*, 10.) Resistance is expressed in units of ohms. (*Id.*, 11.)

29. A person of ordinary skill would have known that most circuit components are described as being *active* or *passive* components. (*Id.*, 19.) “Active components use the movement of electrons ... to perform some function in the circuit,” whereas “[p]assive devices ... do not control the movements of the electrons, but rather allow the electrons to flow through them.” (*Id.*) A person of ordinary skill would have known that the most commonly encountered passive

circuit component is the resistor, which is a “component[] intended to insert a known amount of resistance into an electrical circuit.” (*Id.*)

30. The relationship between current (denoted by the letter I), voltage (denoted by the letter V), and resistance (denoted by the letter R) is given by Ohm’s Law, $V = I * R$ (i.e., voltage is current multiplied by resistance). (*Id.*, 10-11.) These three terms are shown in Figure 2.5 of *Watson* (a textbook regarding electronics), which shows how electrical principles are similar to principles relating to the flow of water.

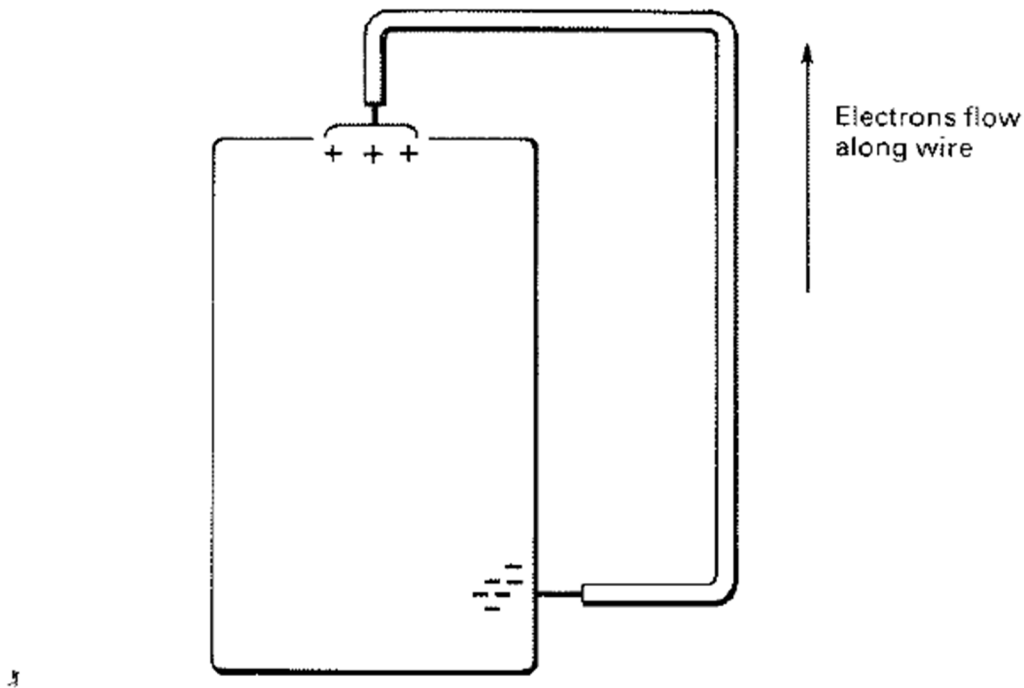
fig 2.5 a plumbing analogy: voltage, current and resistance all have their equivalents in the water system



(*Id.*, FIG. 2.5.)

31. A person of ordinary skill would have known that electrons (and thus current) flow in a circuit, as shown at the right side of Figure 2.5 above, and also in Figure 2.3 below.

fig 2.3 *electrons flowing in a circuit*

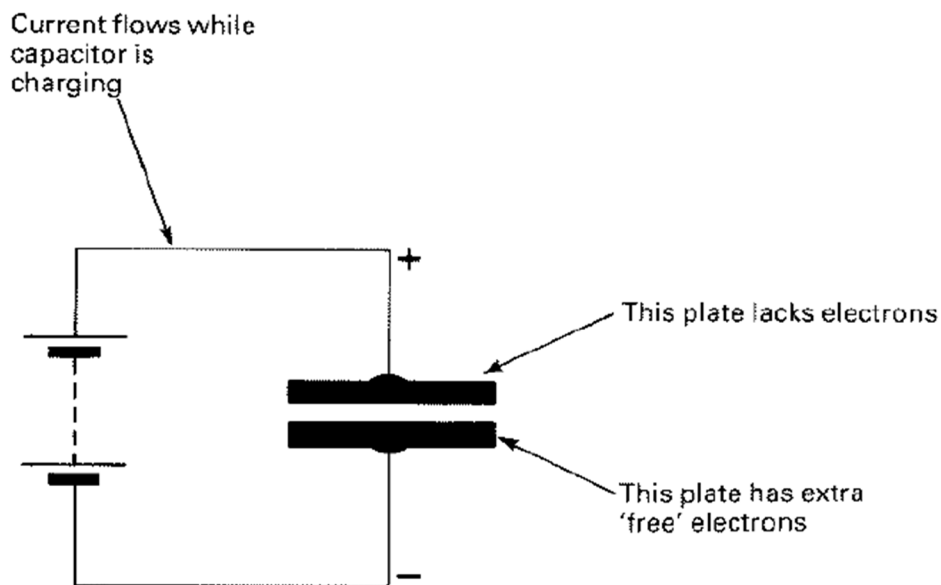


(*Id.*, FIG. 2.3.) A person of ordinary skill would have known that without such a closed path (e.g., as shown above in Figure 2.3), current cannot flow. (*Id.*, 8-11, FIGS. 2.3-2.5.)

32. It was well known that the amount of energy dissipated per unit time (power, expressed in units of watts) is expressed as the following formula: $P=VI$. (*Id.*, 19-20.)

33. A person of ordinary skill would have also known that “[n]ext to resistors, the most commonly encountered component is the *capacitor*,” which is another passive circuit component. (*Id.*, 25 (emphasis in original).) “A capacitor is a component that can store electric charge,” and “[i]n essence, it consists of two flat parallel plates, very close to each other, but separated by an insulator.” (*Id.*) A person of ordinary skill would have known that “[w]hen the capacitor is connected to a voltage supply, a current will flow through the circuit” as shown below in Figure 3.8 of *Watson*, and “[e]lectrons are stored in one of the plates of the capacitor” and “in the other there is a shortage of electrons.” (*Id.*, 25-26.)

fig 3.8 *a capacitor connected to a power supply; current will flow until the capacitor is charged*



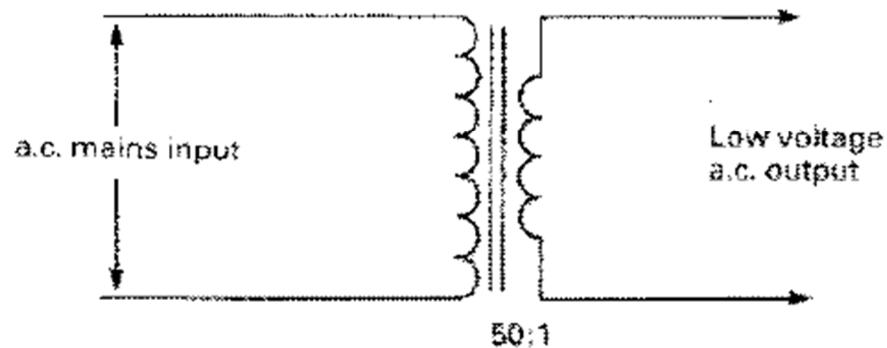
(*Id.*, FIG. 3.8.) A person of ordinary skill would have known that “[i]n this state the capacitor is said to be *charged*,” and [i]f the charged capacitor is connected in a

circuit, it will, for a short time, act as a voltage source, just like a battery.” (*Id.*, 27 (emphasis in original).) It was known to use capacitors, such as variable capacitors that may be varied in capacitance value, in radio frequency (RF) circuits, e.g., to tune the circuit and “improve efficiency.” (*Id.*, 200-201; *see also id.*, 31 (describing “[v]ariable capacitors” as “[c]apacitors ... that can be varied in value.”), 201 (“the capacitors are variable, so that the circuit can be tuned accurately,” i.e., “tuned to the exact frequency” for the RF transmitter to work properly).)

34. A person of ordinary skill would have known that “[t]he third major passive component is the inductor,” which may be a coil of wire. (*Id.*, 33.) “When a coil is connected in a circuit ... the flow of current through the coil causes an electromagnetic field to be created around the coil.” (*Id.*, 33-34.) This phenomenon was well known and commonly applied to construct a transformer, which was a known device that was widely used to reduce an AC voltage to a lower level. (*Id.*, 12; *see also id.*, 36 (FIG. 3.17, reproduced below), 37 (“A transformer is used to reduce the voltage of the a.c. mains to something more usable in electronic circuits...”), 37-41 (describing power supplies that utilize transformers and rectifiers to convert AC power to DC power).) Transformers make use of “mutual inductance,” where “a current flowing in a coil produces an electromagnetic field, which in turn induces a current to flow in a second coil wound over the first one.” (*Id.*, 34-35, FIG. 3.16.) It was known that by adjusting the “turn ratios” of a

transformer, i.e., the ratio of the turns in the two coils of the transformer, the output voltage of the transformer is modified. (*Id.*, 36.)

fig 3.17 *circuit symbol for a transformer with a laminated core*



(*Id.*, 36 (FIG. 3.17, showing “circuit symbol for a transformer”).)

35. A person of ordinary skill in the art would have known that in circuits, “L” signifies inductance and “C” signifies capacitance. (Ex. 1039, 884 (“The oldest technology for realizing filters makes use of inductors and capacitors, and the resulting circuits are called passive LC filters.”), 909 (FIG. 11.17).)

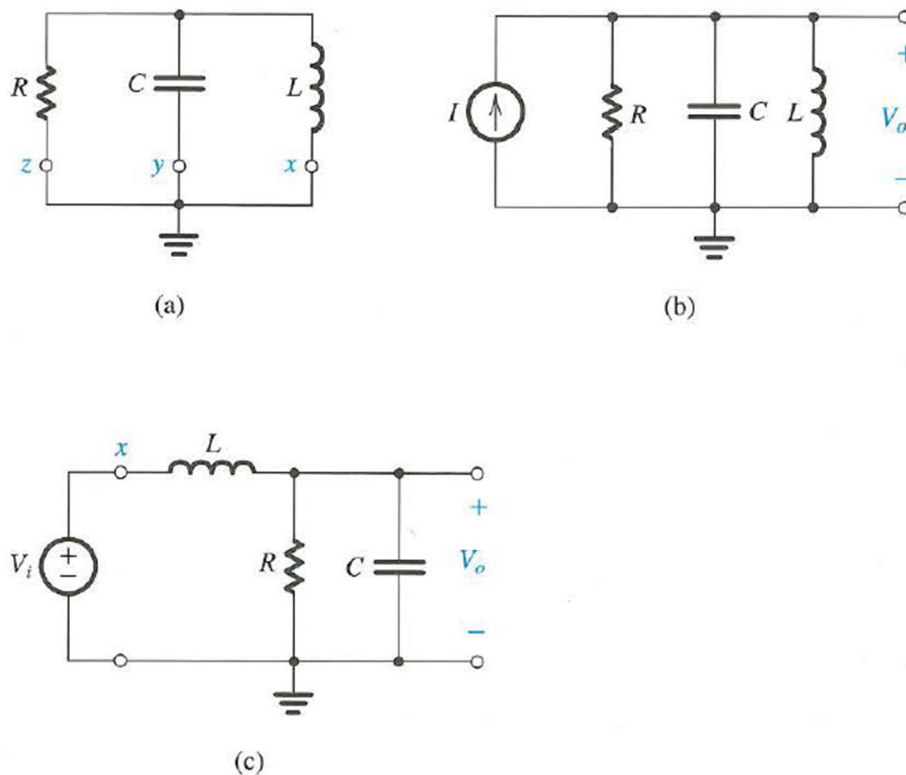


Fig. 11.17 (a) The second-order parallel LCR resonator. (b) and (c) Two ways for exciting the resonator of (a) without changing its *natural structure*. The resonator poles are the poles of V_o/I and V_o/V_i .

(*Id.*, 909 (FIG. 11.17).)

B. Contactless Power/Data Transfer

36. A person of ordinary skill in the art would have understood that many contactless power or data transfer applications rely upon the principle of inductive coupling. Here I begin with an introduction to the well-known principles of inductance and inductive coupling that a person of ordinary skill in the art would have understood, been aware of, and considered when designing, configuring, implementing, or modifying inductive power transfer system and/or

circuits/components thereof. I then discuss applications of such known contactless power/data transfer techniques and technologies.

1. Inductance and Inductive Coupling

37. It has long been known that a current carrying wire generates a magnetic field around it. (Ex. 1040, 557-558.) For example, the magnetic field generated near a straight length of a current carrying wire is circular and **in a plane perpendicular to the flow of current**. (*Id.*, 558.)

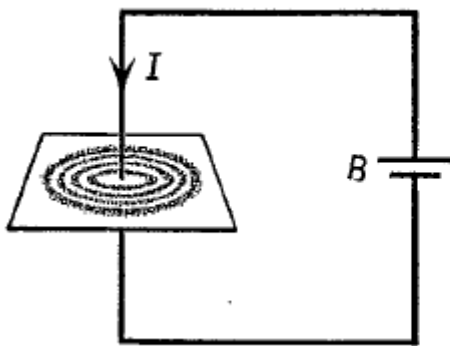
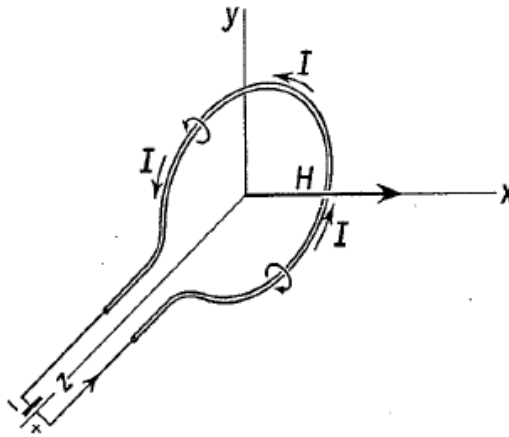


Fig. 30-2 Pattern formed by iron filings showing the circular magnetic field around a wire carrying current.

(*Id.*, 558.)

38. Similarly, if current flows through a wire loop, a magnetic field is generated inside the loop and **perpendicular to the plane of the loop**. (*Id.*, 558-59, FIG. 30-4 (figure caption “The magnetic field at the center is at **right angles** to the plane of the loop.”).)

Fig. 30-4 Magnetic field produced by a current in a circular loop of wire. The magnetic field at the center is at right angles to the plane of the loop.



(*Id.*, 559.)

39. The intensity of the magnetic field at any point around a current carrying conductor, including a coil, can be calculated using Ampère's law, which relates the magnetic field intensity H as **proportional to current I** . (*Id.*, 561-62.) A change in current propagating through the conductor results in a change in the corresponding magnetic field. (*Id.*)

40. A magnetic field results in an associated magnetic flux through a coil. **Changes in the coil current result in changes in the magnetic field and the magnetic flux.** (*Id.*, 601 (“When current is sent through a coil, a magnetic field is established through it, and any changes in the current generate changes in the magnetic flux through the coil.”).) **This change in magnetic flux results in an electromotive force (EMF) being induced in the conductor that opposes the change in current.** (*Id.*) The amount of EMF induced is proportional to the rate of

change of current. (*Id.*) This effect is sometimes called inductance. (*Id.*) “A device having inductance is called an inductor” and “is represented schematically” as shown below:



Fig. 32-11 Schematic representation of an inductor.

(*Id.*)

41. The above phenomenon, which is a property of nature, can be leveraged to transfer energy between a first circuit that includes a first coil and a second circuit that includes a second coil. For example, if the second coil is positioned relative to the first coil, a changing magnetic flux generated by the first coil could result in an EMF being induced in the second coil and the resulting EMF can then provide a current to a load connected to the second coil. This is the basic principle behind transformers.

42. The use of inductive coupling to cause current flow in a second circuit was independently discovered in the early 1800s by both Michael Faraday and Joseph Henry. (*Id.*, 593.) The circuit Faraday used in his experiments, which is illustrated below, is helpful in understanding the concept of inductive coupling. As shown below, a first circuit, which is referred to as the primary circuit, includes a battery B, a switch or key K, and a primary coil P. (*Id.*, 593-94.)

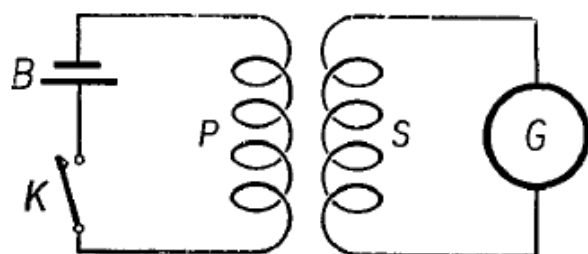


Fig. 32-3 Faraday's experiment on electromagnetic induction.

(*Id.*, 594, FIG. 32-3.)

43. A secondary circuit includes a secondary coil S and a galvanometer G that is used to detect electrical current. (*Id.*, 593.) Faraday observed that when the switch (key) was opened and closed, and **the current flow through the primary coil P was changed, the resulting change in the magnetic flux generated by the primary coil P caused a change in the magnetic field around the secondary coil S.** (*Id.*, 593-94.) The changing magnetic flux through the secondary coil S induces an EMF in the secondary coil and produces a resulting current in the secondary circuit that Faraday measured with a galvanometer. (*Id.*)

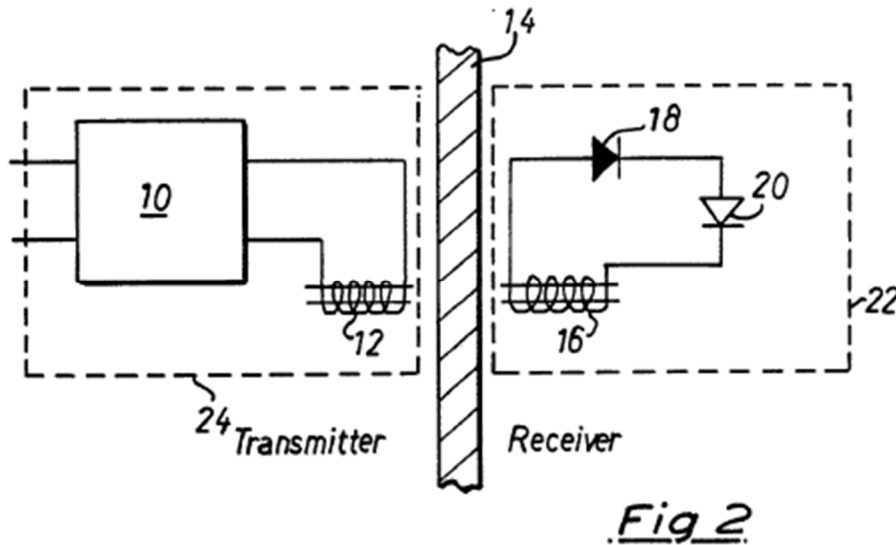
44. Therefore, in order to maintain current in the secondary circuit, the current in the first circuit can be continuously varied. By varying the current in the first circuit, the magnetic field (and therefore, magnetic flux) generated by the primary coil P is continuously varied, thereby inducing a corresponding EMF in the secondary circuit based on the inductive coupling between the primary coil P and the secondary coil S.

2. Applications of Contactless Power/Data Transfer

45. A person of ordinary skill would have been well versed in techniques and technologies for contactless (*e.g.*, wireless) transmission of power and/or data signals between a transmitter and a receiver. For example, such a person would have understood that contactless power/data transfer may be performed between inductively coupled coils, *e.g.*, between a primary coil and a secondary coil.

46. For example, *Logan* notes that “[i]t is, of course, known in principle to transmit power and data using radio waves.” (Ex. 1041, 1:10-12.) It was well known to use inductor coils to facilitate wireless signal transmission. (Ex. 1042, 5:39-66 (describing “receiv[ing] power from an electromagnetic (EM) energy source” and “a coil for the receipt of electromagnetic energy”); Ex. 1041, Abstract, FIGS. 1-2, 3:19-23, 4:12-14, 6:3-5.) It was known in the art to energize a transmitter coil using an alternating electromagnetic field to wirelessly send information to a receiver with a receiver coil. For example, *Logan* discloses features consistent with that known by a person of ordinary skill in the art regarding transmitting data wirelessly. (Ex. 1041, Title, Abstract, FIG. 2 (reproduced below).) *Logan* demonstrates it was known to use an “electromagnetic signal ... of sinusoidal form” to convey power between a transmitter 24 and a receiver 22. (*Id.*, 6:12-14, FIG. 2.) Likewise, *Logan* provides guidance about “energising a transmitter coil 12 to create an alternating

electromagnetic flux,” which “induces an E.M.F. in a receiver coil 16” (*id.*, 3:19-23)
“to [wirelessly] convey information to a demodulator in the receiver” (*id.*, 3:24-25).



(*Id.*, FIG. 2.)

47. Thus, the use of inductor coils to facilitate the wireless transmission of power/data was known by those of ordinary skill in the art at the time, including the circuitry and components, and techniques and characteristics of those circuits/components to provide such contactless power/data transfer. (Ex. 1042, 5:39-66 (describing “receiv[ing] power from an electromagnetic (EM) energy source” and “a coil for the receipt of electromagnetic energy”); Ex. 1041, Abstract, FIGS. 1-2, 3:19-23, 4:12-14, 6:3-5.) Moreover, *Koreis* discloses using a contactless power supply to charge a battery:

Referring to the drawings, a **contactless power supply** according to the present invention is illustrated and

generally indicated by reference numeral 10 in FIG. 1. The **contactless power supply comprises an inductive coil 12 disposed within a charging unit 14**, along with a receptor 16 disposed within or on a computing device 18, wherein the computing device 18 is positioned proximate the charging unit 14 as shown. **When energized, the inductive coil 12 generates magnetic fields to provide electrical current to the receptor 16**, which powers the computing device 18. Further, the electrical current may also be used to charge batteries (not shown) of the computing device 18 in addition to supplying power. . . .

More specifically, the contactless power supply 10 comprises a two-part transformer, wherein the transformer has a flat configuration so as to fit within, for example, a seatback tray or a desktop. **The first part of the transformer is located within the seatback tray** and is coupled to a source of AC power. **The second part of the transformer, hereinafter referred to as receiving coil and core, is located within the computing device 18** and is coupled to a rectifier that converts AC power to DC power. **When magnetic field lines are approximately 90 degrees to the first part of the transformer when the receiving coil and core are placed within the field, current is induced into the computing device 18.**

(Ex. 1043, 2:46-3:8; *see also id.*, FIG. 1.)

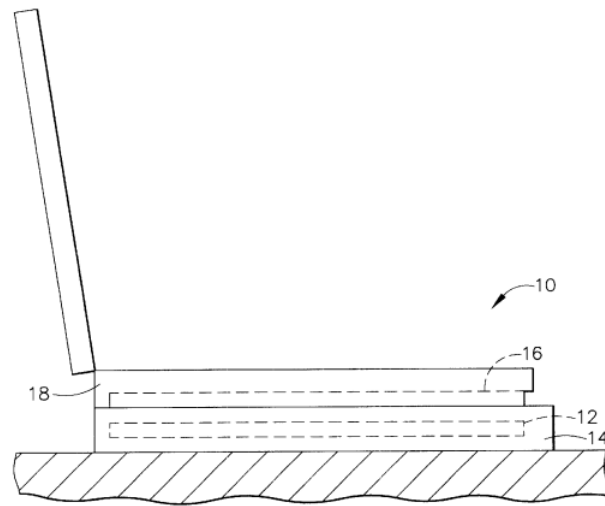


FIG. 1

(*Id.*, FIG. 1.)

48. *Odendaal* also shows that contactless power transfer technology has been used in various applications:

Contactless power transfer has been used in applications such as the non-intrusive charging of pacemaker batteries, the charging of hybrid vehicle batteries, etc. **In such applications, inductive coupling is used exclusively so that a current is induced from a power station to a load.** In such systems, the power transfer is exclusively accomplished by means of coupling **magnetic flux of the power station and the load.**

For example, road systems that would encourage the use of electric vehicles have been studied by states such as California. In such a system, **inductively coupled flat coils are embedded in the roadway**, or cables that are

embedded in the roadway **are energized, so that an induction coil of the vehicle receives induced current from the roadway coils to permit battery charging and/or even propulsion.**

(Ex. 1044, 1:13-27; *see also* Ex. 1045, Abstract (“[c]urrent is induced in a secondary coil”), 4:29-5:2; Ex. 1046, 1:10-15, 12:5-9, FIG. 1.)

49. As a further example, *Kung* discloses “identif[ying] those primary coils that are closest to the secondary coil, and a current director that, responsive to the proximity detector, selectively directs time-varying currents through the closest primary coils.”

An electromagnetic field source (EFS) for **providing electromagnetic energy to a secondary coil**, including **two or more primary coils that each carry a time-varying current** to produce an electromagnetic field, and a controller that selectively provides current to one or more primary coils **based on their position with respect to the secondary coil...** The controller includes a **proximity detector that identifies those primary coils that are closest to the secondary coil**, and a **current director that, responsive to the proximity detector, selectively directs time-varying currents through the closest primary coils**. The controller may also include an orientation detector, coupled to the current director, that determines an orientation of the secondary coil with

respect to the closest primary coils. In one implementation, the proximity detector identifies the quantity of closest primary coils utilizing a resonance frequency shift detector that detects a shift in inductance of one or more primary coils due to the proximity of the secondary coil.

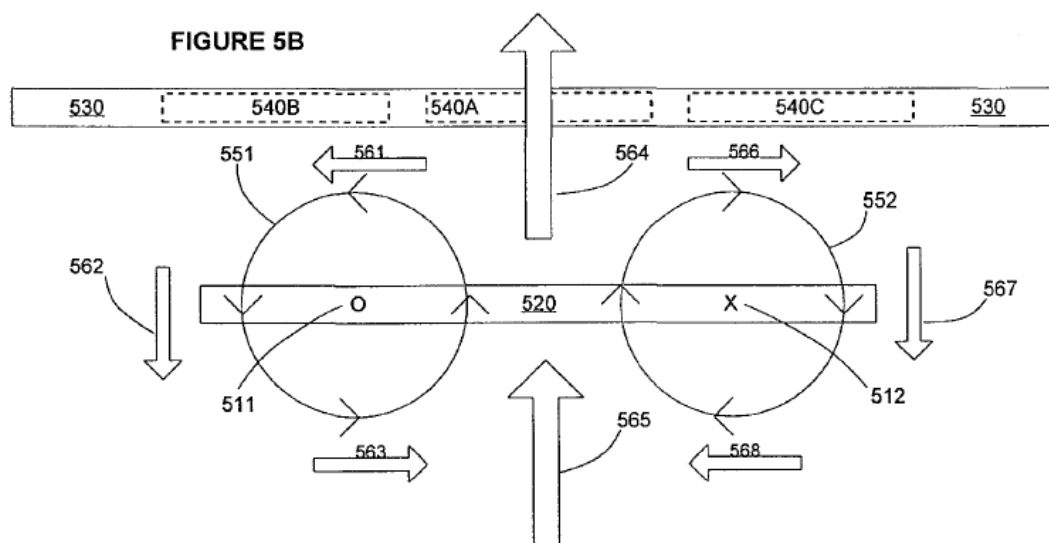
(Ex. 1047, Abstract.)

50. *Kung* also explains how the generated magnetic field traverses across the space. For example, *Kung* shows that a magnetic field represented by arrows 564 and 565 is perpendicular to plane 520 of charger and primary coil 510 and/or plane 540A of secondary coil 230.

Components of the magnetic fields generated by loop segments 511 and 512 generally reinforce each other in certain areas, such as the interior area of coil 510. These reinforced **magnetic field components are represented by large arrows 564 and 565 that are directed upward from plane 520 toward plane 530.** More specifically, magnetic fields represented by exemplary iso-magnetic contour lines 551 and 552 are oriented in the same direction (upward toward plane 530), and thus are reinforcing, in the regions of arrows 564 and 565. Elsewhere, such as in the regions of small arrows 561 and 566, there is no such reinforcement.

If secondary coil 230 is in position 540A, i.e., in a plane parallel to that of primary coil 510 and generally vertically aligned with the interior of coil 510, then, as is well known by those skilled in the relevant art, primary coil 510 induces a current to flow in secondary coil 230. The magnetic field that induces this current flow is represented by arrows 564 and 565. In contrast, if secondary coil 230 is disposed in plane 530 at a position generally outside of the interior of coil 510, such as positions 540B or 540C, then primary coil 510 generally does not induce a current to flow in secondary coil 230.

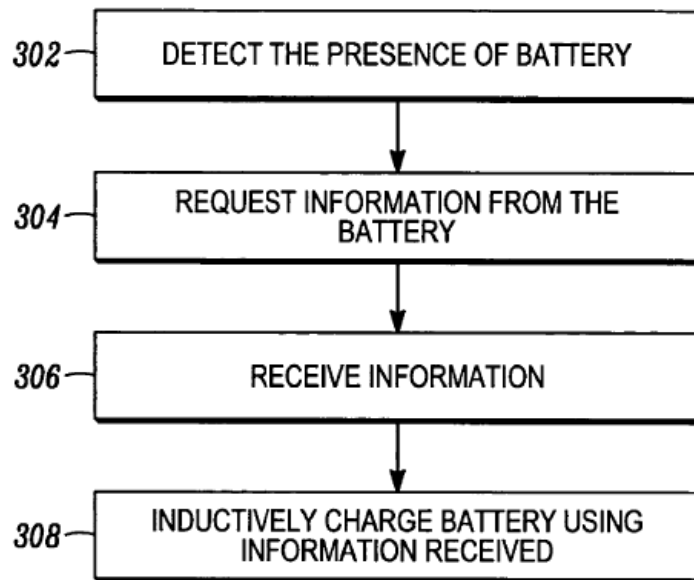
(*Id.*, 8:55-9:52.)



(Ex. 1047, FIG. 5B; *see also id.*, FIGS. 1-5A, FIGS. 6A-10, 7:21-8:54, 9:53-10:22, 11:27-14:67; Ex. 1040, 557-562, 593-594, 601; Ex. 1048, 3-4, 27-50.)

3. Controlling and Regulating Contactless Power/Data Transfer

51. A person of ordinary skill in the art would have known that different types of batteries or electronic devices may have different requirements for the amount or level of power/voltage/current supplied to the batteries or devices. Mechanisms have existed in the early 2000s that provide communications between the charger and the device subject to charging such that the charger may determine relevant parameters or settings used during the charging process. For example, *Black* discloses a procedure for “device identification and charging” that I summarized below. (Ex. 1049, ¶0020.)



(*Id.*, FIG. 3.) The procedure involves the charger first detecting the **presence** of a battery placed near the charger, then requesting **information from the battery**, such as the ID of the battery/device. (*Id.*, ¶0020.) The battery may also provide

information to the charger, such as “encryption information, battery characteristics or charging profile or the like.” (*Id.*, ¶¶0021-0022.) *Black* explains that the charger uses the provided information “[t]o determine **how** to inductively charge the battery.” (*Id.*) In fact, it was known that “[c]onsideration of the...charging characteristics” of a battery is “**necessary for maximizing the amount of energy the battery will hold and to prevent overcharging of the battery**” and also for avoiding some potentially serious safety issues. (Ex. 1050, 1:56-2:6.)

An incorrectly charged, improperly charged, overcharged or undercharged battery may **lose the ability to store an electric charge, may produce a voltage less than the nominal voltage or may combust or explode**, for example. Additionally, the number of charge cycles the battery is capable of undergoing may be significantly reduced **causing premature battery failure** which may require specialized reconditioning in order to return the battery to a proper operational state. Improper battery charging may also lead to **permanent premature battery failure**. Thus, the battery charging process **must account for the characteristic charging behavior** of the particular electrochemical cells in order to ensure proper functioning and maximized output and lifespan of the battery to be utilized.

(*Id.*, 1:59-2:6.)

52. Additionally, mechanisms for identifying whether a device subject to charging is **present** and **properly placed** on the charger (e.g., primary and secondary coils are properly aligned) were also well known. A way to do this is for the charger to send a signal to the device subject to charging. If there is a response from the device, and, based on the strength of the responsive signal, the charger can determine whether a device is present and properly placed/aligned on the charger. This is to ensure that the charger does not transmit power to unknown object(s) and also that the power transmission is performed where there is a high power transmission efficiency. For example, *Nakamura*, discusses such features consistent with that known by a person of ordinary skill in the art at the time. (*See, e.g.*, Ex. 1051, ¶¶0080-0083, FIGS. 11A-11B.) *Nakamura* explains:

[T]he power transmission enable/disable determination circuit 33 determines whether or not power reception equipment is placed on the power transmission apparatus 1, based on the “code indicating being power reception equipment” (step S3). **If a predetermined “code indicating being power reception equipment” is received, it is determined that power reception equipment is placed on the power transmission apparatus 1 and it is determined whether or not the power reception equipment is correctly placed on the power transmission apparatus 1 (step S4).** On the other

hand, unless the predetermined “code indicating being power reception equipment” is received, it is determined that no power reception equipment is placed on the power transmission apparatus 1, and the carrier wave is outputted again (step S2).

(*Id.*, ¶0078.)

Next, as for **determination on whether or not the power reception equipment is correctly placed on the power transmission apparatus 1**, the meaning of this phrase is whether or not the coil of the power receiving side and the coil of the power transmission side are **arranged at positions where a high power transmission efficiency** in a non-contact power supply system is obtained. In other words, whether or not the transmission apparatus 1 and the portable telephone 2 which is power reception equipment, shown in FIG. 2, are arranged at positions where a high coupling degree in magnetic coupling is established between the primary side core 15 of the power transmission apparatus 1 and the secondary side core 16 of the portable telephone 2.

(*Id.*, ¶0079.)

53. Moreover, once the power transmission process has started, mechanisms were known to adjust the power output to the device subject to charging based on the device’s power demand. This is to accommodate the fact that the power

demand may be variable in time. For example, *Berghegger* discloses using a detection means 42 to measure the power demand at the load (e.g., power demand by a battery), and then providing the power demand information to a drive circuit of the charger in order to adjust or control the power transmission to the load. (Ex. 1052, 5:65-6:37.)

4. Universal Wireless Charging Using Multiple Protocols

54. Before the alleged time of invention, persons of ordinary skill in the art were mindful of interoperability issues for wireless power devices. (Ex. 1007, 1:56-67 (“While...organization[s] are attempting to establish standards regarding the control channel protocol, currently, vendors are free to use whatever protocol they chose, making compatibility issues between different vendors’ wireless power products.”); Ex. 1037, 1:51-54 (“[A] need exists for a chargeable device configured to detect one or more wireless chargers and, thereafter, determine an optimal charging solution for receiving a charge.”).)

55. Accordingly, wireless power devices were being designed with compatibility and flexibility in mind. *Walley*, as one such effort relating to reducing compatibility issues for wireless power devices, discloses wireless power transmitters and receivers that are compatible with a variety protocols. (Ex. 1007, FIG. 1.) For instance, *Walley* discloses:

The WP [wireless power] TX [transmit] unit 10 communicates with the WP transceivers 24, 30 of the devices 12-14 via one or more control channels 34 that use one or more frequencies in the ISM bands 36 and/or one or more frequencies in another non-licensed frequency band(s) 38. The communication via the control channel 34 may use one or more standardized protocols 40, 44 and/or one or more proprietary protocols 42, 46.

(*Id.*, 4:14-25.)

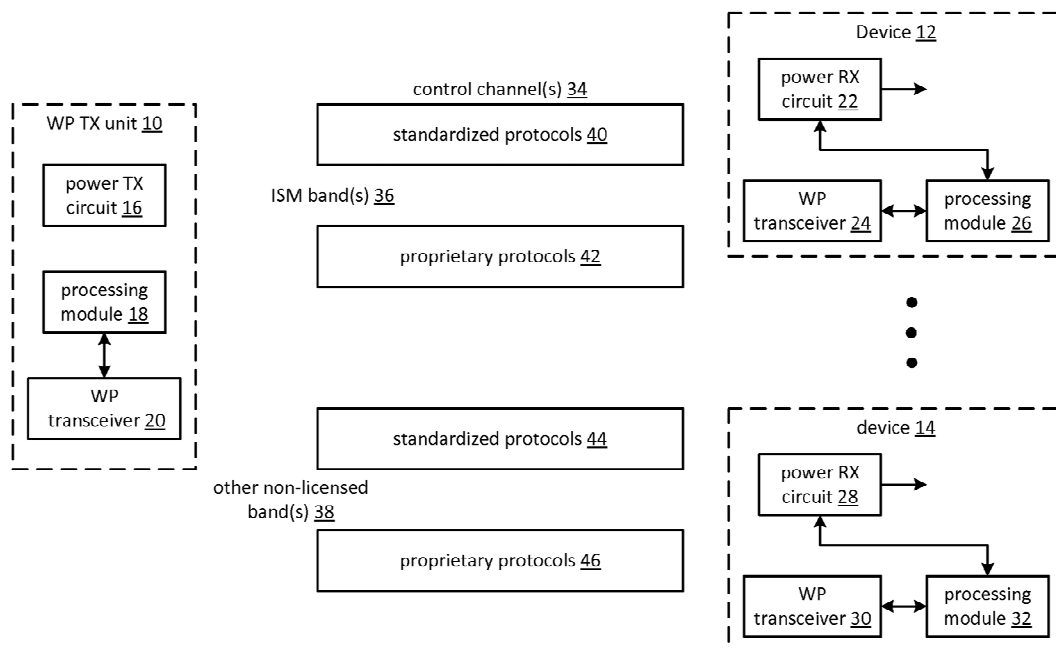


FIG. 1

(*Id.*, FIG. 1.) Moreover, *Walley* discloses that a variety of techniques were understood to establish communication between a wireless power transmitter and a

wireless power receiver, including set up communications, protocol negotiations, channel scanning, etc.:

The receive unit processing module 26, 32 **may identify the control channel protocol by interpreting a beacon signal transmitted by the transmit unit transceiver to determine the control channel protocol**. Alternatively, or in addition to the preceding example, the receive unit processing module 26, 32 **may identify the control channel protocol by receiving a set-up communication from the transmit unit transceiver 20 using a default control channel protocol**. As another alternative, or in addition to one or more of the preceding examples, the receive unit processing module 26, 32 **may identify the control channel protocol by scanning a frequency spectrum** for control channel activity to produce scanned frequency spectrum and identify the control channel protocol from the scanned frequency spectrum. As yet another alternative, or in addition to one or more of the preceding examples, the receive unit processing module 26, 32 **may identify the control channel protocol by evoking a trial and error system** using known control channel protocols.

...

As yet another alternative to identifying the control channel protocol, the transmit unit transceiver 20 and the receive unit transceiver 24, 30 **may negotiate which control channel protocol to use**. For example, the transmit unit transceiver may

transceive negotiation information (e.g., what protocols they each support, desired data rate, available bandwidth, etc.) with the receive unit transceiver to mutually select the control channel protocol.

(*Id.*, 6:22-7:4.)

56. As another such instance, *Jakubowski* discloses chargers that were configured to receive protocol information from devices and thereafter transmit power in accordance with an identified protocol:

In particular embodiments, **the wireless charger 100 also comprises a wireless communications device (not shown) capable of receiving identifications of power-transmitting protocols.** ... By receiving an identification, it is meant that information is received that is sufficient to identify a particular power-transmitting protocol. In particular embodiments, the received information may be a single numeric value that the control logic 110 has associated with a particular power-transmitting protocol. In other embodiments, the received information may include values that correspond to parameters of a power-transmitting protocol, such as the frequency of alternating voltage and the intensity of the inductive field as discussed above.

The wireless charger 100 may receive an identification of a power-transmitting protocol from an electronic device to be charged. For example, an electronic device to be charged may

be placed within range of the wireless charger 100. If the electronic device is capable of detecting that it is within range of the wireless charger 100 and is capable of wirelessly communication with the wireless charger 100, the electronic device to be charged may transmit an identification of a power-transmitting protocol for the wireless charger 100 to use when the wireless charger 100 charges the electronic device. **The wireless charger 100 may receive the transmitted identification of a wireless power-transmitting protocol and transmit power to the electronic device in accordance with the identified protocol.**

(Ex. 1029, 4:63-5:27.)

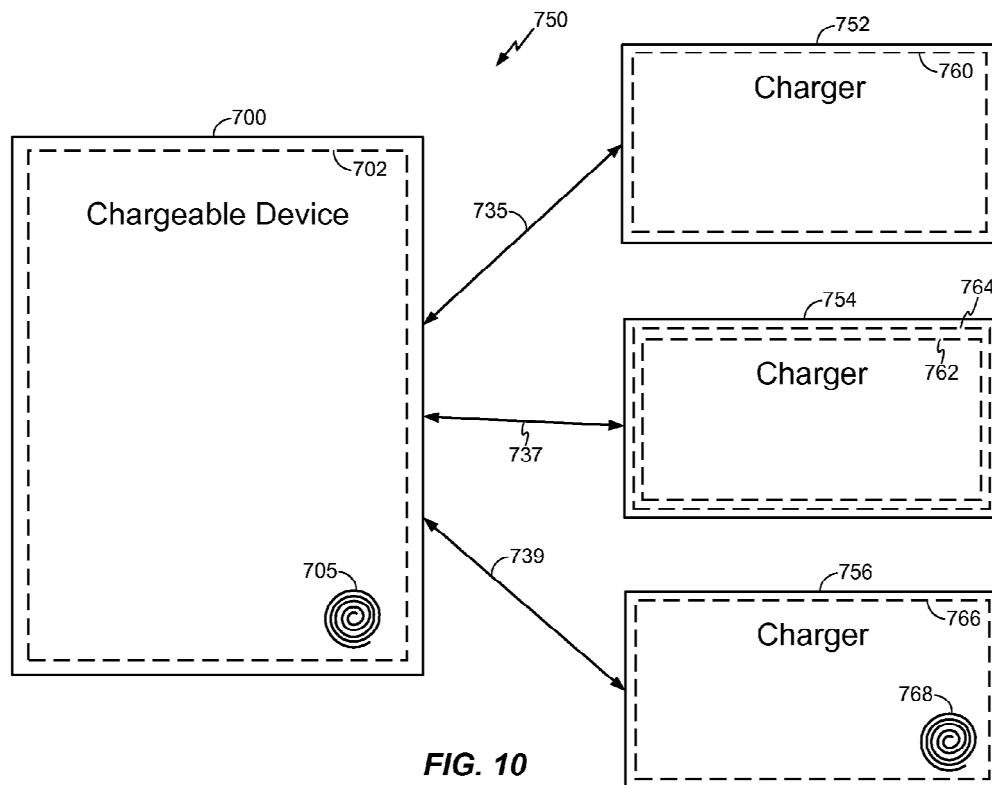
57. *Jakubowski* also discloses that a wireless power charger can include a mechanical button to easily switch between charging protocols to support compatibility with different types of wireless power devices:

The **wireless charger 100 includes a settings mechanism 118**. The settings mechanism 118 includes **four selectable buttons** (shown in FIG. 2). **Each selectable button has associated with it a power-transmitting protocol**. The control logic 110 is capable of detecting when one of the selectable buttons is selected. The control logic 110 is also capable of operating the wireless power-transmitting device in accordance with the power-transmitting protocol associated with the selected buttons. **In this manner, a user of the wireless charger 100 can choose a particular power-transmitting protocol that is best suited**

for a particular electronic device to be charged. For example, the user may select button 1 to select a power-transmission protocol that is suited for charging a particular cellular phone. The user may select button 2 to select a power-transmission protocol that is suited for charging a different electronic device, such as a different cellular phone or a rechargeable computer mouse. Similarly, button 3 and button 4 may be used for charging other electronic devices.

(*Id.*, 4:45-62.)

58. *Kirby* similarly discloses wireless chargers and devices that were compatible with a variety of charging protocols:



(Ex. 1037, FIG. 10 (illustrating a chargeable device 700 that is compatible with different types of chargers 752, 754, and 756), 11:55-13:14.)

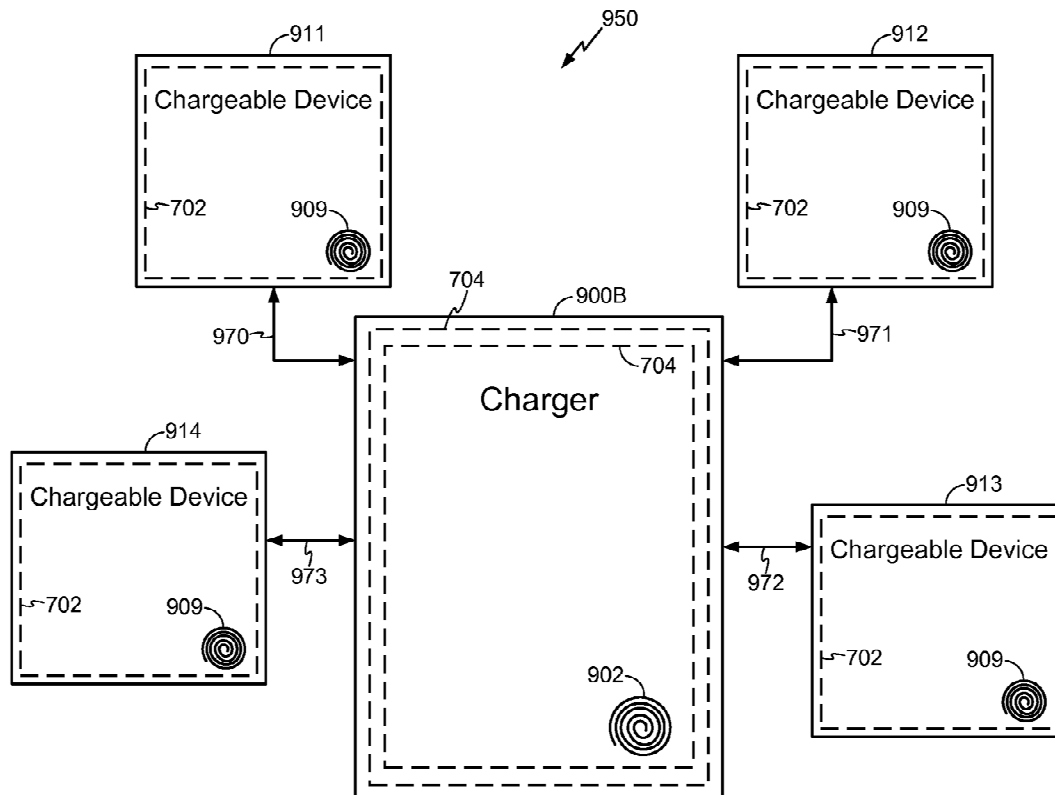


FIG. 16

(*Id.*, FIG. 16 (illustrating a charger 900B that is compatible with chargeable devices 911-914), 17:53-18:11 (“[C]harger 900B may determine which one or more chargeable devices should be charged with which protocols and frequencies to enable for an optimal charging scenario of system 950.”).)

59. Further still, *Gioscia* similarly discloses identifying processes for ensuring compatibility between a wireless transmitter and corresponding receiver:

Step 1020 provides that an identification process of one or both devices is performed. In an embodiment, sub-step 1022 provides for one or both of **the two devices identifying the other device by class or type. For example, the dock may identify the MCD device by class or type. Likewise, the MCD may identify the dock by class.** The identification process may involve, for example, the MCD identifying whether it is being inductively mated to a dock or another device (e.g. another MCD). As another example, the MCD can determine whether it is to supply power exclusively (such as to another accessory device that can only consume power, rather than to the dock).

As an alternative or addition, the process of identification includes one or both of the **devices determining the other devices hardware, firmware, or software, including version and compatibility between two devices.** For example, software/firmware versions may be determined **to identify and/or resolve compatibility issues.**

...

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** (step 1142). 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.**

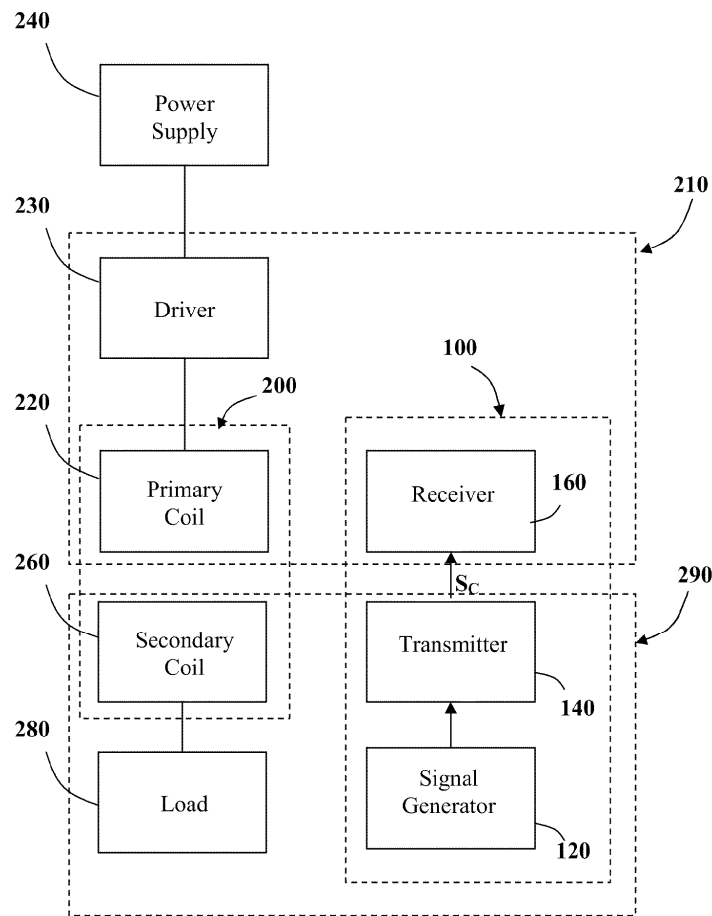
(Ex. 1035, 19:3-20, 21:7-18, FIGS. 10-11.)

60. Consistent with such exemplary systems, inter-protocol operability and compatibility was a well-understood and explored feature for wireless power systems before the alleged time of invention.

5. Wireless Charging Using Uni-directional and Bi-directional Protocols

61. In addition to understood multi-protocol wireless power devices, both uni-directional and bi-directional messaging was well-known for controlling wireless power systems before the alleged time of invention.

62. As one such example, *Azancot* discloses a power outlet 210 that inductively provides power to electrical device 290.



(Ex. 1006, FIG. 1, 6:63-7:8.)

63. *Azancot's* electrical device 290 is configured to send uni-directional S_C control signals to power outlet 210 to control wireless power flow:

The signal transfer system 100 comprises: a signal generator 120, for generating a control signal SC ; a transmitter 140 for transmitting said control signal SC ; and a receiver 160 for receiving said control signal SC .

Although in the signal transfer system 100 described herein, the transmitter 140 is incorporated into the power outlet 210 and the

receiver 160 is incorporated into the electrical device 290, it will be appreciated that a transmitter 140 may alternatively or additionally be incorporated into the electrical device 290 and a receiver 160 may alternatively or additionally be incorporated into the power outlet 210.

The control signal SC communicates encoded data pertaining to the power transmission. This data may be pertinent to regulating efficient power transmission. Examples of such data includes parameters such as: **required operating voltage, current, temperature or power for the electric load 280**, the measured voltage, current, temperature or power supplied to the electric load 280 during operation, the measured voltage, current, temperature or power received by the electric load 280 during operation **and the like**.

(*Id.*, 7:9-29.) Similar uni-directional wireless power control systems were well-known. (*See, e.g.*, Ex. 1008.)

64. Moreover, uni-directional wireless power control was becoming standard before the alleged time of invention. The Wireless Power Consortium (“WPC”) standard, also known as the Qi standard, was an understood and adopted wireless power control protocol before the alleged time of invention. (Ex. 1010; Ex. 1011.) Qi compliant systems and devices allowed various Power Receivers to control wireless Power Transmitters via one-way messaging. (Ex. 1010, Cover, 1, 7-9, 51.)

65. As I discussed previously, *Jakubowski* also discloses wireless power receivers that can communicate uni-directional identification information to control wireless power flow:

In particular embodiments, **the wireless charger 100 also comprises a wireless communications device (not shown) capable of receiving identifications of power-transmitting protocols.** ... By receiving an identification, it is meant that information is received that is sufficient to identify a particular power-transmitting protocol. In particular embodiments, the received information may be a single numeric value that the control logic 110 has associated with a particular power-transmitting protocol. In other embodiments, the received information may include values that correspond to parameters of a power-transmitting protocol, such as the frequency of alternating voltage and the intensity of the inductive field as discussed above.

The wireless charger 100 may receive an identification of a power-transmitting protocol from an electronic device to be charged. For example, an electronic device to be charged may be placed within range of the wireless charger 100. If the electronic device is capable of detecting that it is within range of the wireless charger 100 and is capable of wirelessly communication with the wireless charger 100, the electronic device to be charged may transmit an identification of a power-transmitting protocol for the wireless charger 100 to use when

the wireless charger 100 charges the electronic device. **The wireless charger 100 may receive the transmitted identification of a wireless power-transmitting protocol and transmit power to the electronic device in accordance with the identified protocol.**

(Ex. 1029, 4:63-5:27.)

66. Beyond uni-directional wireless power control messages, conventional two-way communication was also known for controlling wireless power systems. (Ex. 1054, 22:4-9, Abstract.) For instance, *Gioscia* discloses bi-directional messaging between an MCD (mobile computing device) and a wireless power docking station/accessory device:

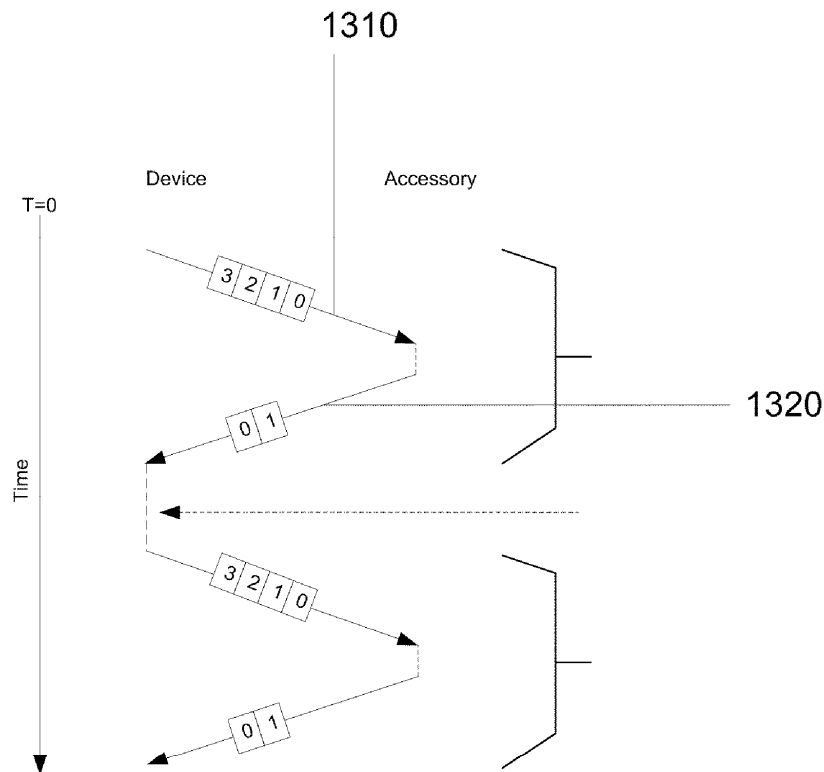


FIG. 13

(Ex. 1035, FIGS. 1, 13, 4:65-5:5, 5:64-6:26, 22:39-60.) Indeed, such two-way communication in wireless power systems was understood in the art:

In one embodiment, the inductive coupling of a device with a power supply is used for wirelessly transferring power to the device from the power supply. **As part of the wireless connection, information may be transmitted to the device from the power supply.** As described below, that information may include a listing of other devices in the system or connected to the power supply, as well as access restrictions, control codes,

and/or commands for controlling other devices. In one embodiment, load modulation may be used to communicate from the device to the power supply. The modulation may occur while the load is powered for reasons of simplicity and cost. The system may be designed to listen or pause. **This communications methodology may be adopted for transmitter and receiver designs.** For example, either **rail voltage modulation or frequency-shift keying (“FSK”) modulation may be used for wireless communication from the power supply to the receiver.** Although it may be more difficult to receive signals while powering a device, known decoding technology may be utilized for receiving these messages. **Each power channel or device being charged may establish a communications link through this power control channel.** This data may then be shared via the two and three wire communication channel between remote wireless power supplies. This allows many devices to be multiplexed or many power channels to facilitate many devices all communicating independently to the system.

(Ex. 1053, 5:45-6:3.)

VI. OVERVIEW OF THE '777 PATENT

67. The '777 patent generally relates to wireless charging/powering systems using inductive charging protocols, such as *e.g.*, uni-directional messaging and bi-directional messaging protocols. (Ex. 1001, Abstract, 1:45-2:3, 2:41-52,

13:52-58.) In my opinion, as I discuss in detail below, it is my opinion that such features, including those recited in the claims I address in this declaration, were disclosed or suggested in the prior art, and thus recite a compilation of known technologies/techniques. (*See my below analysis at §IX.*)

VII. CLAIM CONSTRUCTION

68. I understand that claim terms are typically given their ordinary and customary meanings, as would have been understood by a person of ordinary skill in the art at the time of the alleged invention. For the claims I address in this declaration, I have been asked to apply the plain and ordinary meaning of the terms in those claims (although I may address other interpretations that I have been asked to consider below in my analysis of those claims in Section IX). My opinions concerning the interpretation of the claims terms is based on the time of the alleged invention I have been asked to consider as I noted above (*e.g.*, October 18, 2010 to January 18, 2011). I understand that in considering the meaning of the claims, one must consider the language of the claims, the specification, and the prosecution history of record. I have done so to support my opinions in this declaration where appropriate.

VIII. OVERVIEW OF THE PRIOR ART

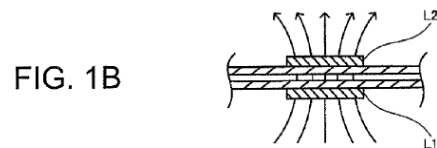
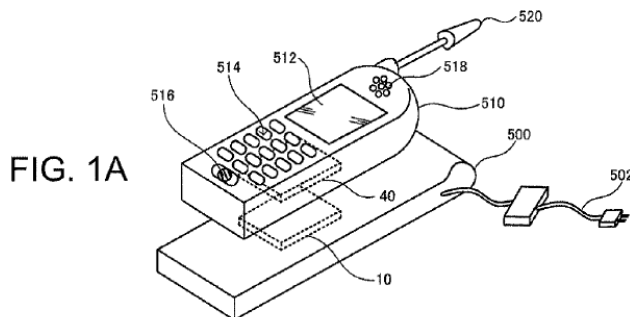
69. I rely on the disclosures and analysis thereof of the prior art discussed in this Section VIII for my opinions regarding their respective teachings and

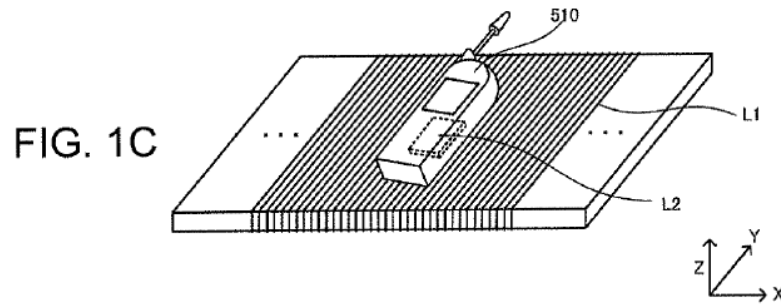
suggestions as applied to the challenged claims of the '777 patent below in Section IX. Accordingly, the following discussions are incorporated into my analysis below in Section IX.

A. Sogabe (Ex. 1005)

70. I understand that *Sogabe* is an issued United States patent. (Ex. 1005, Cover.) My understanding is that *Sogabe* was filed July 15, 2009 and issued February 5, 2013. (*Id.*)

71. *Sogabe* discloses examples of a system including a charging electronic apparatus, such as a charger/cradle 500, that inductively powers/charges an electronic apparatus, such as a phone 510 (or other type of electronic apparatus with a load/battery), as exemplified regarding FIGS. 1A-1C (below). (*Id.*, 1:43-5:7, 5:59-6:38, FIGS. 1A-1C.)





72. The charger/cradle includes a power transmission device 10 and the cell phone (or other device) includes a power receiving device 40 coupled to a load/battery 90/94. (*Id.*, 5:16-19, 5:60-65, 6:39-55.) Figures 2 and 9 illustrate examples of power transmission device 10 and power receiving device 40. (*Id.*, FIGS. 2, 9; *see also id.*, 5:33-35, 22:7-24:17 (describing additional component details of an exemplary system including power transmission device 10 and power receiving device 40).)

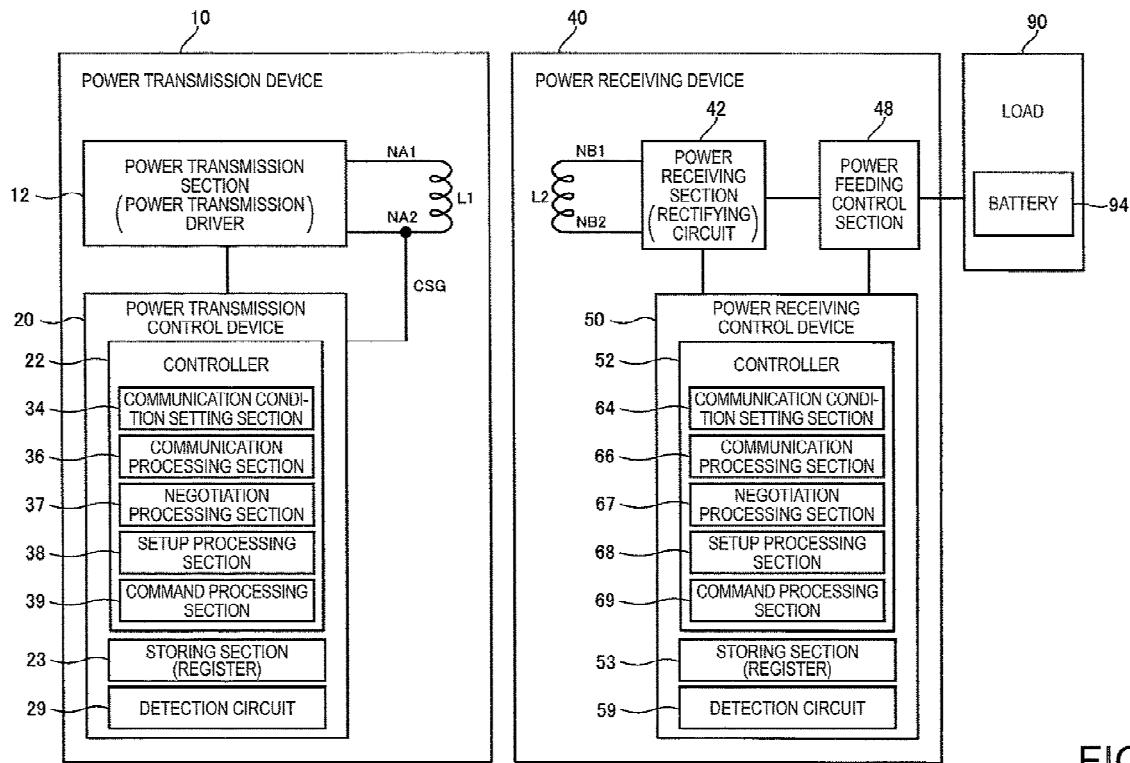


FIG. 2

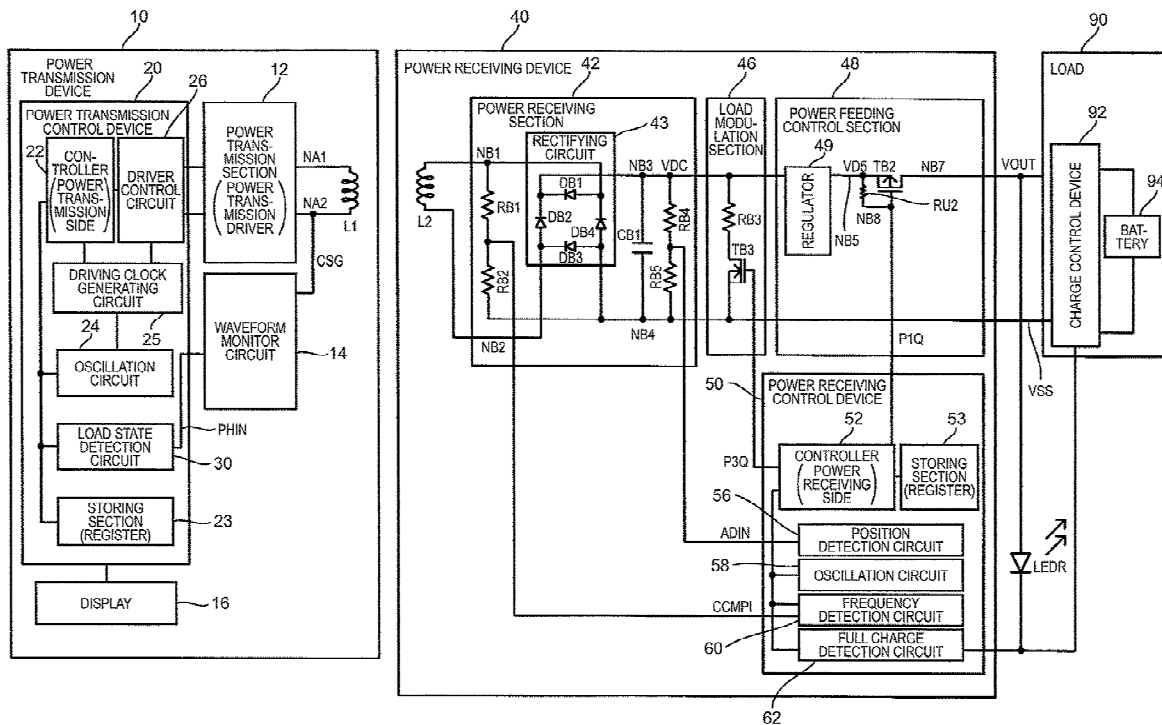


FIG. 9

73. *Sogabe* describes how the components within power transmission device 10 and power receiving device 40 operate to provide/control inductive powering/charging of battery 94 via electromagnetically coupled primary coil L1 and secondary coil L2. (*Id.*, 6:56-14:32, 8:13-22, 8:23-36; *see also id.*, FIGS. 3A-5C, 14:33-18:9 (discussing “an operation of the embodiment...in detail with reference to FIGS. 3A to 5C”).)

74. *Sogabe* discloses that the power transmission device 10 can receive communication condition information from the power receiving device 40 such that the power transmission device can charge a variety of different power receiving devices:

In contrast, in the embodiment, **a communication condition is set by exchanging information between the power transmission side and the power receiving side.** The information communication between the power transmission side and the power receiving side are performed by using the set communication condition. **Accordingly, a plurality kinds of power receiving devices having different power specifications can be used. As a result, (the multi-power corresponding system) a power transmission system can be achieved that corresponds with multiple power specifications.**

For example, the power receiving device 40 is designed for contactless power transmission with 0.5 watts, the power

receiving device 40 (storing section 53) has communication condition information most suitable for the power transmission of 0.5 watts. Therefore, the communication under the optimum communication condition for the contactless power transmission of 0.5 watts can be performed by the following manner. The power transmission side receives the communication information from the power receiving device 40, and performs a communication processing by setting a communication condition based on the received communication condition information. As a result, quality and reliability of the communication can be improved.

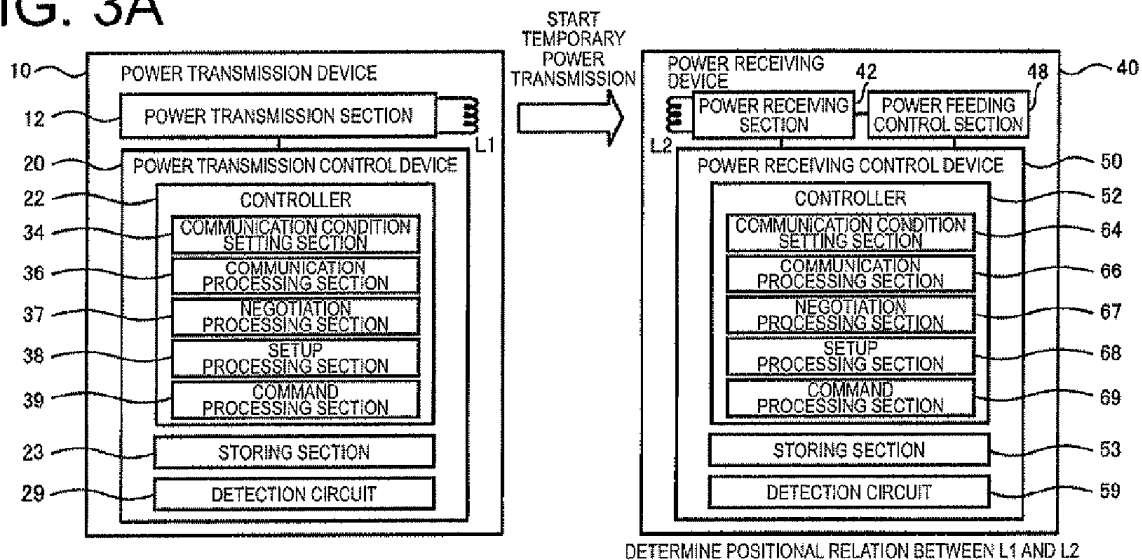
As another example, the power receiving device 40 is designed for contactless power transmission with 15 watts, the power receiving device 40 has communication condition information most suitable for the power transmission of 15 watts. Therefore, the communication under the optimum communication condition for the contactless power transmission of 15 watts can be performed by the following manner. The power transmission side receives the communication information from the power receiving device 40, and performs a communication processing by setting a communication condition based on the received communication condition information. **As described above, the power transmission side can correspond with both the ones of 0.5 watts and 15 watts. The general versatility can be improved, enabling a power transmission system**

corresponding with multiple power specifications to be achieved.

(*Id.*, 10:45-11:16.)

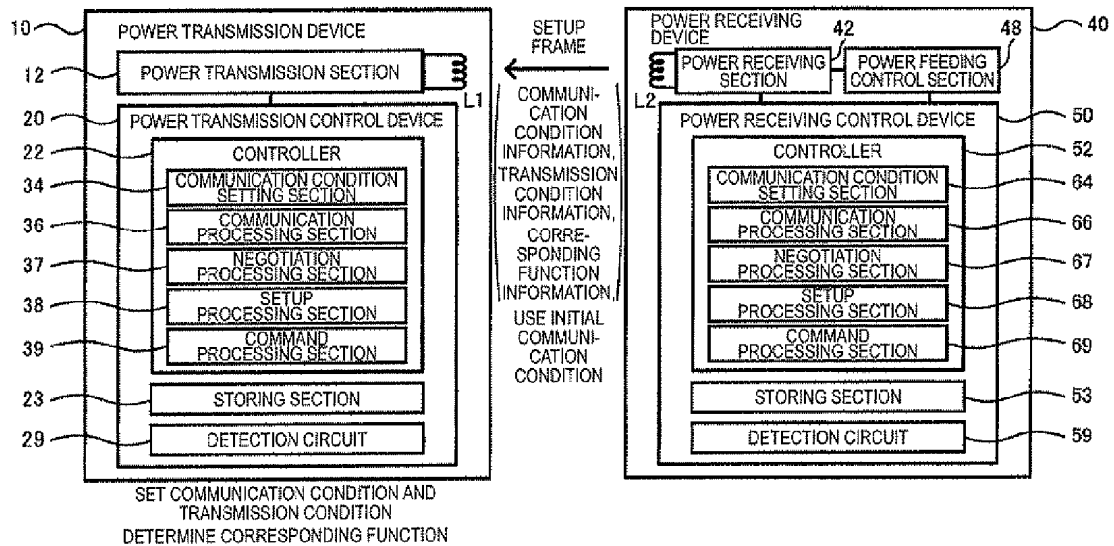
75. Figures 3A-5C illustrate an example of how a wireless power flow is set up between a power transmission device and a power receiving device. (*Id.*, 14:34-16:36.) The setup entails first powering the power receiving device at a low temporary power level so that the device can send setup information to the power transmission device. (*Id.*, FIGS. 3A, 4A, 14:34-16:36.)

FIG. 3A



(*Id.*, FIG. 3A.)

FIG. 4A



(*Id.*, FIG. 4A.) After such setup processing, normal power transmission can begin based on information that is communicated during setup processing. (*Id.*, FIGS. 5A-5B, 14:34-16:36.)

FIG. 5A

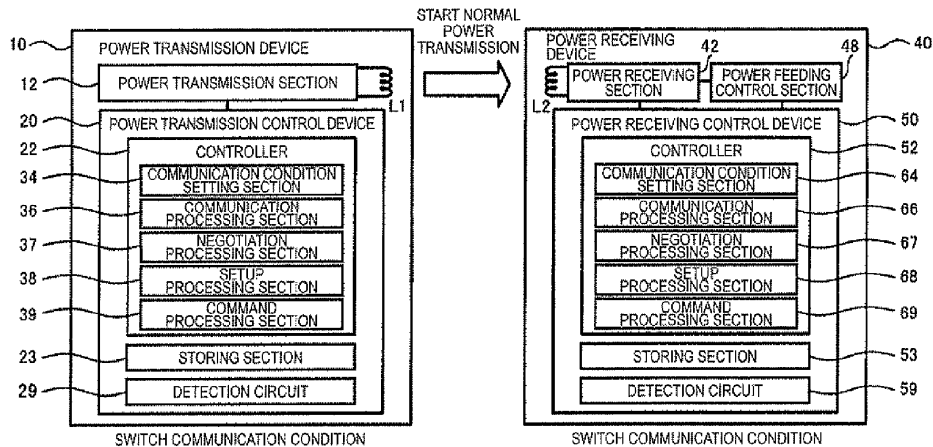
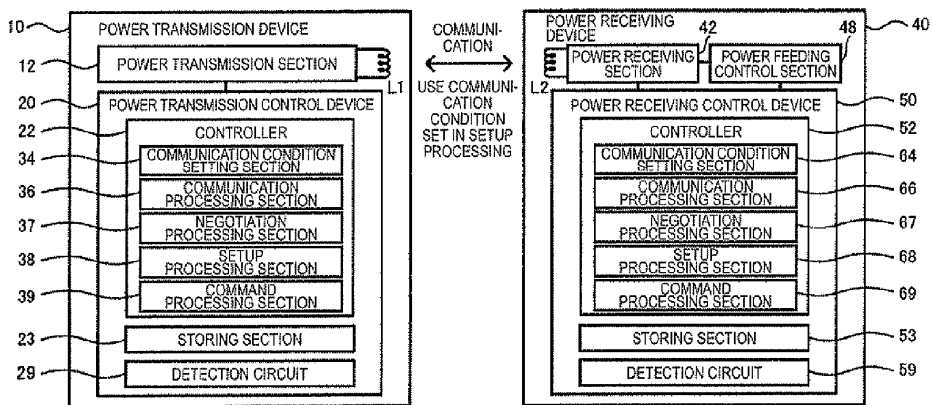


FIG. 5B



(*Id.*, FIGS. 5A-5B.)

B. Azancot (Ex. 1006)

76. I understand that *Azancot* is an issued United States patent. (Ex. 1006, Cover.) My understanding is that *Azancot* was filed September 21, 2009 and issued January 3, 2012. (*Id.*)

77. *Azancot* relates to a contactless, inductive power system. (*Id.*, 1:17-19 (“The present invention relates to a system and method for ... controlling power

transfer across an inductive power coupling.”), 1:38-53, 8:44-47 (“[A] method for regulating power transfer across a contactless inductive coupling is taught wherein the output signal provides details of power requirements of the load.”), FIGS. 1, 2A.) For example, figure 2a of *Azancot* shows such an inductive power transfer system, which includes a primary coil L_1 that is driven by a voltage that oscillates at a driving frequency generated by a power source 2240, which provides power to a load 2280 in a device that includes the secondary coil L_2 . (*Id.*, 8:60-9:30; *see also id.*, 1:38-53.)

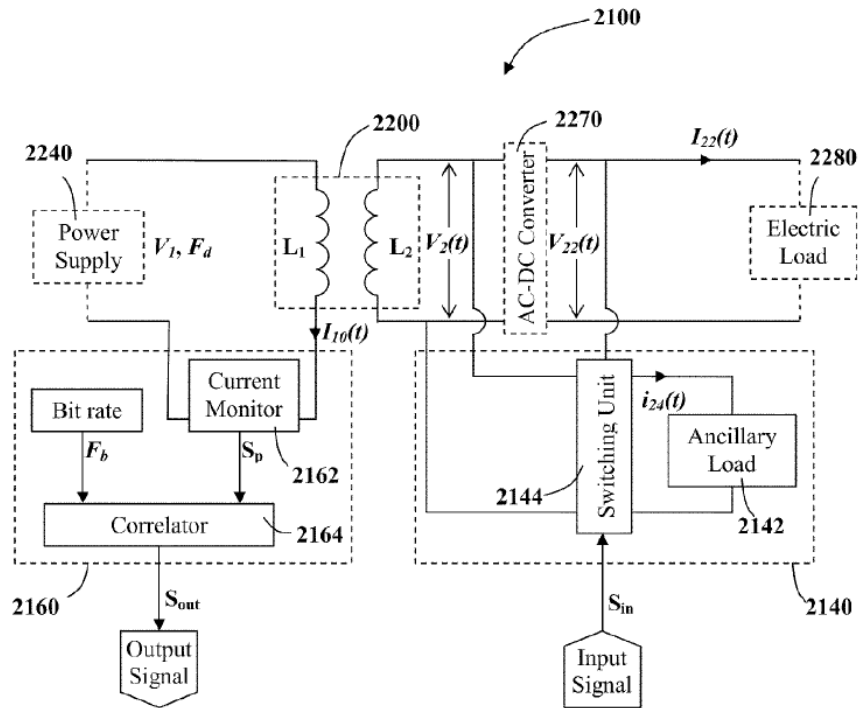


Fig. 2a

(*Id.*, FIG. 2a.)

78. *Azancot* also discloses that the circuitry on the device driving the primary coil L_1 that transmits power also includes a flyback power source 2240F comprising a driver 2248, and a current monitor 2162. (*Id.*, 8:9-11, 10:38-11:3, FIGS. 2A, 2D.) *Azancot* further discloses that circuitry controlling the primary coil L_1 includes a microcontroller 2168, which is used to control the power that is wirelessly transmitted to the load 2280 in the device receiving the power. (Ex. 1006, 8:9-11, 10:38-11:14, FIGS. 2c-d.)

79. *Azancot* also discloses that microcontroller 2168 of the power transmission side can process feedback signals from the device receiving power to control output power from the transmission side. (*Id.*, 8:9-11, 8:60-65, 10:11-37, 10:38-52, 11:4-14, FIGS. 2a, 2d.) For instance, *Azancot* discloses that the power receiving side includes a transmission circuit 2140 that is used to digitally encode information relating to load parameters or external data that is transmitted through the inductive energy coupling to a receiver circuit 2160 on the power transmission side. (*Id.*, 9:58-63, 10:20-37, FIG. 2B.) The data sent from the power receiving circuit to the power transmitting circuit can then be used by the microcontroller to control power output. (*Id.*, 10:38-11:14, FIGS. 2C, 2D.)

C. *Walley* (Ex. 1007)

80. I understand that *Walley* is an issued United States patent. (Ex. 1007, Cover.) My understanding is that *Walley* was filed June 3, 2010 and issued March 5, 2013. (*Id.*)

81. *Walley* discloses wireless power transmitters and receivers that are compatible with a variety protocols. (*Id.*, FIG. 1.) For instance, *Walley* discloses:

The WP [wireless power] TX [transmit] unit 10 communicates with the WP transceivers 24, 30 of the devices 12-14 via one or more control channels 34 that use one or more frequencies in the ISM bands 36 and/or one or more frequencies in another non-licensed frequency band(s) 38. The communication via the control channel 34 may use one or more standardized protocols 40, 44 and/or one or more proprietary protocols 42, 46.

(*Id.*, 4:14-25.)

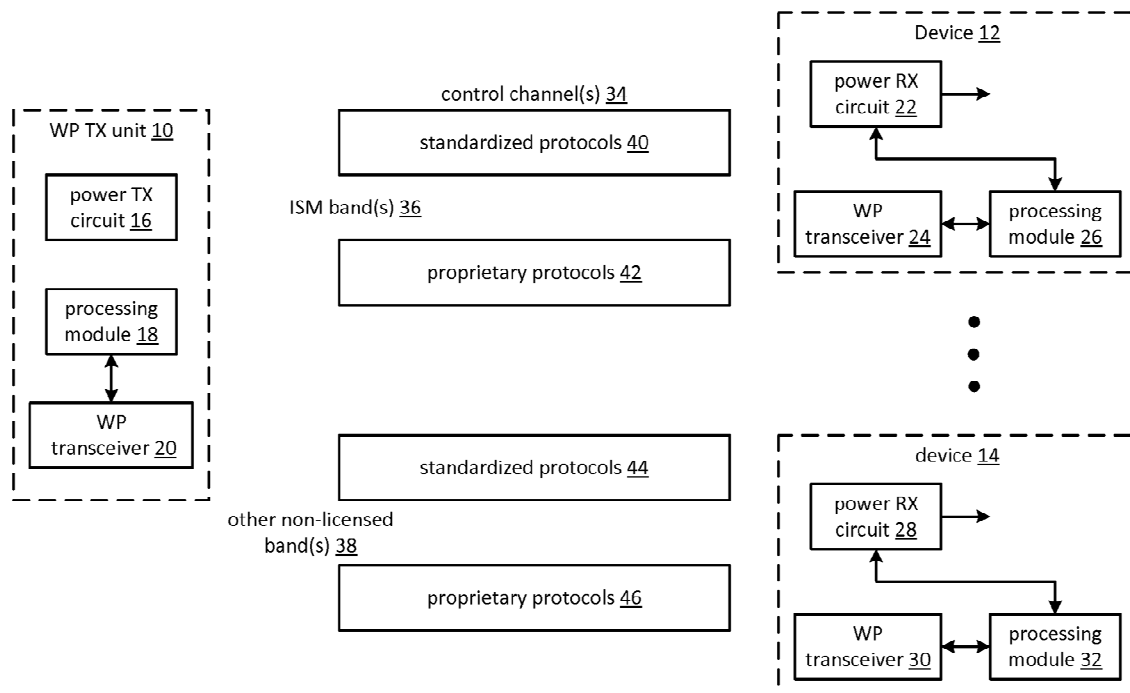


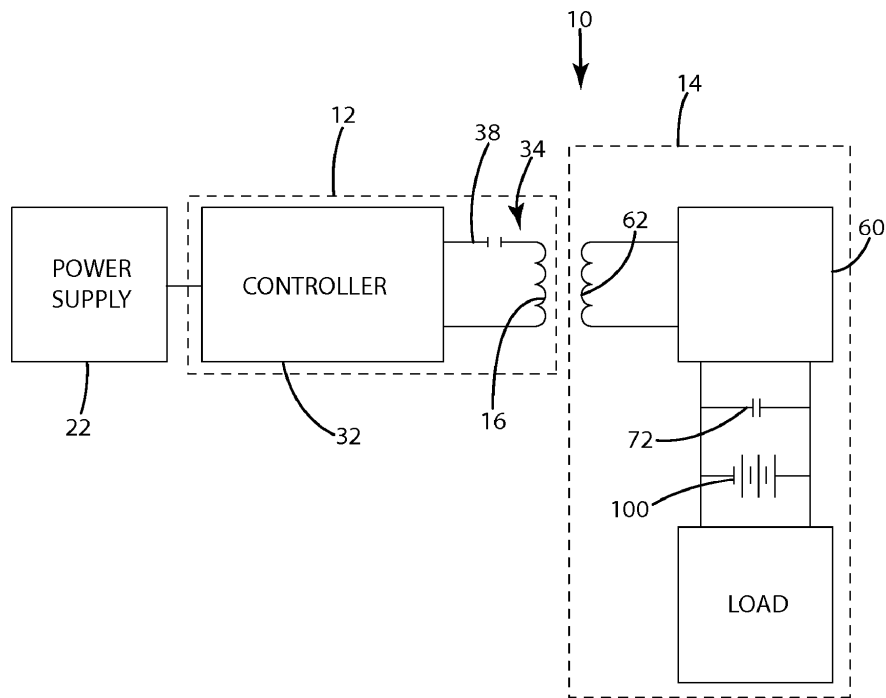
FIG. 1

(*Id.*, FIG. 1.)

D. *Baarman* (Ex. 1008)

82. I understand that *Baarman* is a published United States patent application. (Ex. 1008, Cover.) My understanding is that *Baarman* was filed July 9, 2009 and published January 14, 2010. (*Id.*)

83. *Baarman* discloses a “wireless charging system.” (*Id.*, Title, Abstract, FIG. 1, ¶¶0030.) *Baarman*’s system includes an inductive power supply 12, which includes a controller 32 and a tank circuit 34, which includes the primary coil 16 that transmits wireless power to remote control 14. (*Id.*, ¶¶0030, 0032, FIGS. 1-2A.)



(*Id.*, FIG. 1.)

84. *Baarman* further discloses that “the inductive power supply enters a ping state 202 by periodically applying a relatively small amount of power to the tank circuit 34. The amount of power in each ping is typically sufficient to enable a remote control 14 with a depleted battery 100 to generate a feedback signal to identify its presence within the electromagnetic field.” (*Id.*, ¶0048, FIG. 4.) The controller 32 controls the tank circuit 34 to output the power ping through the primary coil 16 of tank circuit 34. (*Id.*, ¶0032, FIGS. 1, 2A, 2C.)

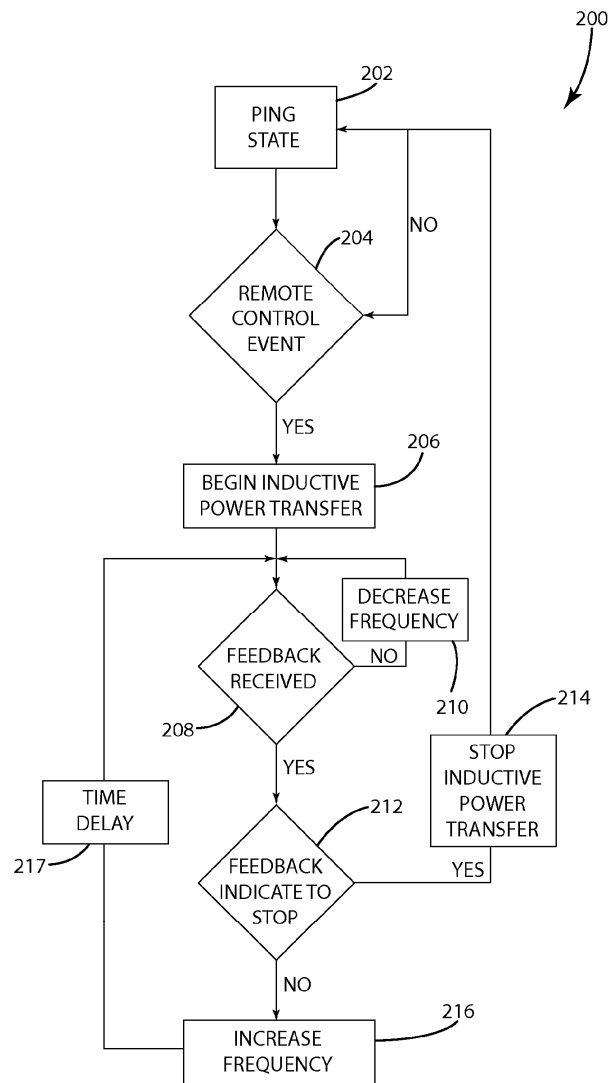


Fig.4

(*Id.*, FIG. 4.)

IX. THE PRIOR ART DISCLOSES OR SUGGESTS ALL RECITED FEATURES OF CLAIMS 15, 17, and 20-23 OF THE '777 PATENT²

A. Ground 1: *Sogabe* in view of *Azancot* discloses and/or suggests claims 15, 20, 21, and 23

1. Claim 15

a) An electronic device capable of receiving power inductively, the electronic device comprising:

85. I have been asked to assume that the preamble of claim 15 is limiting. Under that assumption, it is my opinion that *Sogabe* discloses this limitation. (See below and my discussions above in §VIII.A.)

86. For instance, *Sogabe* discloses a cell phone 510 (and other electronic apparatuses with a load/battery (*e.g.*, watches, physical digital assistants, etc.)) (“**electronic device**”) that inductively receives power/charge from a charger 500 (“**capable of receiving power inductively**”):

FIG. 1A shows an example of an electronic apparatus **employing a contactless power transmission method** according to an embodiment of the invention. A charger 500 (a cradle) that is one of electronic apparatuses includes a power transmission device

² In this section (Section IX), I refer to exhibits other than those identified prior art reference(s) that disclose and/or suggest the claimed limitations. Such exhibits reflect the state of the art known to a person of ordinary skill in the art at the time of the alleged invention. (See *also* my discussions above in Section V.)

10. A cell phone 510 that is one of electronic apparatuses includes a power receiving device 40. The cell phone 510 includes a display 512 such as an LCD, an operation section 514 composed of buttons and the like, a microphone 516 (a voice input section), a speaker 518 (a voice output section), and an antenna 520.

Power is supplied to the charger 500 through an AC adapter 502, and the power is transmitted from the power transmission device 10 to the power receiving device 40 by contactless power transmission. Accordingly, a battery of the cell phone 510 can be charged and devices in the cell phone 510 can be operated.

The electronic apparatus according to the embodiment is not limited to the cell phone 510. The embodiment is applicable to various electronic apparatuses such as watches, cordless phones, shavers, electric toothbrushes, wrist computers, handy terminals, personal digital assistants, electric bicycles, and IC cards.

As schematically shown in FIG. 1B, power is transmitted from the power transmission device 10 to the power receiving device 40 by electromagnetically coupling a primary coil L1 (a power transmission coil) provided on the power transmission device 10 side and a secondary coil L2 (a power receiving coil) provided on the power receiving device 40 side and thus forming a power transmission transformer. This structure enables non-contact power transmission to be performed.

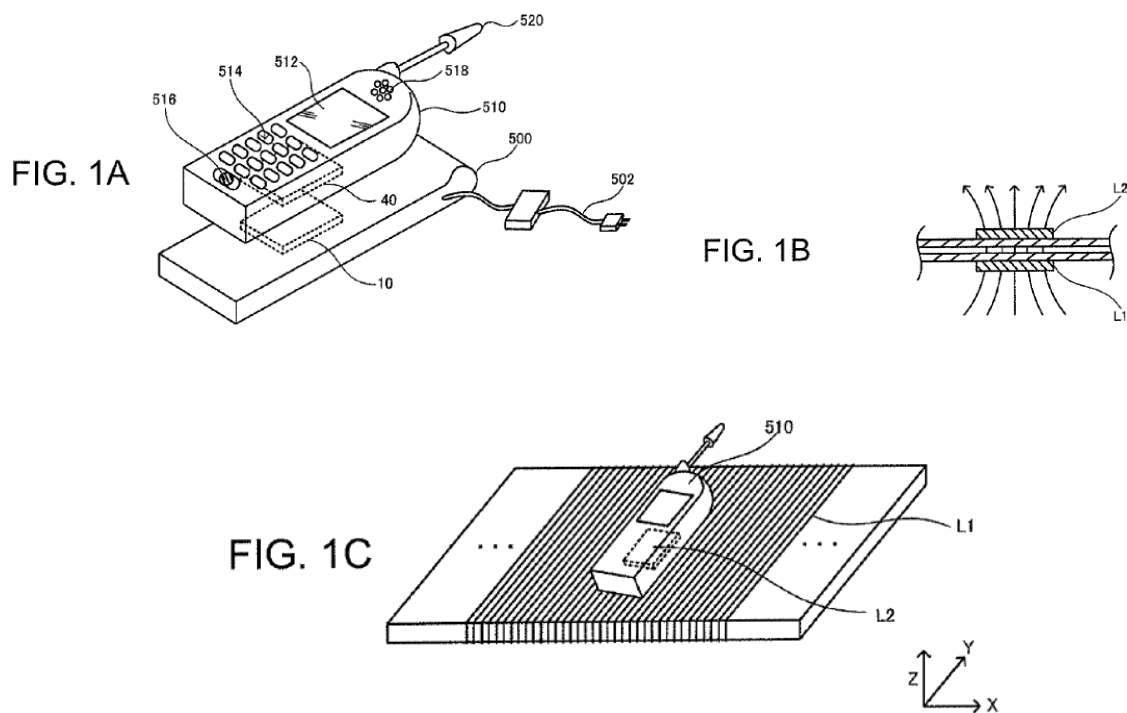
In FIG. 1B, the primary coil L1 and the secondary coil L2 are, for example, a flat coil having an air-core formed by winding a coil wire in a spiral manner on a plane. The coil of the embodiment is not limited to this. Any coil can be employed regardless of its shape, structure, and the like as long as one can be used to transmit power by electromagnetically coupling the primary coil L1 and the secondary coil L2.

For example, referring to FIG. 1C, the primary coil L1 is formed by winding a coil wire in a spiral manner about an X axis of a magnetic substance core. The secondary coil L2 provided in the cell phone 510 is similarly formed. The embodiment is also applicable to the coil shown in FIG. 1C. In a case shown in FIG. 1C, as the primary coil L1 and the secondary coil L2, a coil formed by winding a coil wire about a Y axis may be used other than the coil formed by winding the coil wire about the X axis.

(Ex. 1005, 5:59-6:38; *see also id.*, 6:3-8 (“Power is supplied to the charger 500 through an AC adapter 502, and the power is transmitted from the power transmission device 10 to the power receiving device 40 by **contactless power transmission**. Accordingly, a battery of the cell phone 510 can be charged and devices in the cell phone 510 can be operated.”)³, 6:41-50, 1:43-5:7, 1:19-26 (“[C]ontactless power transmission (non-contact power transmission) has been

³ In this Declaration, all emphasis is added unless otherwise indicated.

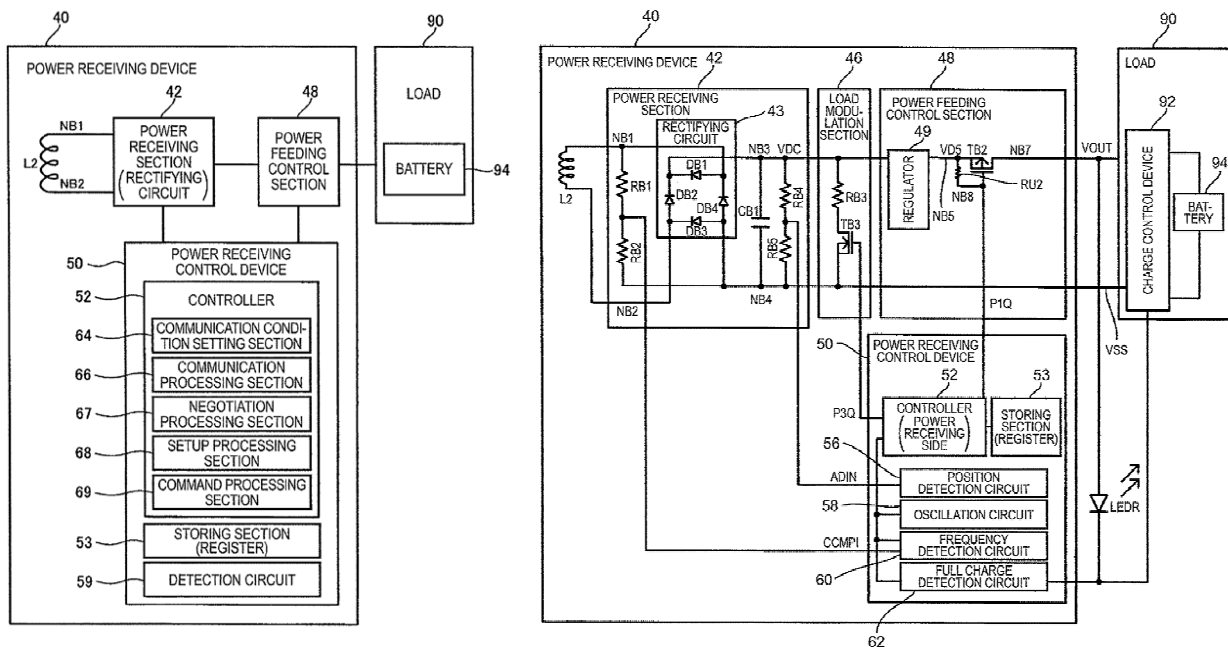
highlighted. The contactless power transmission makes it possible to perform **transmission of electric power by utilizing electromagnetic induction** without using a metallic contact.”.) For example, Figures 1A-1C (below), illustrate a cell phone 510 that receives power wirelessly from charger/cradle 500. (*Id.*, 5:59-6:38, FIGS. 1A-1C.)



(*Id.*, FIGS. 1A-1C.)

87. *Sogabe* discloses that the charger/cradle includes a power transmission device 10 (“PTD10”), and that the cell phone (or other device) includes a power receiving device 40 (“PRD40”) (which is also an “**electronic device**”) coupled to a load/battery 90/94. (*Id.*, 5:16-19, 5:60-65 (“FIG. 1A shows an example of an

electronic apparatus employing a contactless power transmission method according to an embodiment of the invention. A charger 500 (a cradle) that is one of electronic apparatuses includes a power transmission device 10. A cell phone 510 that is one of electronic apparatuses **includes a power receiving device 40.**”), 6:39-55, 8:28-36.) Figures 2 and 9 illustrate additional details of the PRD40 of the electronic device. (*Id.*, 6:39-55, 22:7-11, FIGS. 2, 9.)



(*Id.*, FIG. 2 (left) (excerpted), FIG. 9 (right) (excerpted).)

b) an inductive charging receiver coil;

88. In my opinion, *Sogabe* discloses this limitation. *Sogabe* discloses that the electronic device that receives power includes “secondary coil L2” (“**inductive charging receiver coil**”). (Ex. 1005, 6:50-57, FIGS. 2, 9; *see also id.*, 6:23-38,

FIGS. 1B-1C.) Secondary coil L2 receives wireless power from a primary coil L1 of PTD10 in order to charge battery 94:

Power is supplied to the charger 500 through an AC adapter 502, and the power is transmitted from the power transmission device 10 to the power receiving device 40 by contactless power transmission. Accordingly, **a battery** of the cell phone 510 **can be charged** and devices in the cell phone 510 can be operated.

....

Based on a structure shown in FIG. 2, a contactless power transmission (non-contact power transmission) system is realized in which **the primary coil L1 and the secondary coil L2 are electromagnetically coupled so as to transmit power from the power transmission device 10 to the power receiving device 40** to supply the power to the load 90, for example.

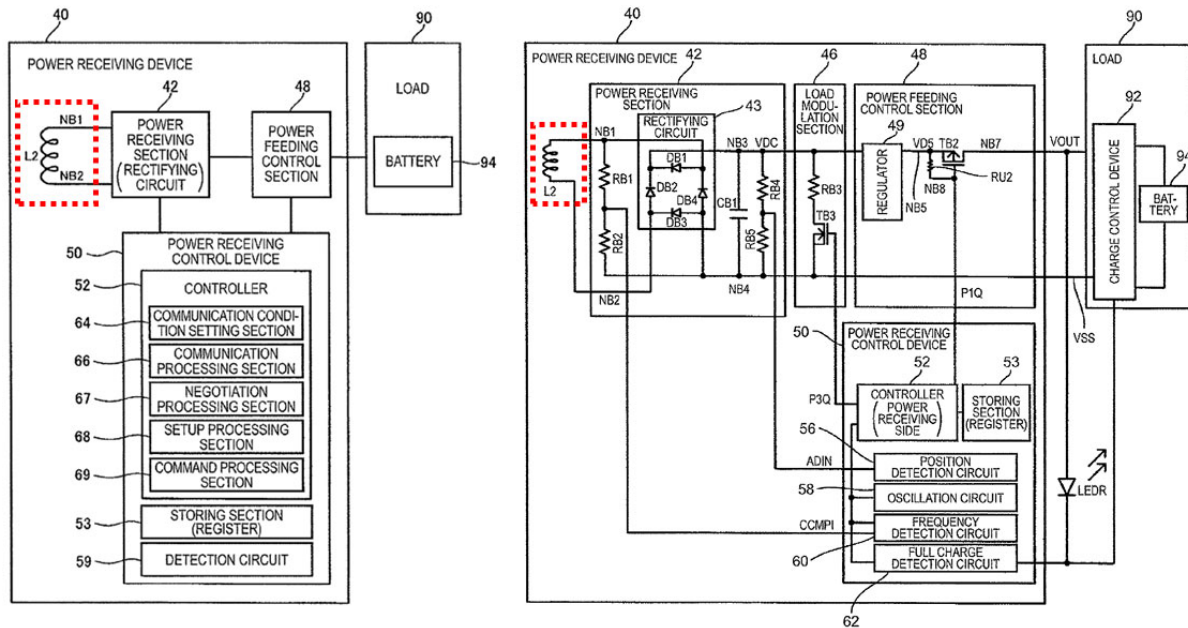
....

The power receiving section 42 converts an alternating-current induced voltage of the secondary coil L2 into a direct-current voltage. The conversion can be realized by a rectifying circuit and the like included in the power receiving section 42.

The power feeding control section 48 controls power feeding to the load 90. That is, the power feeding control section 48 controls turning on/off the power feeding to the load 90. Specifically, a level of the direct-current voltage from the power receiving section 42 (the rectifying circuit) is regulated so as to generate a

power supply voltage. Thereafter, the power supply voltage is supplied to the load 90 so as to charge a battery 94 of the load 90. The load 90 may not include the battery 94.

(*Id.*, 6:3-8, 6:50-55, 8:23-35; *see also id.*, 6:65-7:25.)



(*Id.*, FIGS. 2 (left), 9 (right) (annotated and excerpted).)

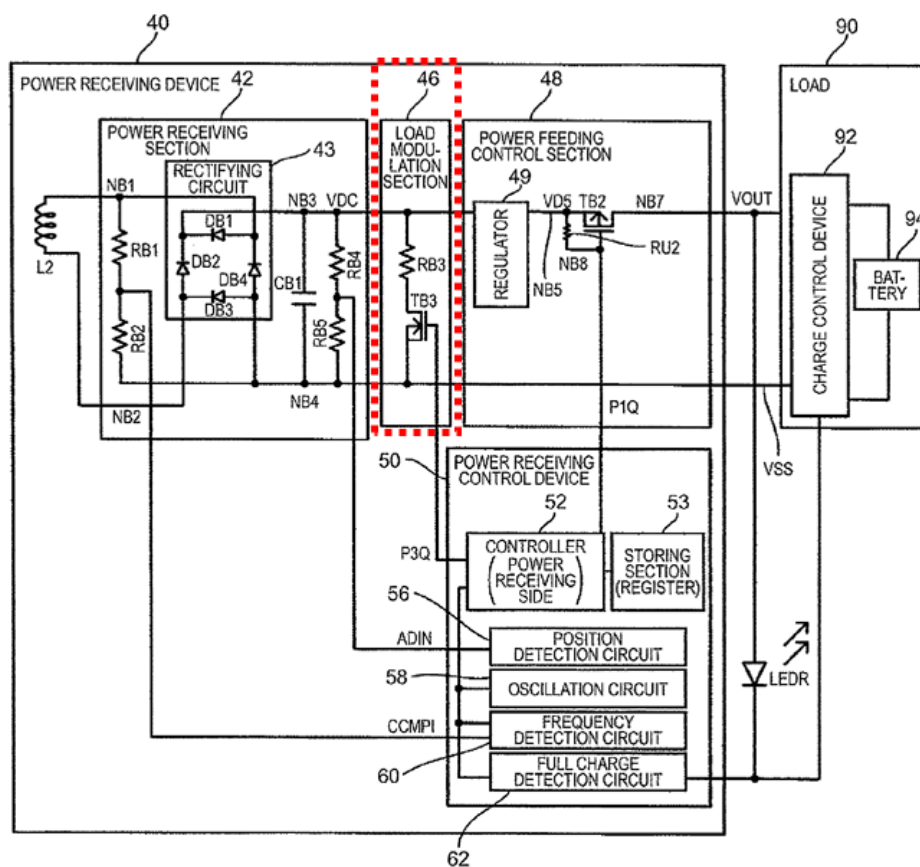
- c) a communication transmitter circuit electrically coupled to the inductive charging receiver coil for communicating through the coil;

89. In my opinion, *Sogabe* discloses this limitation. For instance, *Sogabe* discloses that the electronic device that receives power includes “load modulation section 46” (an example of a “**communication transmitter circuit**”):⁴

The **load modulation section 46** performs a load modulation processing. Specifically, **when desired data is transmitted from the power receiving device 40 to the power transmission device 10, a load on the load modulation section 46 (the secondary side) is variably changed so as to vary a signal waveform of the induced voltage of the primary coil L1.** Therefore, the load modulation section 46 includes a resistance RB3 and a transistor TB3 (an N-type CMOS transistor) that are provided in series between nodes NB3 and NB4. The transistor TB3 is on/off-controlled by a signal P3Q from the controller 52 of the power receiving control device 50. When the transistor TB3 is on/off-controlled so as to perform a load modulation, a transistor TB2 of the power feeding control section 48 is turned off. As a result, the load 90 is in a state of not being electrically coupled to the power receiving device 40.

⁴ Additionally, load modulation section 46 together with one or more components/circuitry in PRD40 that facilitate the discussed transmissions/communications through L2 also teach the claimed “**communication transmitter circuit.**”

(Ex. 1005, 23:10-26, FIG. 9; *see also id.*, 7:51-55, 8:16-22, 8:50-53.) “[W]hen desired data is transmitted from the power receiving device 40 to the power transmission device 10, a load on the load modulation section 46 (the secondary side) is variably changed so as to vary a signal waveform of the induced voltage of the primary coil L1.” (*Id.*, 23:10-16.)



(*Id.*, FIG. 9 (annotated and excerpted).)⁵

⁵ The Figure 2 disclosure may include a similar structure. (Ex. 1005, 8:16-22 (“The power receiving device 40 (a power receiving module, a secondary module) may

90. *Sogabe* discloses that load modulation section 46 is “**electrically coupled to the inductive charging receiver coil for communicating through the coil.**” For instance, *Sogabe* discloses “a load on the load modulation section 46 (the secondary side) is variably changed so as to vary a signal waveform of the induced voltage of the primary coil L1.” (Ex. 1005, 23:10-16.) To induce a voltage on the primary coil L1, load modulation section 46 transmits 1s and 0s over the secondary coil L2 by changing between high and low load states:

The processing sequence according to the embodiment is more specifically described with reference to FIG. 7. In the standby phase after the detection of the removal shown in F1, placement detection is performed once every k1 second, for example. As shown in F2, if a placement (an installation) of the electronic apparatus is detected, the negotiation processing and the setup processing are performed. As shown in F3, if the negotiation processing and the setup processing are normally ended, and the

include the secondary coil L2, a power receiving section 42, a power feeding control section 48, and the power receiving control device 50. **The structures of the power receiving device 40 and the power receiving control device 50 are not limited to those shown in FIG. 2, and various modifications, such as omitting a part of components (e.g., the secondary coil), adding another component (e.g., a load modulation section), and changing connections, can be made.”.)**

normal power transmission start command is issued in the command processing, the normal power transmission starts so as to start charging the electronic apparatus. As shown in F4, if a full charge is detected, an LED of the electronic apparatus is turned off. Then, the processing sequence moves to the standby phase after the detection of the full charge as shown in F5.

....

On the other hand, the load modulation section 46, on the power receiving side, variably changes a load of the power receiving side in accordance with data to be transmitted. That is, as shown in FIG. 10B, a signal waveform of the induced voltage of the primary coil L1 is varied. For example, **when data “1” is transmitted to the power transmission side, the power receiving side is in a high load state. On the other hand, when data “0” is transmitted, the power receiving side is in a low load state.** Then, a load state detection circuit 30, on the power transmission side, detects the load state change on the power receiving side so as to determine data “1” or “0.” As a result, data communication by the load modulation from the power receiving side to the power transmission side can be realized.

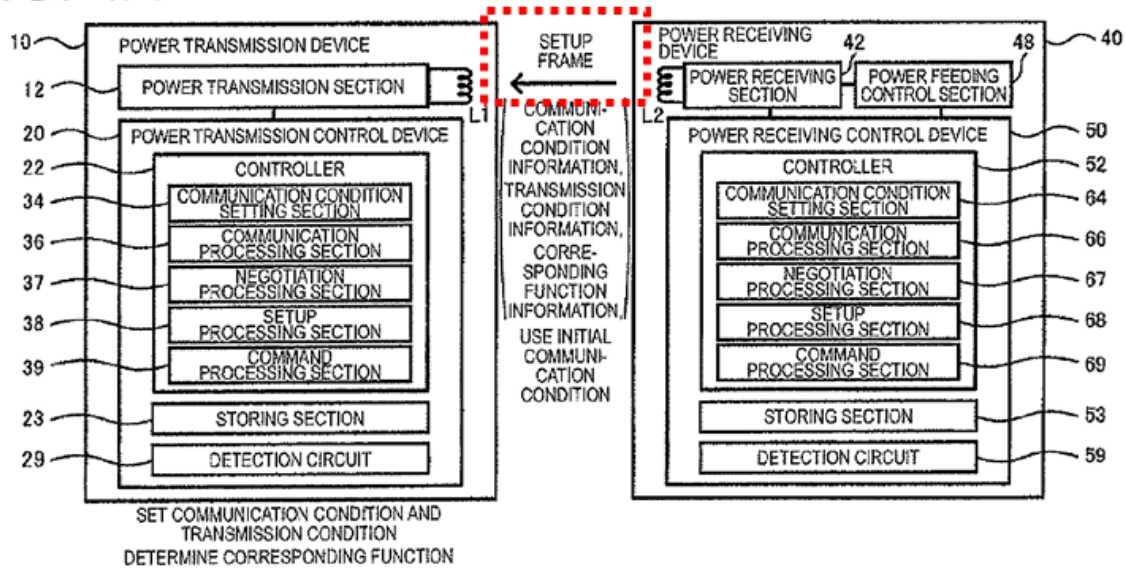
....

As for the communication method, various methods can be assumed. FIG. 14A shows an example of a third communication method detecting a load state by current detection. In FIG. 14A, the load state detection circuit 30 includes a current/voltage

conversion circuit 610 and an amplifier circuit 620. The current/voltage conversion circuit 610 including a resistor RIV detects a current flowing at the coil terminal and converts it into a voltage. The converted voltage is amplified by the amplifier circuit 620. Based on a signal after the amplification, a load state on the power receiving side is detected. Specifically, the load state on the power receiving side can be detected by comparing the phase difference between the coil terminal current and the coil terminal voltage.

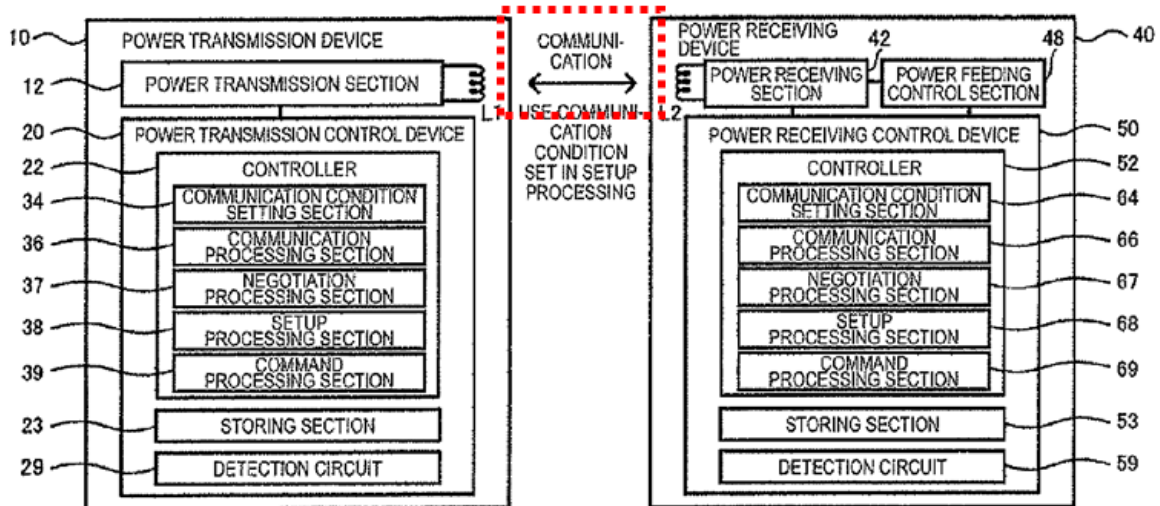
(*Id.*, 23:10-26, 24:4-17, 28:17-29, FIGS. 2, 9, 14A.) *Sogabe* discloses that various setup information, data, etc. is communicated from PRD40 to PTD10, thereby demonstrating that the above exemplary communication transmitter circuit is **“electrically coupled to the inductive charging receiver coil for communicating through the coil.”** (*Id.*, 7:50-55, 24:4-17, FIGS. 2, 9, 14A.)

FIG. 4A



(Id., FIG. 4A.)

FIG. 5B



(Id., FIG. 5B.)

91. Thus, for the reasons I explained above, it is my opinion that *Sogabe* discloses a communication transmitter circuit electrically coupled to the inductive charging receiver coil for communicating through the coil, like that claimed.

d) a communication receiver circuit electrically coupled to the inductive charging receiver coil for communicating through the coil; and

92. In my opinion, *Sogabe* discloses this limitation. For example, in discussing features associated with Figure 2 (below), *Sogabe* discloses the electronic device that receives power includes a “detection circuit 59” (an example of a **“communication receiver circuit”**):⁶

The **detection circuit 59 detects data transmitted from the power transmission device 10**. For example, if data is transmitted from the power transmission device 10 by frequency modulation, the detection circuit 59 detects the data by detecting a variation in the frequency.

(Ex. 1005, 8:58-62, FIG. 2.) *Sogabe* explains that “[t]he detection circuit 59 detects data transmitted from the power transmission device 10,” where, for example, the data can be transmitted by frequency modulation. (*Id.*, 8:58-62.) Figure 9 is a

⁶ In my opinion, detection circuit 59/60 with one or more components/circuitry in PRD40 that facilitate the discussed reception/communications through coil L2 also disclose the claimed **“communication receiver circuit.”**

detailed structural example of *Sogabe*'s system shown in figure 2 (*id.*, 22:8-11 (“A detailed structural example of the embodiment is shown in FIG. 9. Hereinafter, the elements described in FIG. 2 are indicated by the same numerals and the description thereof is omitted.”)). In discussing figure 9, *Sogabe* explains a “frequency detection circuit 60” (“**communication receiver circuit**”) which performs a similar data detection function:

A frequency detection circuit 60 detects frequencies (f_1 , f_2) of a signal CCMPI.

....

In FIG. 9, data communication from the power transmission side to the power receiving side is realized by a frequency modulation while data communication from the power receiving side to the power transmission side is realized by a load modulation.

Specifically, as shown in FIG. 10A, for example, when data “1” is transmitted to the power receiving side, the power transmission section 12 generates an alternating-current voltage having a frequency f_1 . On the other hand, when data “0” is transmitted, the power transmission section 12 generates an alternating-current voltage having a frequency f_2 . Then, the frequency detection circuit 60, on the power receiving side, detects the frequency change so as to determine data “1” or “0.” As a result, data communication by the frequency modulation from the

coils L1 and L2. (*Id.*, 6:65-7:4, 7:15-21, 8:58-62, 10:18-27, 22:8-11, 23:44-45, 23:60-24:17, FIG. 9.) Therefore, in my opinion, a person of ordinary skill in the art would have understood that detection circuit 59/60 is “**electrically coupled to the inductive charging receiver coil for communicating through the coil**” so as to receive data from PTD40. Also, as I explained above, detection circuit 59/60 together with other circuitry within PRD40 that connect to coil L2 to facilitate receiving communications from primary coil L1 (*e.g.*, one or more circuits in power receiving section 42, etc.) provide an example of the claimed “**communication receiver circuit.**”

94. Thus, for the reasons I explained above, it is my opinion that *Sogabe* discloses a communication receiver circuit electrically coupled to the inductive charging receiver coil for communicating through the coil, like that claimed.

e) a microcontroller, wherein the microcontroller is configured for:

95. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. *Sogabe* discloses that a controller 52 controls PRD40 of cell phone 501 (or a similar wireless power receiving apparatus). (Ex. 1005, 8:42-53 (“The controller 52 (on the power receiving side) controls the power receiving device 40 and the power receiving control device 50.”), 22:8-11, FIGS. 2, 9.) *Sogabe* explains that controller 52 may be “realized by an ASIC circuit such as a gate array, a micro

computer with a program operating on the micro computer, or the like.” (*Id.*, 8:46-48.)

96. While a person of ordinary skill in the art would have understood that *Sogabe* discloses that controller 52 may be realized using a variety of standard controllers (via an ASIC “or the like”), *Sogabe* does not explicitly state that its wireless power receiver controller can be implemented using a “microcontroller.” (*See generally* Ex. 1005.) Nonetheless, a person of ordinary skill in the art would have had good reason, and would have been motivated, to configure *Sogabe*’s system with such a microcontroller.

97. A person of ordinary skill in the art would have understood that the “ASIC circuit” and “micro computer” disclosed by *Sogabe* as the controller 52 would correspond to, or could be implemented as, a “microcontroller,” similar to that claimed. I have reviewed the ’777 patent and in my opinion, the specification does not provide implementation details as to the claimed “microcontroller.” The specification does describe a microcontroller in terms of its functions, which in my opinion, is consistent with a person of ordinary skill in the art’s understanding of such well-known components.

In accordance with an embodiment, the microcontroller unit (MCU) in the charger (MCU1) is responsible for understanding the communication signal from the detection/demodulation

circuit and, depending on the algorithm used, making appropriate adjustments to the charger coil drive circuitry to achieve the desired output voltage, current or power from the receiver output. In addition, MCU1 is responsible for processes such as periodic start of the charger to seek a receiver at the start of charge, keeping the charger on when a receiver is found and accepted as a valid receiver, continuing to apply power and making necessary adjustments, and/or monitoring temperature or other environmental factors, providing audio or visual indications to the user on the status of charging or power process, etc. or terminating charging or application of power due to end of charge or customer preference or over temperature, over current, over voltage, or some other fault condition or to launch or start another program or process.

(*See, e.g.*, Ex. 1001, 12:58-13:8; *see also id.*, 14:4-9 (“A microcontroller is used to measure various values such as output voltage, current, temperature, state of charge, battery full status, end of charge, etc. and to report back to the charger to provide a closed loop system with the charger as described above”).) In my opinion, such a skilled person would have been aware of the use microcontrollers in systems/devices like those described by *Sogabe* (before the effective dates I was asked to assume (*see* my discussion above in Section IV), and likewise would have understood how to implement such microcontrollers to perform certain tasks associated with wireless power transfer.

98. Thus, before the alleged time of invention, a person of ordinary skill in the art would have understood that it was well-known to use a microcontroller to control wireless power devices. As an example, *Walley* confirms a person of ordinary skill in the art's state-of-art knowledge of using a "micro-controller" to control a wireless power transmitter or receiver that is capable of operating using different protocols. (Ex. 1007, 3:47-55 ("The processing modules...of the WP [wireless power] TX unit 10 and in each of the devices 12-14 may each be a....micro-controller."), 4:14-21 ("The WP TX unit 10 communicates with the WP transceivers 24, 30 of the devices 12-14 via one or more control channels 34....The communication via the control channel 34 may use one or more standardized protocols 40, 44 and/or one or more proprietary protocols 42, 46."), FIG. 1; *see* also my discussions above in §VIII.C.) *Walley's* teachings regarding the use of a microcontroller is consistent with a person of ordinary skill in the art's state-of-art knowledge before the alleged time of the invention. For example, state-of-art teachings in *Baarman* (Ex. 1012), include:

FIG. 10 is a schematic representation of a circuit suitable for supplying power to the power supply of FIG. 3. The power supply 10 includes an AC/DC rectifier 60 for converting the AC power received from the AC mains into DC power....The power supply 10 also includes a microcontroller 64 and a switching circuit 66. The microcontroller 64 is programmed to control the

switching circuit 66 to generate the appropriate AC power for the coil 20. In this embodiment, the microcontroller 64 also controls operation of the dual-channel converter 62.

For example, the microcontroller 64 may send control signals to the dual-channel converter 62 specifying the level of the DC power being supplied to the switching circuit 66. The microcontroller 64 may determine the appropriate DC power level based on signals received from the wireless device. These signals may be communicated from the wireless device to the power supply 10 by reflected impedance or through a separate communications systems, such as a separate inductive coupling, infrared communications, WiFi communications, Bluetooth communications or other communication schemes.

The microcontroller 64 may follow essentially any of a wide variety of inductive power supply control algorithms. In some embodiments, the microcontroller 64 may vary one or more characteristics of the power applied to the coil 20 based on feedback from the portable device D. For example, the microcontroller 64 may adjust the resonant frequency of the tank circuit (e.g. the coil and capacitor combination), the operating frequency of the switching circuit 66, the rail voltage applied to the coil 20 or the duty cycle of the power applied to coil 20 to affect the efficiency or amount of power inductively transferred to the portable device D.

A wide variety of techniques and apparatus are known for controlling operation of an inductive power supply. For example, the microcontroller may be programmed to operate in accordance with one of the control algorithms disclosed in U.S. Pat. No. 6,825,620, which is entitled “Inductively Coupled Ballast Circuit” and issued Nov. 30, 2004, to Kuennen et al; the adaptive inductive power supply of U.S. Pat. No. 7,212,414, which is entitled “Adaptive Inductive Power Supply” and issued May 1, 2007, to Baarman; the inductive power supply with communication of U.S. Ser. No. 10/689,148, which is entitled “Adaptive Inductive Power Supply with Communication” and filed on Oct. 20, 2003 to Baarman; the inductive power supply for wirelessly charging a LI-ION battery of U.S. Ser. No. 11/855,710, which is entitled “System and Method for Charging a Battery” and filed on Sep. 14, 2007 by Baarman; the inductive power supply with device identification of U.S. Ser. No. 11/965,085, which is entitled “Inductive Power Supply with Device Identification” and filed on Dec. 27, 2007 by Baarman et al; or the inductive power supply with duty cycle control of U.S. Ser. No. 61/019,411, which is entitled “Inductive Power Supply with Duty Cycle Control” and filed on Jan. 7, 2008 by Baarman—all of which are incorporated herein by reference in their entirety.

(Ex. 1012, ¶0059 (which I separated into paragraphs for readability purposes).)

For purposes of disclosure, FIG. 10 also shows a wireless electronic device D positioned adjacent to the power adapter 13.

The wireless electronic device D generally includes a wireless power receiver 80, an AC/DC rectifier 70, a microcontroller 74, a battery 76 and a load 78.

The wireless power receiver 80 of this embodiment may be a secondary coil 22. The secondary coil 22 is configured to inductively receive power from the primary coil 20 in the power supply 10....AC power generated in the secondary coil 22 passes into the rectifier 70 where it is converted to DC power. The rectifier 70 may be configured to scale the DC power to the appropriate level or the microcontroller 74 may include a DC/DC converter for adjusting the output of the rectifier 70 before applying it to the battery 76 or the load 78.

The secondary microcontroller 74 may follow essentially any of a wide variety of inductive power supply control algorithms. In some embodiments, the secondary microcontroller 74 may send communications to the primary microcontroller 64 that permit the primary microcontroller 64 to vary one or more characteristics of the power applied to the coil 20. For example, the secondary microcontroller 74 may send communication signals indicative of the amount of power being received from the primary coil 20 or indicating whether more or less power is required.

A wide variety of techniques and apparatus are known for controlling operation of an inductive power supply in the wireless electronic device. For example, the secondary microcontroller may be programmed to operate in accordance with one of the control algorithms disclosed in U.S. Pat. No. 6,825,620, which is entitled “Inductively Coupled Ballast Circuit” and issued Nov. 30, 2004, to Kuennen et al; the adaptive inductive power supply of U.S. Pat. No. 7,212,414, which is entitled “Adaptive Inductive Power Supply” and issued May 1, 2007, to Baarman; the inductive power supply with communication of U.S. Ser. No. 10/689,148, which is entitled “Adaptive Inductive Power Supply with Communication” and filed on Oct. 20, 2003 to Baarman; the inductive power supply for wirelessly charging a LI-ION battery of U.S. Ser. No. 11/855,710, which is entitled “System and Method for Charging a Battery” and filed on Sep. 14, 2007 by Baarman; the inductive power supply with device identification of U.S. Ser. No. 11/965,085, which is entitled “Inductive Power Supply with Device Identification” and filed on Dec. 27, 2007 by Baarman et al; or the inductive power supply with duty cycle control of U.S. Ser. No. 61/019,411, which is entitled “Inductive Power Supply with Duty Cycle Control” and filed on Jan. 7, 2008 by Baarman—all of which are incorporated herein by reference in their entirety.

(*Id.*, ¶0061.) (*See also* disclosures in Ex. 1013, ¶¶0023-0024; Ex. 1014, FIGS. 10-11.)

99. Consistent with such state-of-art knowledge, *Azancot* discloses using a microcontroller to control a wireless power system. (See below and my discussions above in §VIII.B.) Like *Sogabe*, *Azancot* relates to a contactless, inductive power system. (Ex. 1006, 1:17-19 (“The present invention relates to a system and method for...controlling power transfer across an inductive power coupling.”), 8:44-47 (“[A] method for regulating power transfer across a contactless inductive coupling is taught wherein the output signal provides details of power requirements of the load.”), FIGS. 1, 2a.) Figure 2a of *Azancot* shows such an inductive power transfer system, which includes a primary coil L_1 that is driven by a voltage that oscillates at a driving frequency generated by a power source 2240, where it provides power to a load 2280 in a device that includes a secondary coil L_2 :

Reference is now made to FIGS. 2 a-d wherein a signal transfer system 2100 according to a second general embodiment of the invention is shown. With particular reference to FIG. 2 a, the signal transfer system 2100 is configured to transmit a transmission signal through an inductive energy coupling 2200. The inductive energy coupling 2200 consists of a primary coil L_1 which may be connected to a power source 2240 and a secondary coil L_2 , galvanically isolated therefrom, across which an electric load 2280 may be connected either directly or via an AC-DC converter 2270.

A transmission circuit 2140 may be connected in parallel with the electric load 2280. The transmission circuit 2140 comprises an ancillary load 2142 connected to the secondary coil L2 via a switching unit 2144. Typically the ancillary load 2142 is much smaller than the electric load 2280.

A corresponding reception circuit 2160 is connected to the primary coil L1 of the inductive energy coupling 2200 and comprises a current monitor 2162, such as an ammeter in series with the primary coil L1, and a correlator 2164.

The switching unit 2144 is configured to receive an input signal S_{in} , and a bit-rate signal F_b . A modulator (not shown) modulates the bit-rate signal F_b with the input signal S_{in} to produce a modulated signal S_M . The ancillary load 2142 is intermittently connected to the secondary coil L2 at a rate determined by the modulated signal S_M .

The power source 2240, such as an alternating-current voltage source, intermittent direct current voltage source or the like, is configured and operable to produce a primary voltage V_1 which oscillates at a driving frequency F_d . The oscillating primary voltage V_1 in coil L1 induces a secondary voltage $V_2(t)$ in the secondary coil L2. The secondary voltage $V_2(t)$ is optionally passed through an AC-DC converter 22 producing a direct-current voltage $V_{22}(t)$.

The electric load 2280 which is coupled to the secondary coil L2—either directly or via the AC-DC converter 2270—draws a

load current I_{22} . The power P_{22} provided to the load 2280 is given by the scalar product of the voltage V_{22} and the load current I_{22} .

(*Id.*, 8:60-9:30; *see also id.*, 1:38-53.)

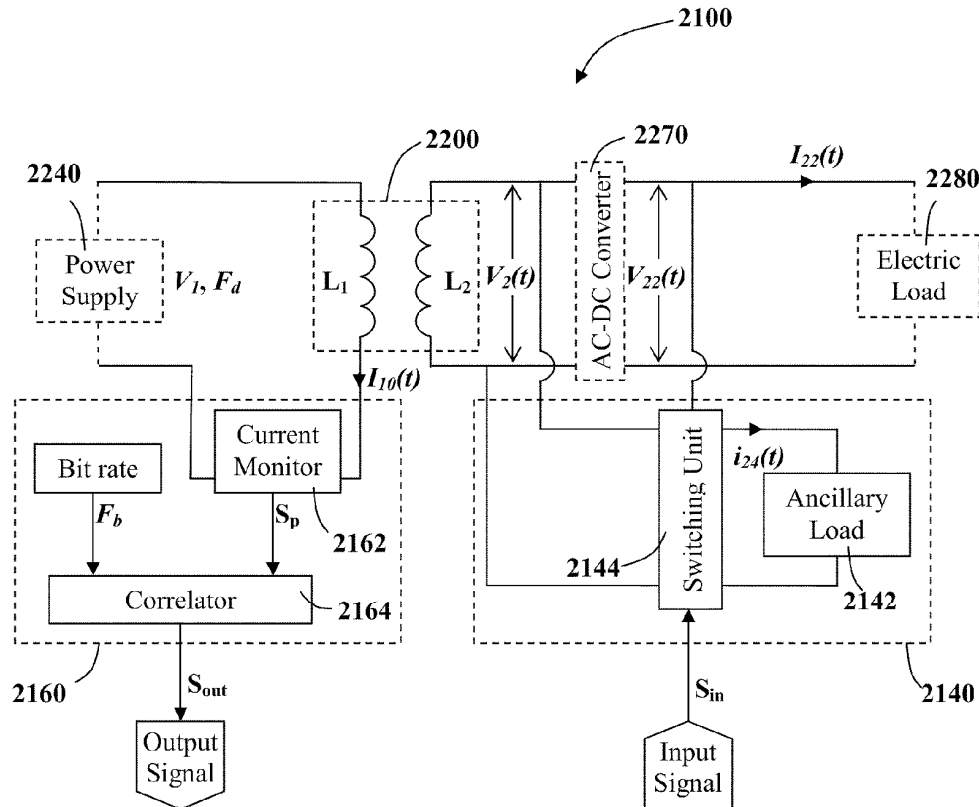


Fig. 2a

(*Id.*, FIG. 2a.)

100. Similar to the electronic device disclosed by *Sogabe* (*see my above analysis at §§IX.A.1.a-d*), *Azancot* discloses that the device receiving wireless power includes a circuit 2140 that comprises microcontroller 2146 (illustrated below),

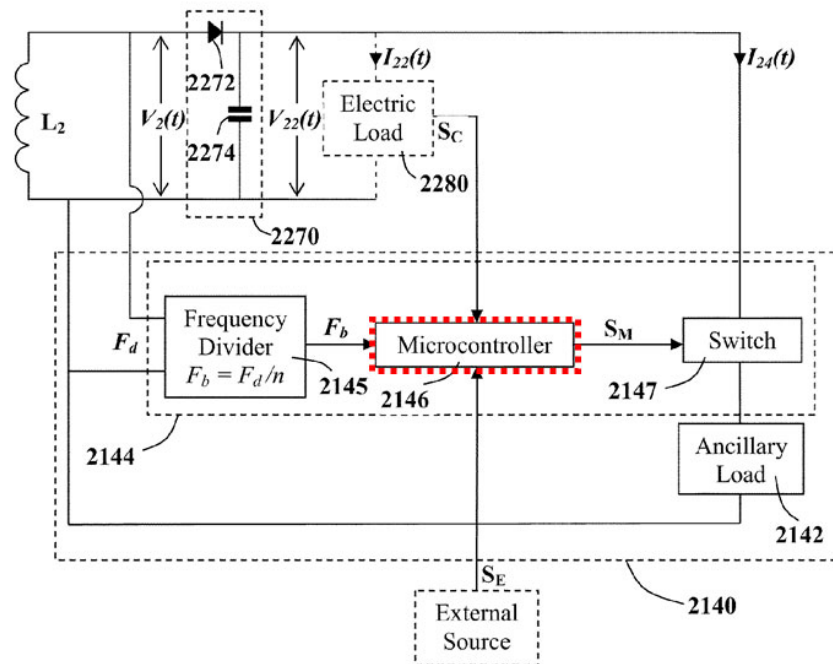
which is used to control power that a secondary coil L2 wirelessly receives across an inductive/contactless energy coupling 2200:

A transmission circuit 2140 may be connected in parallel with the electric load 2280. The transmission circuit 2140 comprises an ancillary load 2142 connected to the secondary coil L2 via a switching unit 2144. Typically the ancillary load 2142 is much smaller than the electric load 2280.

....

With reference now to FIG. 2 b, an exemplary transmission circuit 2140 of the signal transfer system 2100 of FIG. 2 a is shown. An AC-to-DC converter 2270 comprising a diode 2272 and a capacitor 2274, which is connected in parallel to the secondary coil L2, converts an AC secondary voltage V2 from the secondary coil L2 into a DC load voltage V22 which is connected across an electric load 2280.

The connection between the ancillary load 2142 and the load voltage V2 is controlled by a switching unit 2144 which includes a frequency divider 2145, microcontroller 2146 and a switch 2147. The frequency divider 2145 provides the bit-rate signal Fb which is passed to the microcontroller 2146. The microcontroller 2146 is configured to modulate the bit-rate signal Fb according to input signals including control signals SC from the electric load 2280 and external signals SE. as described hereinbelow.



(*Id.*, FIG. 2b (annotated).)

101. *Azancot* discloses that microcontroller 2146 of the power receiving side transmits signals across an inductive/contactless energy coupling 2200 to control the power that the power transmitting side outputs:

The inductive energy coupling is typically a device wherein the **primary coil is galvanically isolated from said secondary coil.**

• • • •

Reference is now made to FIGS. 2 a-d wherein a signal transfer system 2100 according to a second general embodiment of the invention is shown. With particular reference to FIG. 2 a, the signal transfer system 2100 is **configured to transmit a transmission signal through an inductive energy coupling 2200**. The inductive energy coupling 2200 consists of a primary coil L1 which may be connected to a power source 2240 and a secondary coil L2, galvanically isolated therefrom, across which an electric load 2280 may be connected either directly or via an AC-DC converter 2270.

....

The connection between the ancillary load 2142 and the load voltage V2 is controlled by a switching unit 2144 which includes a frequency divider 2145, microcontroller 2146 and a switch 2147. The frequency divider 2145 provides the bit-rate signal Fb which is passed to the microcontroller 2146. The **microcontroller 2146 is configured to modulate the bit-rate signal Fb according to input signals including control signals SC from the electric load 2280 and external signals SE**. as described hereinbelow.

Control signals SC may be used to regulate the power supply. Control signals SC typically provide data relating to load parameters. Typically these include the **required operating voltage, current and temperature** and the actual measured

operating voltage, current and temperature as monitored during operation of the load.

External Signals SE may be used to provide the transmission circuit 2140 with external data to be **digitally encoded into the input signal Sin by the microcontroller 2146 and transmitted to the receiver circuit 2160**. External information, may, for example, provide useful supplementary data such as a user identification code, a pass key, battery level of the load device and the like.

It will be appreciated that the ability to transmit supplementary information such as external signals SE through the inductive energy coupling 2200 presents a further advantage over prior art systems which are only suitable for transmitting control signals.

....

FIG. 2 d shows the innovative use of the signal transfer system 2100 which receives a feedback signal transferred between the primary and secondary power transmission coils and received by the receiver circuit 2160. This is an improvement on prior art flyback converters, wherein additional elements such as optocouplers or the like have been used to transmit feedback signals.

The microcontroller 2168 generates a control signal SC which is relayed to the driver 2248. The control signal SC determines the

duty cycle of the switch 2248 and so may be used to regulate power transmission.

(*Id.*, 8:9-11, 8:60-9:2, 10:11-37, 11:4-14, FIGS. 2a-2b.) For example, *Azancot* discloses that the microcontroller 2146 modulates or encodes signals S_C and external signals S_E , which relate to load parameters or external data and are transmitted from the power receiving device across the inductive coupling to a receiver circuit 2160 on the wireless power transmitting device that includes the primary inductor L_1 :

In this manner, information carried by the input signal S_{in} is transmitted from the transmission circuit 2140 and is retrievable by the receiver circuit 2160 from the output signal S_{out} . It is noted that the signal transfer system 2100 described herein, transmits a transmission signal across the same inductive power coupling 2200 as used for power transmission.

(*Id.*, 9:58-63; *see also id.*, 10:11-37, FIGS. 2a-2b.) Current monitor 2162 and a correlator 2164 of the power transmission side receive the signals from the power receiving side and output S_{OUT} signals to a microcontroller 2168 on the power transmission side:

FIG. 2 c shows a schematic representation of an exemplary receiver circuit 2160 in accordance with the signal transfer system of FIG. 2 a, consisting of a current monitor 2162, a frequency divider 2166, a correlator 2164 and a microcontroller 2168. The frequency divider 2166 provides the bit-rate signal F_b which is typically an integer fraction of the driving frequency F_d .

The current monitor 2162 provides a primary current signal SP which is passed to the correlator 2164 for cross-correlation with the bit-rate signal Fb. The resulting output signal Sout is passed to a microcontroller 2168 which may use the output signal Sout to pass a control signal SC to control the power source 2240 so as to regulate the power provided to the electric load 2280. The microcontroller 2168 may also be used to extract external signals SE from the output signal.

....

FIG. 2 d shows the innovative use of the signal transfer system 2100 which receives a feedback signal transferred between the primary and secondary power transmission coils and received by the receiver circuit 2160. This is an improvement on prior art flyback converters, wherein additional elements such as optocouplers or the like have been used to transmit feedback signals.

The microcontroller 2168 generates a control signal SC which is relayed to the driver 2248. The control signal SC determines the duty cycle of the switch 2248 and so may be used to regulate power transmission.

(*Id.*, 10:38-52, 11:4-14, FIGS. 2a, 2c-2d.) Then microcontroller 2168 on the power transmission side is able to extract the S_C and S_E signals from the power receiving side from the S_{OUT} signal, so as to control a power source in accordance with the S_C and S_E signals. (*Id.*, 10:20-32, 10:38-55, 11:4-14, FIGS. 2a, 2c-2d.)

102. A person of ordinary skill in the art would have been motivated to configure *Sogabe*'s system to include a microcontroller for controlling *Sogabe*'s power receiving device, which was a known and common way to control circuits/operations in inductive power transfer systems, as demonstrated by *Azancot* and the state of the art teachings I discussed above (*see* my discussions above). In my opinion, a person of ordinary skill in the art would have been motivated to implement such a modification for several reasons, including, *e.g.*, to save cost, reduce implementation complexity, and/or achieve other understood benefits associated with such well-known microcontroller use. (Ex. 1028, 4:3-6 (“Numerous advantages are realized by using a microcontroller unit, including greatly increased cost savings, significant design simplification and size reduction of the overall system.”); Ex. 1027, ¶0032 (noting that microcontrollers may be “inexpensive” and “low-power”); Ex. 1014, ¶0192 (“another inexpensive microcontroller”), ¶0295 (“10F220 Programmable IC by Microchip Inc. or another inexpensive microcontroller”).) A person of ordinary skill in the art would have understood and appreciated that microcontroller-based implementations in such systems like that of *Sogabe* would have been advantageous because it would have promoted timely implementations for potential market use, cost savings, streamlined development, and supported robust feature flexibility. (Ex. 1015, 3, 6; *see also* Ex. 1026 (noting that microcontrollers are “cheap and very easy to interface to real world devices”).)

Moreover, a person of ordinary skill in the art would have appreciated that implementing *Sogabe*'s controller with a microcontroller would have been no more than a straightforward and simple substitution to obtain a predictable microcontroller-based implementation.

103. A person of ordinary skill in the art would have had a reasonable expectation of success in implementing the *Sogabe* system with a microcontroller. *Sogabe* describes using a variety of standard hardware types to implement the controller (Ex. 1005, 8:44-48 (“The controller 52 (on the power receiving side) controls the power receiving device 40 and the power receiving control device 50. The controller 52 can be realized by an ASIC circuit such as a gate array, a micro computer with a program operating on the micro computer, or the like.”)). Further, *Azancot* (consistent with the state of the art disclosures I discussed above) discloses using microcontrollers to control similar wireless power systems as I previously discussed. (See my discussions above in this section.)

104. Additionally, a person of ordinary skill in the art would have appreciated the minimal complexities involved in the use of a microcontroller to control such a wireless power system—which would have been within the realm of knowledge and capabilities of such a skilled person at the time. (Ex. 1007, 3:47-55 (“The processing modules 18, 26, 32 of the WP TX unit 10 and in each of the devices 12-14 may each be a single processing device or a plurality of processing devices.

Such a processing device may be a microprocessor, micro-controller, digital signal processor, microcomputer, central processing unit, field programmable gate array, programmable logic device, state machine, logic circuitry, analog circuitry, digital circuitry, and/or any device that manipulates signals (analog and/or digital) based on hard coding of the circuitry and/or operational instructions”), 4:14-21 (“The WP TX unit 10 communicates with the WP transceivers 24, 30 of the devices 12-14 via one or more control channels 34 that use one or more frequencies in the ISM bands 36 and/or one or more frequencies in another non-licensed frequency band(s) 38. The communication via the control channel 34 may use one or more standardized protocols 40, 44 and/or one or more proprietary protocols 42, 46”), FIG. 1; Ex. 1012, ¶¶0059, 0061; Ex. 1013, ¶¶0023-0024; Ex. 1014, FIGS. 10-11.)

105. Therefore, a person of ordinary skill in the art would have been motivated to implement the above modification, especially since it would have involved the use of known technologies and techniques, that would have foreseeably led to implementation of an electronic device comprising a microcontroller for controlling the electronic device, as known and disclosed in the prior art (as I explained above).

106. Such reasons, motivations, and expectation of success relating to implementing such a “microcontroller” in the modified *Sogabe* device are applicable to my opinions below regarding both the first mode of operation (addressed below

for claim elements (f)-(h) and (m)-(n)) and the second mode of operation (addressed below for claim elements (i)-(l) and (m)-(n).) Thus, for the same reasons explained here, and those respectively below for each claim element, a person of ordinary skill in the art would have been motivated to configure such “microcontroller” to operate in the “first mode of operation” and “second mode of operation” as claimed in claim 15. (*See* my analysis and discussions below for claim elements 15(f)-(n).)

- f) operating in a first mode of operation using a first protocol, wherein the first protocol is an inductive charging communication-and-control protocol that comprises uni-directional messaging, wherein the first mode of operation comprises:**

107. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As demonstrated below, *Sogabe* discloses a two-stage charging operation that allows different power receiving devices to be supported by the charger. The first stage corresponds to a setup stage where information regarding the receiving device is provided to the power transmission device 10 of the charger by the receiving device, whereas the second stage corresponds to normal power transmission, where the information sent by the receiving device during the setup stage is used to control power transmission and communication with the receiving device during the normal stage. (Ex. 1005, 3:54-4:65, 9:7-15 (“The communication condition setting section 34, on the power transmission side, sets a communication condition by exchanging information with the power receiving device 40. For

example, the communication condition is set by receiving communication condition information from the power receiving device 40. Specifically, the **communication condition is set by receiving the communication condition information from the power receiving device 40 in a setup processing**, which is described later”), 10:38-54, 11:56-12:13 (“In this way, information is exchanged in communication under the initial communication condition before the start of normal power transmission so as to set communication condition after the start of normal power transmission, whereby communication after the start of normal power transmission can be performed by using the communication condition. Therefore, communication can be performed with an optimum communication condition in accordance with each of the period before the start of normal power transmission and the period after the start of normal power transmission.”).)

108. During the setup stage, *Sogabe* discloses that information, which *Sogabe* refers to as a “communication condition,” is sent from the receiving device to the transmission side via “communication processing using the initial communication condition before the start of normal power transmission, thereby setting the communication condition used in a communication processing after the start of normal power transmission,” where the information can be included in a setup frame:

The communication condition setting section 34, on the power transmission side, exchanges information with the power receiving device 40 in the communication processing using the initial communication condition before the start of normal power transmission, thereby setting the communication condition used in a communication processing after the start of normal power transmission. For example, the communication condition setting section 34 receives communication condition information (e.g., a setup frame, which is described later) from the power receiving device 40 so as to set the communication condition after the start of normal power transmission.

On the other hand, the communication condition setting section 64, on the power receiving side, exchanges information with the power transmission device 10 in the communication processing using the initial communication condition before the start of normal power transmission, thereby setting the communication condition used in a communication processing after the start of normal power transmission. For example, the communication condition setting section 64 transmits communication condition information (e.g., the setup frame, which is described later) to the power transmission device 10 so as to set the communication condition after the start of normal power transmission.

(*Id.*, 11:33-55.) *Sogabe* also discloses that the power receiving device 40 transmits a “start frame” during the setup stage. (*Id.*, 16:14-16 (“For example, when normal power transmission (a charge) is performed, the power receiving device 40 transmits

a start frame to the power transmission device 10.”), 25:64-26:2 (“When receiving the setup frame (step S29), the power receiving side verifies the setup frame (step S30). If the setup frame is appropriate, the power receiving side makes a start frame so as to transmit it to the power transmission side (step S31). On the other hand, if the setup frame is not appropriate, the power receiving side returns to the step S21.”), FIG. 12, S31.) Transfer of communication condition and start frame information from the receiving device to the transmitting device is performed “under the initial communication condition before the start of normal power operation,” whereas “communication after the start of normal power transmission can be performed by using the communication condition.” (*Id.*, 11:56-61.)

109. *Sogabe* further discloses that, during setup processing, a communication condition setting section 34 and a communication processing section 36 included in the controller 22 set the communication condition in the transmitter, where the communication condition can include information regarding the communication method to use after normal power transmission begins (*e.g.*, load modulation or frequency modulation) as well as information regarding desirable power transmission levels for the receiver device (*e.g.*, 0.5 watts or 15 watts), that is later used during normal power transmission mode:

In contrast, in the embodiment, a communication condition is set by exchanging information between the power transmission side

and the power receiving side. The information communication between the power transmission side and the power receiving side are performed by using the set communication condition. Accordingly, a plurality kinds of power receiving devices having different power specifications can be used. As a result, (the multi-power corresponding system) a power transmission system can be achieved that corresponds with multiple power specifications.

For example, the power receiving device 40 is designed for contactless power transmission with 0.5 watts, the power receiving device 40 (storing section 53) has communication condition information most suitable for the power transmission of 0.5 watts. Therefore, the communication under the optimum communication condition for the contactless power transmission of 0.5 watts can be performed by the following manner. The power transmission side receives the communication information from the power receiving device 40, and performs a communication processing by setting a communication condition based on the received communication condition information. As a result, quality and reliability of the communication can be improved.

As another example, the power receiving device 40 is designed for contactless power transmission with 15 watts, the power receiving device 40 has communication condition information most suitable for the power transmission of 15 watts. Therefore, the communication under the optimum communication condition

for the contactless power transmission of 15 watts can be performed by the following manner. The power transmission side receives the communication information from the power receiving device 40, and performs a communication processing by setting a communication condition based on the received communication condition information. As described above, the power transmission side can correspond with both the ones of 0.5 watts and 15 watts. The general versatility can be improved, enabling a power transmission system corresponding with multiple power specifications to be achieved.

....

In addition to the communication parameters, the communication method may also differ before and after the start of normal power transmission. In other words, communication is performed by a first communication method before the start of normal power transmission while communication is performed by a second communication method after the start of normal power transmission. For example, information communication is performed by a communication method using the RF-ID tag before the start of normal power transmission while communication is performed by another communication method using load modulation or frequency modulation after the start of normal power transmission. Further, an amplitude detection method (a peak detection method) is used as a detection method of the load modulation before the start of normal power transmission while a pulse width detection method (a phase

detection method) is used as another detection method of the load modulation after the start of normal power transmission. With the communication methods different before and after the start of normal power transmission, communication can be performed, by an optimum communication method in each period of before and after the start of normal power transmission, also in a power transmission system corresponding with multiple power specifications.

(*Id.*, 10:45-11:16, 12:14-37.)

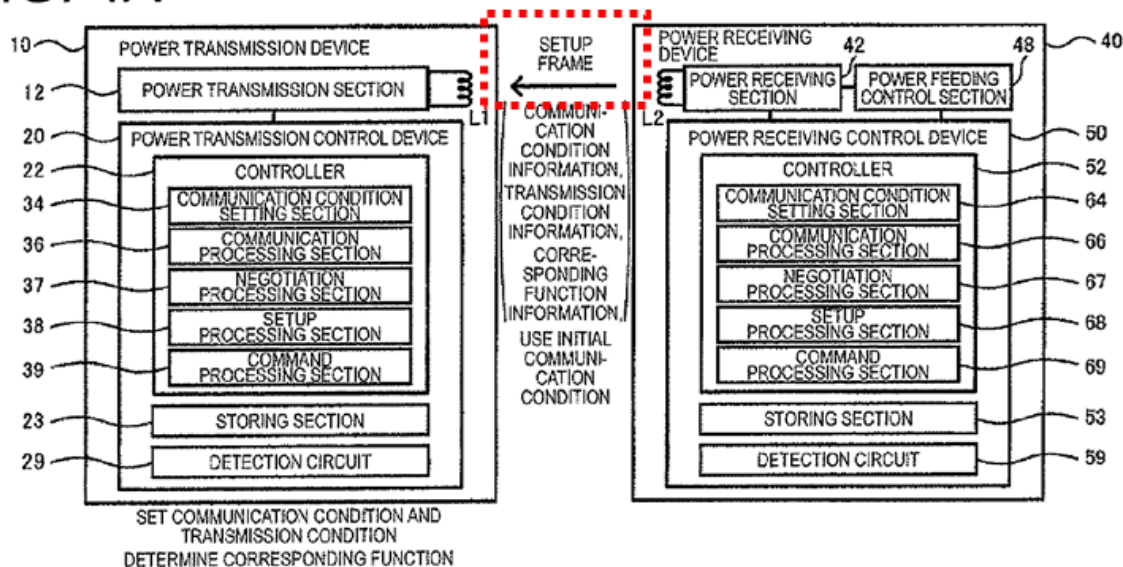
110. Therefore, the setup processing of *Sogabe* corresponds to the claimed “first mode of operation,” where the claimed “first protocol” corresponds to *Sogabe*’s setup stage communication method that uses the initial communication condition before the start of normal power transmission. As I discussed above and further demonstrated below, *Sogabe*’s setup communication method is an “inductive charging communication-and-control protocol” as it is a communication protocol that controls the inductive charging operations in *Sogabe*’s system.⁷ (See my below analysis at §§IX.A.1.g-h.)

⁷ In a parent application, Patent Owner explained that a charging protocol may be a specific “frequency of operation” point or include a specific “communication method, message structure, etc.” (Ex. 1017, 88-89.)

111. As I explained previously, the *Sogabe-Azancot* device comprises a microcontroller that controls the operation of PRD40 of cell phone 501 (or a similar wireless power receiving apparatus). (See my above analysis at §IX.A.1.e; Ex. 1005, 8:44-53 (“**The controller 52 (on the power receiving side) controls the power receiving device 40 and the power receiving control device 50.** The controller 52 can be realized by an ASIC circuit such as a gate array, a micro computer with a program operating on the micro computer, or the like. The controller 52 controls the power feeding control section 48 and storage of the storing section 53. Specifically, the controller 52 controls various sequences and performs a determination processing required for position detection, frequency detection, load modulation, full charge detection, and the like.”), FIGS. 2, 9.) Given that a microcontroller of the *Sogabe-Azancot* device/system controls and operates the power receiving device, a person of ordinary skill in the art would have been motivated to configure such microcontroller to “operat[e] in a first mode of operation using a first protocol” as claimed in claim element 15(f) and the other claim elements (for reasons explained here and below). (§§IX.A.1.g-h.) For similar reasons, and those respectively below, the “microcontroller” in the modified *Sogabe* device would have been configured to operate in such a first mode of operation that includes processes like those recited in claim elements 15(g)-(h) and (m)-(n). (See my analysis below in this section, and in §§IX.A.1.g-h, m-n.)

112. Moreover, *Sogabe*'s setup stage communication method "includes uni-directional messaging" as claimed, as it includes information being sent from the receiving device to the transmission device ("uni-directional messaging"), including the communication condition and start frame information I discussed previously. (Ex. 1005, 11:33-55, 16:14-16, 25:64-26:2.)

FIG. 4A



(*Id.*, FIG. 4A (illustrating uni-directional messaging during setup operation).)

113. A person of ordinary skill in the art would have understood that *Sogabe*'s disclosures regarding uni-directional messaging supports the transfer of the information during the setup phase, as the information regarding the communication method and charging parameters to use during the normal charging phase are provided from the power receiver to the power transmission device. (*Id.*,

9:31-37 (“The embodiment is not limited to the case where communication condition information (transmission condition information) is transmitted to the power transmission device 10 from the power receiving device 40, and is also applicable to a case where communication condition information is transmitted to the power receiving device 40 from the power transmission device 10.”).) Although *Sogabe* discloses that in the embodiment shown in Figures 4A and 4B setup frames are sent both from the power receiving device to the power transmission device, *Sogabe* discloses that the setup frame in of figure 4B includes functions that are not required for operation; the information included in the setup frame of figure 4A differs from the information that is included in the setup frame of figure 4B. (*Id.*, 21:16-20 (“In the setup frame transmitted from the power transmission side, information on the corresponding functions (Function, Function2) on the power transmission side are set after the command indicating a setup.”).) *Sogabe* explains,

Each apparatus on the power transmission side and the power receiving side can perform minimum contactless power transmission by the negotiation processing, and each apparatus can expand the functions by exchanging the setup information. Each apparatus makes the minimum setting required for a contactless power transmission system in the negotiation processing, and the system can be optimized in the setup processing. As a result, a flexible system can be realized. The power transmission side receives threshold information and

system information from the power receiving side, and can realize contactless power transmission and foreign object detection only by setting the received threshold information and the system information. Therefore, the processings on the power transmission side can be simplified. In this case, the power receiving side transmits coil information of an appropriate combination and threshold information to the power transmission side, so that appropriate and safe contactless power transmission can be realized.

(*Id.*, 21:55-22:6; *see also id.*, FIGS. 4A-B.) Furthermore, the power receiving device 40 sends the “start frame,” which is never sent by the power transmission device. (*Id.*, 16:14-16, 25:64-26:2, FIG. 12, S31.) And neither of the communication condition and start frame information necessitates responsive signaling, such that the first mode comprises uni-directional messaging. (*Id.*, 11:33-55, 16:14-16, 25:64-26:2, FIGS. 11-12.)

114. In addition, to the extent that *Sogabe* were to disclose bi-directional messaging during the setup phase, such disclosures/features—as implemented in the above *Sogabe-Azancot* combined device, in my opinion, would meet the features of this limitation. For example, claim 15 states the first protocol “**comprises** uni-directional messaging.” A person of ordinary skill in the art would have understood that bi-directional (two-way) messaging **includes** uni-directional (one-way) messaging. Such an understanding is consistent with the features recited in claim

element 15(i), which recites a “second protocol” that “*defines* bi-directional messaging.” (See §IX.A.1(i) below.) Such an understanding is also consistent with disclosures in the ’777 patent. (Ex. 1001, 14:52-58 (“In the above description, a **uni-directional communication** (from the receiver to the charger) **is described**. However, **this communication can also be bi-directional**, and data can be transferred from the charger to the receiver through modulation of the voltage or current in the charger coil and read back by the microcontroller in the receiver detecting a change in the voltage or current, etc.”).) (See my discussions and analysis above, including reasons pertaining to configuring the “microcontroller” to perform such a “first mode of operation,” applicable to the above scenario.)

115. It is my opinion that even if claim element 15(f) is interpreted such that *only* uni-directional messaging can be used in the first protocol, it is my opinion that such a protocol would have been suggested based on *Sogabe*’s disclosure in view of *Azancot* for similar reasons discussed above. As I noted above, the information regarding what communication method and the charging parameters are to be used after the start of normal charging is provided by the receiver to the transmitter, and therefore such communications only require uni-directional communication from the receiver to the transmitter. A person of ordinary skill in the art would have understood that bi-directional communication is not required to support such functionality and would have been motivated to use uni-directional communication

in order to simplify the setup process. In this way, under the above scenario, and for reasons explained above, it is my opinion that the modified *Sogabe* device/system suggests such features. (See my discussions and analysis above, including reasons pertaining to configuring the “microcontroller” to perform such a “first mode of operation,” applicable to the above scenario.)

116. I have also been asked to assume another scenario where using only uni-directional messaging is not disclosed or suggested by *Sogabe*. As to that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to configure the “microcontroller” to implement such a feature for the “first protocol” (see my analysis above) in view of *Azancot*. As I discussed above in Section IX.A.1(e), *Azancot* includes uni-directional messaging from the power receiving device to the power transmitting device to control the power transmission. (See my above analysis at §IX.A1(e); Ex. 1006, 8:60-65, 9:58-63, 10:11-11:14, FIGS. 2a-2d.) Therefore, similar to *Sogabe*, *Azancot* discloses sending power transmission control information from the power receiving device to the power transmitting device. Such information in *Azancot* is sent using uni-directional messaging, and, in view of *Azancot*’s teachings and in context of the state of the art, a person of ordinary skill in the art would have been motivated to use uni-directional messaging for the setup communications in *Sogabe*. Indeed, such a configuration would have been consistent with what was understood in the art: Uni-directional

wireless power control messages were well-understood as I explained previously.
(§V.B.5.)

117. A person of ordinary skill in the art would have been motivated to configure *Sogabe*'s first protocol to "comprise[] uni-directional messaging." For instance, a person of ordinary skill in the art would have appreciated that having the first protocol comprise uni-directional messages, similar to those disclosed by *Azancot*, would have allowed the *Sogabe* system to dynamically meet the power needs of the power receiving device to better address changing load conditions, voltage and current needs, temperature conditions, etc. (Ex. 1006, 10:20-37, 3:4-22, 7:21-37.) A person of ordinary skill in the art would have appreciated that having the first protocol comprise such uni-directional control messages in the modified *Sogabe* device/system would have increased responsiveness by preventing a lengthy power negotiation process that *Sogabe* discloses and prevented improper powering conditions. (Ex. 1005, FIG. 6; Ex. 1006, 10:20-37, 3:4-22, 7:21-37.) Such features and their benefits were well-understood in the art (as I explained above (§V.B.5)), and such understanding in context of the *Sogabe-Azancot* teachings and suggestions would have guided a person of ordinary skill in the art to consider and implement the above modification.

118. Moreover, allowing the power receiving device to send such uni-directional control messages would have increased the interoperability and

compatibility of the *Sogabe* wireless power receiving device with uni-directional messaging systems like those disclosed by *Azancot* and others, which was a desired feature before the alleged time of invention, as suggested by *Sogabe*. (Ex. 1005, 1:33-41.) In fact, *Sogabe* further discloses,

According to the first aspect of the invention, the communication condition, which is at least one of the communication method and the communication parameter, is set by exchanging information between the power transmission device and the power receiving device. With the communication condition, the communication processing is performed between the power transmission device and the power receiving device. This structure makes it possible to set different communication conditions in accordance with power receiving devices. As a result, the general versatility of the power transmission control device can be improved.

(*Id.*, 1:66-2:9.) Also that,

In this way, the communication condition between the power transmission device 10 and the power receiving device 40 can be set by using the communication condition information on the power receiving side. As a result, various types of power receiving devices can be used since the communication condition can be set in accordance with the condition on the power receiving side. The embodiment is not limited to the case where communication condition information (transmission condition

information) is transmitted to the power transmission device 10 from the power receiving device 40, and is also applicable to a case where communication condition information is transmitted to the power receiving device 40 from the power transmission device 10.

(*Id.*, 9:24-37; *id.*, 11:12-16 (“As described above, the power transmission side can correspond with both the ones of 0.5 watts and 15 watts. The general versatility can be improved, enabling a power transmission system corresponding with multiple power specifications to be achieved”); *see also* Ex. 1007, 1:63-67; Ex. 1029, 1:52-58 (“In particular embodiments wireless chargers disclosed herein are programmable. By programmable it is meant that the wireless chargers can operate so as to wirelessly transmit power in accordance with one of a plurality of selectable protocols. In this manner, a power-transmitting protocol may be selected that is particularly suited for the particular electronic device being charged by the wireless charger”); Ex. 1008 (disclosing a similar wireless power system comprising uni-directional messaging); Ex. 1010 (same).)

119. A person of ordinary skill in the art would have also appreciated that using uni-directional power control messages in the first mode of operation would have reduced communication complexity while still allowing the remote device to take full control of power transfer. (Ex. 1006, 10:20-37, 3:4-22, 7:21-37; Ex. 1010 (noting that a wireless power protocol comprising uni-directional messaging was

“simple” but still enabled a “Mobile Device to take full control of the power transfer”).) My discussions above further explains how universal wireless charging systems were established and desired. (§V.B.5.)

120. Consistent with that known in the state of the art, in my opinion, a person of ordinary skill in the art would have been motivated to make such a foreseeable modification. As I discussed above in Section §V.B.5, using uni-directional control messaging for a wireless power system before the alleged time of invention was a well-understood and desired feature. Thus, a person of ordinary skill in the art would have appreciated the understood benefits of using such uni-directional messaging when considering configuring and implementing a system such as that described by *Sogabe*.

121. A person of ordinary skill in the art would have had a reasonable expectation of success in having the first protocol “comprise[] uni-directional messaging.” Especially since *Sogabe* suggests that a variety of conventional controller hardware types would have been appropriate to realize controller 22 and process various signals in a first mode of operation. (Ex. 1005, 8:46-48 (“The controller 52 can be realized by an ASIC circuit such as a gate array, a micro computer with a program operating on the micro computer, or the like.”), FIGS. 3A-5C.) Also, such a skilled person would have appreciated how *Azancot* discloses using a microcontroller to control similar wireless power systems with uni-

directional messaging as I previously discussed. A person of ordinary skill in the art would have appreciated and understood that the modified electronic device based on such collective teachings and suggestions would have been a foreseeable combination of known technologies and techniques (*e.g.*, using a microcontroller to encode unidirectional signals), that would have understandably led to an electronic device that receives wireless power that includes a microcontroller operating in a first mode with a first protocol that “comprises uni-directional messaging.” Such configurations were understood before the alleged time of invention as I explained above. (§V.B.5.)

g) **sending, using the communication transmitter circuit, a first communication to an inductive charger, wherein the first communication identifies the first protocol; and**

122. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. (*See* my discussions above for claim elements 15(e)-(f) (explaining that such features here would have been performed by the “microcontroller” in the modified *Sogabe* device).) In addition to that explained above, *Sogabe* discloses “**sending**” communications from a power receiving device 40 “**using the communication transmitter circuit**” because, as I explained previously, load modulation section 46 (“**communication transmitter circuit**”) transmits data to power transmission device 10 (“**inductive charger**”). (*See* my above analysis at

§IX.A.1.a, c.) Such communications include the “communication condition information” or the “start frame” sent during the setup stage (“first communication”). (See my above analysis at §IX.A.1.f; Ex. 1005, 2:23-46, 28:11-29.) Because the communication is sent during the setup stage, it is “based on the first protocol,” which, as I discussed above in Section IX.A.1(f), uses the initial communication condition (default condition) that is used before the start of normal power transmission. (Ex. 1005, 11:23-10:13, 15:32-50.)

123. *Sogabe* discloses that the “communication condition information” sent during the setup stage can be sent using a “setup frame”:

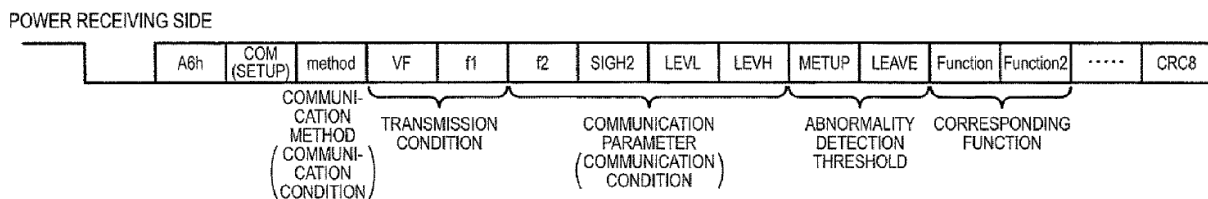
For example, the communication condition setting section 64 transmits communication condition information (e.g., the setup frame, which is described later) to the power transmission device 10 so as to set the communication condition after the start of normal power transmission.

....

The power receiving device 40 collates the standard/coil/system information on the power receiving side with that of the received negotiation frame. As shown in FIG. 4A, the power receiving device 40 (the setup processing section 68) makes a setup frame so as to transmit it to the power transmission device 10. Examples of the setup frame include communication condition information such as the communication method and the communication parameters (f2, SIGH2), transmission condition

information such as the driving voltage (VF) and the driving frequency (f1) of the coil, and corresponding function information showing functions (commands and the like) that the power receiving side corresponds to. That is, the setup frame is made based on the communication condition information and the transmission condition information stored in the storing section 53 on the power receiving side, and then is transmitted to the power transmission side. The setup frame communication, in this case, is performed by using the communication method and the communication parameter in the initial communication condition.

(*Id.*, 11:50-55, 15:32-50.) An example setup frame is shown in Figure 8 below. (*Id.*, 5:32.)



(*Id.*, FIG. 8 (excerpted).)

124. The communication (“**first communication**”) by which the communication condition is sent (*e.g.*, setup frame) “**identifies the first protocol**” as claimed as it is presented in a format that can be recognized by the power transmission device to which it is sent. As a person of ordinary skill in the art would have appreciated, the device receiving the setup frame above would need to know

the format of the frame in order to understand what the different information in the frame is and where it is located within the frame format. In my opinion, such an understanding appears consistent with the disclosure of the '777 patent regarding the “identif[ying] the first protocol.” (Ex. 1001, 20:29-51, 21:48-59, 22:8-14, 63:29-35.) For example, the '777 patent specification discusses that a charger can decode protocol communications, such that an encoded signal identifies a protocol as claimed. (*Id.*, 22:8-14 (“In accordance with an embodiment, the **charger can** be implemented so that it is able to **decode** and implement **multiple communication and regulation protocols** and respond to them appropriately. **This enables the charger to be** provided as **part of a multi-protocol system**, and to operate with different types of receivers, technologies and manufacturers.”).)

125. I have also been asked to assume a scenario where the communications in the *Sogabe-Azancot* modified device/system do not “identif[y] the first/second protocol.” As to that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to include such protocol identifying information in the communication. Indeed, it was well-known, if not conventional, to include protocol identifying information in wireless communications. (*See, e.g.*, Ex. 1010 (Qi Wireless Power Standard), 52 (“The preamble consists of a minimum of 11 and a maximum of 25 bits, all set to ONE, and encoded as defined in Section 6.2.2. The preamble enables the Power Transmitter to synchronize with the incoming data and

accurately detect the start bit of the header.”); Ex. 1055, 6:14-22; Ex. 1056, ¶0035 (“identifies the type of protocol based upon the protocol header within the packet”); Ex. 1057, ¶0005; Ex. 1058, 2:57-62 (“The signal processing module may also add a pattern of bits into the digital signal that identifies the analog transmission protocol.”); Ex. 1059, ¶0056; Ex. 1060, ¶0010 (“In one embodiment, a mobile device for seamless multimode wireless communication over a plurality of wireless communication systems is disclosed....The packet data units have a header with a wireless protocol identifier....”); Ex. 1061, ¶0019 (“The protocol sensing module identifies network protocols by analyzing periodic frame headers and preambles.”).) Such protocol identifying information would have enabled the transmitter to receive data efficiently without having to determine the protocol of a message through another means (*e.g.*, another communication channel or trial and error processing) that would have added further complexity and cost to the system, as understood in the art. For example, consistent with that known by such a skilled person, *Walley* explains (which I reference here to demonstrate such state-of-art knowledge at the time):

As another alternative, or in addition to one or more of the preceding examples, the receive unit processing module 26, 32 may **identify the control channel protocol by scanning a frequency spectrum** for control channel activity to produce scanned frequency spectrum and identify the control channel

protocol from the scanned frequency spectrum. As yet another alternative, or in addition to one or more of the preceding examples, the receive unit processing module 26, 32 may **identify the control channel protocol by evoking a trial and error system** using known control channel protocols.

(Ex. 1007, 6:22-7:4; *see also* Ex. 1056, ¶¶0015-16.) A person of ordinary skill in the art would have increased the compatibility of *Sogabe*'s electronic device by easily allowing transmitters to recognize how to charge or communicate with the *Sogabe* device, which was a desired feature before the alleged time of invention. Indeed, my background section discusses how universal and compatible features for wireless power systems were very much on the mind of persons of ordinary skill in the art. (§§V.B.4-5.) Such a skilled person would have appreciated implementing such a straight forward modification would have furthered such interests. (*Id.*)

126. The modified *Sogabe* device/system would have been configured such that such communications would have been sent by the “microcontroller” using load modulation section 46 (“communication transmitter circuit”). (§§IX.A.1.c, e-f; Ex. 1005, 8:13-22, 8:44-53, 23:10-26, FIGS. 2, 9, 14A; Ex. 1006, FIGS. 2A, 2B, 2D.) Thus, for reasons I explained here and above (§§IX.A.1.a-IX.A.1.f), a person of ordinary skill in the art would have thus been motivated and had good reason to configure the “microcontroller” in the above *Sogabe-Azancot* modified device

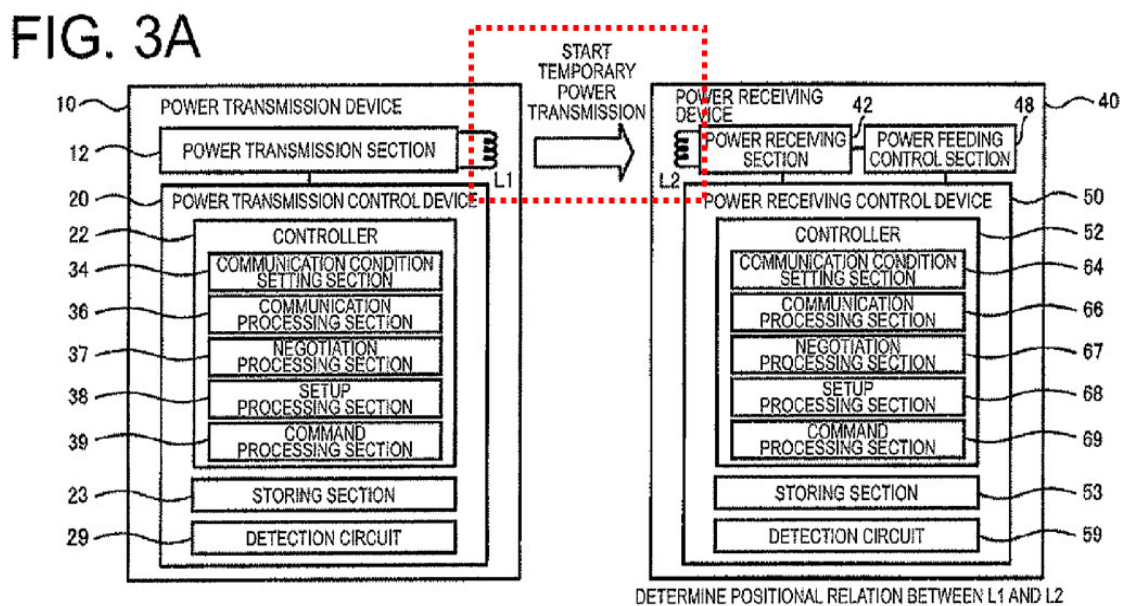
(§IX.A.1.e) to perform similar features as discussed above and claimed (“[microcontroller configured for] sending, using the transmitter circuit,...”).

127. A person of ordinary skill in the art would have had the skills and rationale in light of the teachings/suggestions of *Sogabe*, *Azancot*, in context of a person of ordinary skill in the art’s state of art knowledge, to implement such features while considering design tradeoffs and techniques/technologies with a reasonable expectation of success, especially given such modification would have involved known technologies/techniques as explained, foreseeably resulting in an electronic device having a microcontroller operating in a first mode of operation like that claimed in this claim element (and below), consistent with the teachings and suggestions of *Sogabe* and *Azancot*. (See my analysis and discussions above in this section; see also my analysis and discussions in §§IX.A.1.a-f and in §§IX.1.h-n.)

h) receiving power using the inductive charging receiver coil;

128. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I discussed previously, *Sogabe* discloses that the electronic device comprises “secondary coil L2” (“**inductive charging receiver coil**”). (§IX.A.1.b; Ex. 1005, 6:50-57, FIGS. 2, 9; see also *id.*, 6:23-38, FIGS. 1B-1C.) The secondary coil L2 receives wireless power from a primary coil L1 of PTD10 during both the normal power transmission mode and the setup power transmission mode (“**first**

mode of operation”) (Ex. 1005, 6:50-55, 6:65-7:25, 8:23-35, 11:66-12:13, 14:36-51, 16:14-29, FIGS. 1B-1C, 3A, 5A.) Thus, for reasons I have explained above, a person of ordinary skill in the art would have been motivated to configure the *Sogabe-Azancot* combination such that the “microcontroller” in the modified *Sogabe* device/system would have been configured to operate in the first mode of operation to receive power using secondary coil L2. (§IX.A.1.e; Ex. 1005, 6:3-14, FIGS. 2, 9.)



(Ex. 1005, FIG. 3A (annotated).)

- i) **operating in a second mode of operation using a second protocol, wherein the second protocol is an inductive charging communication-and-control protocol that defines bi-directional messaging, wherein the second mode of operation comprises:**

129. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I discussed above in Section IX.A.1(f), *Sogabe* discloses a two-stage charging operation, where the first stage corresponds to the setup stage, and the second stage corresponds to normal power transmission, where the information sent by the receiving device during the setup stage is used to control power transmission and communication during the normal power transmission stage. (See my above analysis at §IX.A.1.f; Ex. 1005, 3:54-4:65, 9:7-15, 10:38-54.)

130. Therefore, *Sogabe* discloses operating in a normal power transmission mode, where the claimed “second mode of operation” includes either (1) the normal power operation mode either by itself, or (2) the normal operation mode and the setup stage that constitutes the “first mode of operation.” The second operation mode including the first operation mode is consistent with claim 5 of the ’777 patent, which states that “the first mode of operation is a subset of the second mode of operation.” (Ex. 1001, 71:11-12 (claim 5).)

131. As I explained above for claim element 15(e), the reasons, motivations, and expectation of success relating to implementing and configuring a “microcontroller” in the modified *Sogabe* device are applicable to my opinions here and below regarding the second mode of operation (addressed below for claim elements (i)-(n)). Thus, for the same reasons explained, and those respectively here, and below for associated “second mode” claim elements, a person of ordinary skill

in the art would have been motivated to configure the “microcontroller” in the modified *Sogabe* device to operate in the “second mode of operation” as claimed in claim 15. (See my analysis above for claim element 15(e) and discussions below for claim elements 15(j)-(n).)

132. In the normal power transmission mode, the communication method used is determined based on the communication condition received during the setup stage:

On the other hand, the communication condition setting section 64, on the power receiving side, sets a communication condition by exchanging information with the power transmission device 10. For example, the communication condition is set by transmitting communication condition information to the power transmission device 10. Specifically, the communication condition is set by transmitting the communication condition information to the power transmission device 10 in the setup processing, which is described later.

In this way, the communication condition between the power transmission device 10 and the power receiving device 40 can be set by using the communication condition information on the power receiving side. As a result, various types of power receiving devices can be used since the communication condition can be set in accordance with the condition on the power receiving side. The embodiment is not limited to the case where communication condition information (transmission condition

information) is transmitted to the power transmission device 10 from the power receiving device 40, and is also applicable to a case where communication condition information is transmitted to the power receiving device 40 from the power transmission device 10.

Here, the communication condition includes a communication method between the power transmission device 10 and the power receiving device 40, and the communication parameters of the method. The communication method may include various modulation methods such as frequency modulation and load modulation, and methods other than modulation methods. For example, a communication method using the RF-ID tag may be employed. The communication parameters are ones used in those communication methods. Examples of the parameters include a frequency used for a frequency modulation in a case of frequency modulation, and a threshold for detecting a load fluctuation in a case of load modulation.

(Ex. 1005, 9:16-64; *see also*, 11:33-55, 12:14-37.) *Sogabe* discloses that the transfer of information from the receiving device to the transmitting device is performed “under the initial communication condition before the start of normal power operation” (“first protocol”) whereas “communication after the start of normal power transmission can be performed by using the communication condition” (“second protocol”). (*Id.*, 11:56-12:13.) For example, *Sogabe* discloses that the

communication condition defines how the PRD40 communicates with the power transmission device 10 during normal power transmission:

Here, the communication condition includes a communication method between the power transmission device 10 and the power receiving device 40, and the communication parameters of the method. The communication method may include various modulation methods such as frequency modulation and load modulation, and methods other than modulation methods. For example, a communication method using the RF-ID tag may be employed. The communication parameters are ones used in those communication methods. Examples of the parameters include a frequency used for a frequency modulation in a case of frequency modulation, and a threshold for detecting a load fluctuation in a case of load modulation.

When the communication between the power transmission device 10 and the power receiving device 40 are performed by a frequency modulation, as an example, the communication condition setting section 34 sets a frequency (f2) used in the frequency modulation as a communication parameter in the communication condition. Alternatively, when the communication between the power transmission device 10 and the power receiving device 40 are performed by a load modulation, the communication condition setting section 34 sets thresholds (SIGH, SIGH2) used in the load modulation as a communication parameter in the communication condition.

....

The communication processing sections 36 and 66 perform communication processings between the power transmission device 10 and the power receiving device 40 by using communication conditions (communication methods, communication parameters) set by the communication condition setting sections 34 and 64 respectively. Examples of the processings include a processing transmitting data to the power receiving device 40 from the power transmission device 10, and another processing transmitting data to the power transmission device 10 from the power receiving device 40.

....

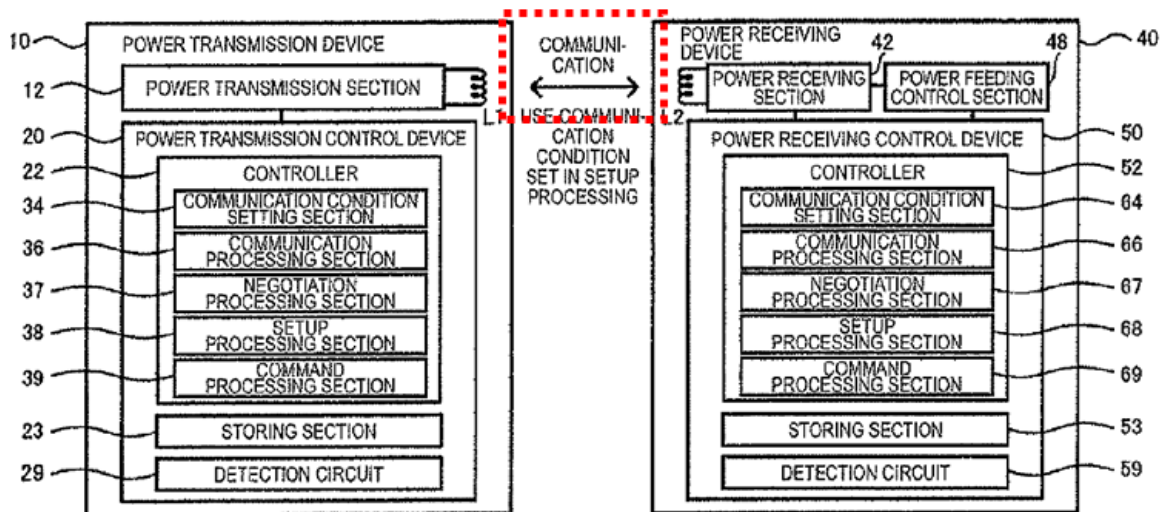
After the start of normal power transmission, the communication condition is switched to the communication condition set in the setup processing shown in FIG. 4A from the initial communication condition. That is, as shown in FIG. 5B, communication after the start of normal power transmission is performed by using the communication condition set in the setup processing.

(*Id.*, 9:38-61, 10:6-17, 16:30-36.)

133. *Sogabe* also discloses that communication during the normal power transmission “defines” “bi-directional messaging.” For example, *Sogabe* explains that in the normal power mode “[t]he communication processing sections 36 and 66” of the power transmission device 10 and power receiving device 40 “perform....a

processing transmitting data to the power receiving device 40 from the power transmission device 10, and another processing transmitting data to the power transmission device 10 from the power receiving device 40.” (*Id.*, 10:6-17, FIG. 5 (illustrating bi-directional communication between the power transmission device 10 and the power receiving device 40).) These bi-directional data messages are transmitted in accordance with the normal communication condition and such messages are illustrated below in figure 5B. (*Id.*, 10:6-17, 11:56-61, 16:30-36, 21:6-12, 24:17-23.)

FIG. 5B



(*Id.*, FIG. 5B (illustrating bi-directional messaging during normal operation).)

134. As I explained previously, the *Sogabe-Azancot* device/system comprises a “microcontroller” that controls the operation of PRD40 of cell phone 501 (or a similar wireless power receiving apparatus). (See my above analysis at

§IX.A.1.e; Ex. 1005, 8:44-53, FIGS. 2, 9.) Because the microcontroller of the *Sogabe-Azancot* device/system controls and operates the power receiving device consistent with that discussed above, it is my opinion that *Sogabe* in view of *Azancot* discloses and/or further suggests the microcontroller in such device/system would have been configured for “operating in a second mode of operation using a second protocol” like that claimed (including the processes/features that I discuss below) for the reasons discussed above and those I explain below. (See my above discussion for this limitation, §IX.A.1.c, §IX.A.1.e; see my below analysis at §§IX.A.1.j-IX.A.1.n.) A person of ordinary skill in the art would have had the skills and rationale in light of the teachings/suggestions of *Sogabe*, *Azancot*, in context of a person of ordinary skill in the art’s state of art knowledge, to implement such features while considering design tradeoffs and techniques/technologies with a reasonable expectation of success, especially given such modification would have involved known technologies/techniques as explained, foreseeably resulting in an electronic device having a microcontroller operating in a second mode of operation like that claimed in this claim element (and below), consistent with the teachings and suggestions of *Sogabe* and *Azancot*. (See my analysis and discussions above in this section; see also my analysis and discussions in §§IX.A.1.a-h and in §§IX.1.j-n.)

- j) **sending, using the communication transmitter circuit, a second communication to the inductive charger, wherein the second communication identifies the**

second protocol;

135. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. *Sogabe* discloses “**sending**” various communications from a power receiving device 40 “**using the communication transmitter circuit**” because, as I explained previously, load modulation section 46 (“**communication transmitter circuit**”) transmits data to power transmission device 10 (“**inductive charger**”). (See my above analysis at §§IX.A.1.a, IX.A.1.c, IX.A.1.g, IX.A.1.i)

136. A person of ordinary skill in the art would have understood that such communications (“second communication”) include, for example, a “full charge detection” command, or an “interrupt request” sent from the power receiving device to the power transmission device, and a “periodic authentication” performed by the power receiving device as disclosed by *Sogabe*.

137. For more context, *Sogabe* explains the periodic authentication feature as follows:

In the power transmission control device, in a case where a periodic authentication is performed from the power receiving device to the power transmission device after the start of the normal power transmission, the communication condition setting section may set a threshold for the periodic authentication as the communication parameter of the communication condition.

According to the structure described above, the threshold used in the periodic authentication is set as the communication parameter by exchanging information between the power transmission device and the power receiving device. With the set threshold, the periodic authentication after the start of the normal power transmission can be performed.

....

In addition, when a periodic authentication is performed to the power transmission device 10 from the power receiving device 40, after the start of normal power transmission, for detecting what is called a takeover state, the communication condition setting section 34 sets thresholds (LEVEL, LEVH) used for the periodic authentication as a communication parameter in the communication condition. In this regard, when foreign object detection is performed after the start of normal power transmission, the threshold for the foreign object detection after the start of normal power transmission may be set.

....

Then, periodic authentication is turned on (step S45), and normal power transmission starts (step S46).

After transmitting the response command (step S64), the power receiving side turns on the transistor TB2 of the power feeding control section 48 (step S65) so as to start power supply to the load 90. The periodic authentication is turned on so as to perform a periodic load modulation (step S66). Specifically, the transistor

TB3 of the load modulation section 46 is turned on/off in accordance with a predetermined pattern in a periodic authentication period.

After the start of normal power transmission, in the periodic authentication period performed by the periodic load modulation, the power transmission side performs takeover state detection, which the detection is caused by a metal foreign object and the like having a large area (step S47). Subsequently, removal detection and foreign object detection are performed (steps S48 and S49). If any takeover is detected in the periodic authentication, or a removal or a foreign object is detected, the power transmission is stopped so as to return to the step S1.

(Ex. 1005, 3:4-16, 9:62-10:5, 26:23-43; *see also id.*, 13:52-58 (“After the setup processing, the command processing section 39 processings various commands such as a normal power transmission start command, a detection command on a full charge of the battery 94 (a full charge notifying command), a confirmation command on a recharge of the battery 94, and a communication command. That is, the command processing section 69 issues and executes these commands”), 17:3-47; 19:55-59 (“If a full charge is detected on the power receiving side after the start of normal power transmission, the power receiving side transmits the full charge detection command to the power transmission side.”).) *Sogabe* further explains:

If continuous power transmission is not required as the full charge is detected, the sequence moves to the standby phase after

the detection of the full charge. After going through the negotiation processing and the setup processing again, the power transmission side transmits the recharge confirmation command to the power receiving side. When receiving the command, the power receiving side checks a battery voltage so as to determine whether or not a recharge is required. If a recharge is required, the recharge confirmation flag is reset. The power transmission side issues the normal power transmission start command so as to restart the normal power transmission.

(*Id.*, 19:60-20:4.) Thus, for the reasons I previously explained, the microcontroller in the *Sogabe-Azancot* combination would have been configured to perform/provide similar features. (*Id.*; §IX.A.1.i.)

138. *Sogabe* in view of *Azancot* further discloses and/or suggests “**wherein the second communication identifies the second protocol**” for reasons similar to those I explained for the first sending limitation 1(g) regarding the first communication identifying the first protocol, and those above relating to the microcontroller’s configuration to provide/perform features like those recited in limitations 1(i)-(j) (above). For instance, the periodic “authentication” communication (“second communication”) sent to the inductive charger (Ex. 1005, 28:54-29:37) identifies the protocol used during normal power mode as the charger that receives that communication and is able to determine the content of such a communication based on the format and content of the communication. (*See*

§IX.A.1(g.) Similarly, the charger that receives the “full charge detection” command, “normal power transmission start command” to restart the normal power transmission, or an “interrupt request” sent from the power receiving device will understand what protocol such communications are using. Such an understanding is consistent with disclosures in the ’777 patent concerning “identif[ying] the second protocol”:

As described above, the charger can periodically start and apply a ping voltage 200 of pre-determined frequency and length to the charger coil (as shown in the lower illustration in FIG. 10). The receiver is then activated, and may begin to send back communication signals as shown in top of FIG. 10. The communication signal can include an optional preamble that is used to synchronize the detection circuit in the charger and prepare it for detection of communication. A communication containing a data packet may then follow, optionally followed by checksum and parity bits, etc. Similar processes are used in communication systems and similar techniques can be followed. In accordance with an embodiment, the actual data packet can include information such as an ID code for the receiver, received voltage, power, or current values, status of the battery, amount of power in the battery, battery or circuit temperature, end of charge or battery full signals, presence of external wired charger, or a number of the above. Also this packet may include the actual voltage, power, current, etc. value or the difference between the

actual value and the desired value or some encoded value that will be useful for the charger to determine how best to regulate the output.

....

After this initial power up of the receiver, the charger communication circuit should be able to detect and understand the communication signal from the receiver. Many microcontrollers are able to communicate in multiple formats and may have different input pins that can be configured differently to simultaneously receive the communication signal and synchronize and understand the communication at different baud rates and protocols. In accordance with an embodiment, the charger firmware can then decide on which type of receiver is present and proceed to regulate or implement what is required (end of charge, shut-off, fault condition, etc.).

....

In accordance with an embodiment, the charger can be implemented so that it is able to decode and implement multiple communication and regulation protocols and respond to them appropriately. This enables the charger to be provided as part of a multi-protocol system, and to operate with different types of receivers, technologies and manufacturers.

(Ex. 1001, 20:29-51, 21:48-59, 22:8-14.) The '777 patent appears to explain that a charger can decode protocol communications, such that an encoded signal identifies

a protocol as claimed. (*Id.*, 22:8-14 (“In accordance with an embodiment, the **charger can** be implemented so that it is able to **decode** and implement **multiple communication and regulation protocols** and respond to them appropriately. **This enables the charger to be** provided as **part of a multi-protocol system**, and to operate with different types of receivers, technologies and manufacturers.”).) Moreover, a person of ordinary skill in the art would have been motivated to configure the modified *Sogabe* device/system to send protocol identification information so as to identify the second protocol used in the normal or setup modes for reasons I previously explained. (§IX.A.1.g.)

139. The modified device/system would have been configured the microcontroller to send such communications using load modulation section 46 (“**communication transmitter circuit**”), consistent with the teachings of *Sogabe*. (§§IX.A.1.c, e-f; Ex. 1005, 8:13-22 (“The power receiving device 40 (a power receiving module, a secondary module) may include the secondary coil L2, a power receiving section 42, a power feeding control section 48, and the power receiving control device 50. The structures of the power receiving device 40 and the power receiving control device 50 are not limited to those shown in FIG. 2, and various modifications, such as omitting a part of components (e.g., the secondary coil), adding another component (e.g., a load modulation section), and changing connections, can be made.”).) *Sogabe* also explains:

The controller 52 (on the power receiving side) controls the power receiving device 40 and the power receiving control device 50. The controller 52 can be realized by an ASIC circuit such as a gate array, a micro computer with a program operating on the micro computer, or the like. The controller 52 controls the power feeding control section 48 and storage of the storing section 53. Specifically, the controller 52 controls various sequences and performs a determination processing required for position detection, frequency detection, load modulation, full charge detection, and the like.

(*Id.*, 8:44-53.) Also that,

The load modulation section 46 performs a load modulation processing. Specifically, when desired data is transmitted from the power receiving device 40 to the power transmission device 10, a load on the load modulation section 46 (the secondary side) is variably changed so as to vary a signal waveform of the induced voltage of the primary coil L1. Therefore, the load modulation section 46 includes a resistance RB3 and a transistor TB3 (an N-type CMOS transistor) that are provided in series between nodes NB3 and NB4. The transistor TB3 is on/off-controlled by a signal P3Q from the controller 52 of the power receiving control device 50. When the transistor TB3 is on/off-controlled so as to perform a load modulation, a transistor TB2 of the power feeding control section 48 is turned off. As a result, the load 90 is in a state of not being electrically coupled to the power receiving device 40.

(*Id.*, 23:10-26.) (*See also id.*, FIGS. 2, 9, 14A; Ex. 1006, FIGS. 2A, 2B, 2D.) Thus, for similar reasons I explained here, and others explained above, a person of ordinary skill in the art would have been motivated, and had good reason to configure the “microcontroller” (§IX.A.1.e) in the *Sogabe-Azancot* device/system for sending, using the “communication transmitter circuit,” a second communication that identifies the second protocol, like that claimed in limitation 1(j). A person of ordinary skill in the art would have had the skills and rationale in light of the teachings/suggestions of *Sogabe*, *Azancot*, in context of a person of ordinary skill in the art’s state of art knowledge, to implement such features while considering design tradeoffs and techniques/technologies with a reasonable expectation of success, especially given such modification would have involved known technologies/techniques as explained, foreseeably resulting in an electronic device having a microcontroller configured to operate in a “second mode of operation” (§IX.A.1.i) like that claimed in this claim element, consistent with the teachings and suggestions of *Sogabe* and *Azancot*. (*See my analysis and discussions above in this section; see also my analysis and discussions in §§IX.A.1.a-i.*)

k) receiving power using the inductive charging receiver coil; and

140. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I discussed previously, *Sogabe* discloses that the electronic device

comprises “secondary coil L2” (“**inductive charging receiver coil**”). (§IX.A.1.b.)

Sogabe also explains that,

Based on a structure shown in FIG. 2, a contactless power transmission (non-contact power transmission) system is realized in which the primary coil L1 and the secondary coil L2 are electromagnetically coupled so as to transmit power from the power transmission device 10 to the power receiving device 40 to supply the power to the load 90, for example.

(Ex. 1005, 6:50-57) Also that,

In FIG. 1B, the primary coil L1 and the secondary coil L2 are, for example, a flat coil having an air-core formed by winding a coil wire in a spiral manner on a plane. The coil of the embodiment is not limited to this. Any coil can be employed regardless of its shape, structure, and the like as long as one can be used to transmit power by electromagnetically coupling the primary coil L1 and the secondary coil L2. For example, referring to FIG. 1C, the primary coil L1 is formed by winding a coil wire in a spiral manner about an X axis of a magnetic substance core. The secondary coil L2 provided in the cell phone 510 is similarly formed. The embodiment is also applicable to the coil shown in FIG. 1C. In a case shown in FIG. 1C, as the primary coil L1 and the secondary coil L2, a coil formed by winding a coil wire about a Y axis may be used other than the coil formed by winding the coil wire about the X axis.

(*Id.*, 6:23-38; *see also* FIGS. 1B-1C, 2, 9 (all shown below).)

FIG. 1B

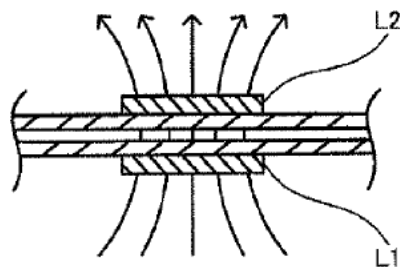


FIG. 1C

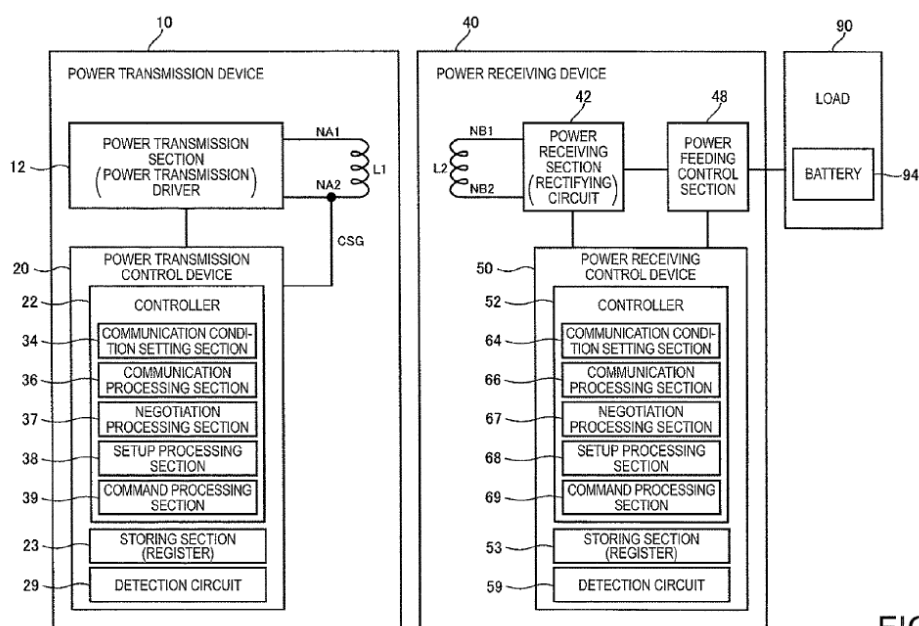
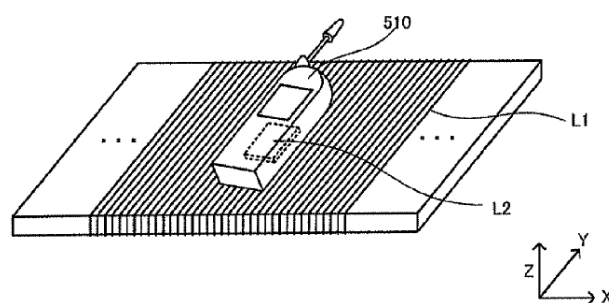


FIG. 2

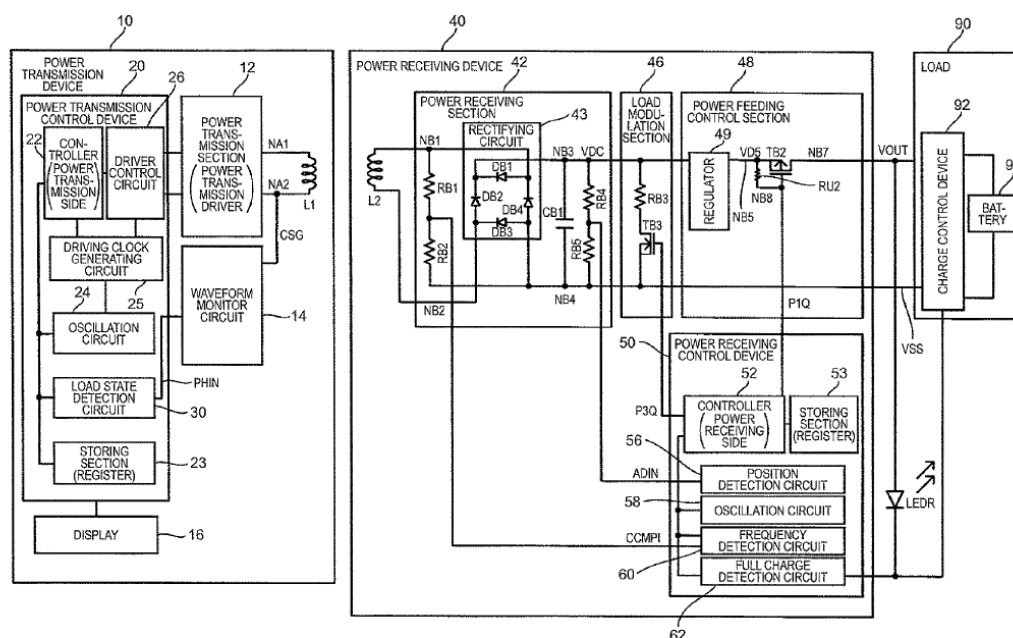
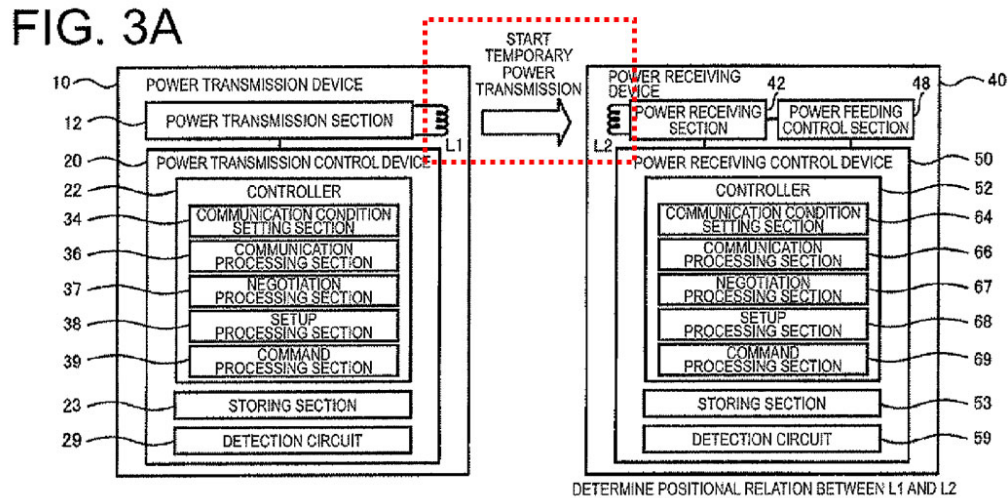


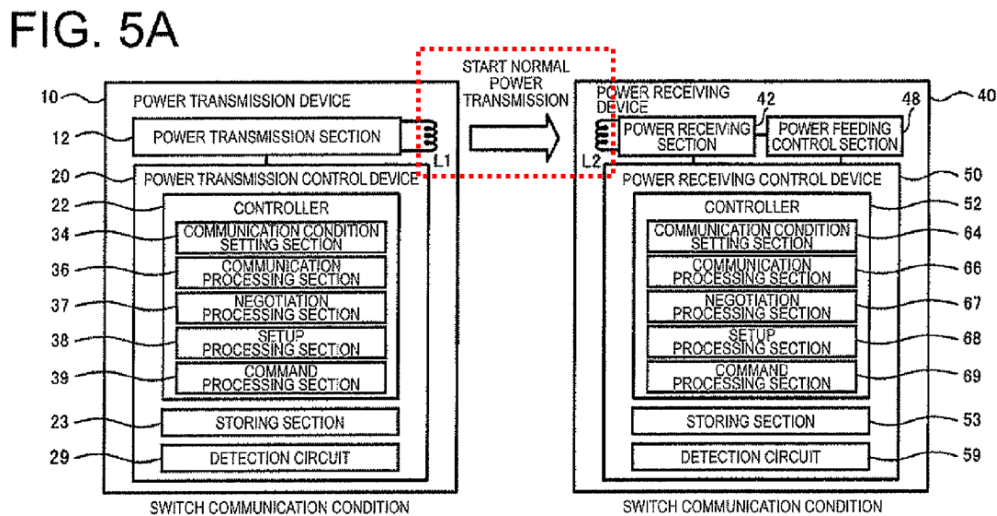
FIG. 9

Secondary coil L2 receives wireless power from a primary coil L1 of PTD10 during both the normal power transmission mode and the setup power transmission mode (*Id.*, 6:50-55, 6:65-7:25, 8:23-35, 14:36-51, 16:14-29, FIGS. 1B-1C, 3A, 5A), where either the normal power transmission mode alone, or the combination of the normal power transmission mode and the setup mode constitutes the “**second mode of operation**” as I discussed previously (*see* my above analysis at §IX.A.1.i). Thus, consistent with such teachings and for reasons I explained, a person of ordinary skill in the art would have been motivated to configure the *Sogabe-Azancot* combination such that the “microcontroller” in the modified *Sogabe* device/system would have been configured to operate in the second mode of operation to receive power using secondary coil L2. Accordingly, it is my opinion the combination discloses/suggests

the microcontroller is configured for “receiving power” using the receiver coil L2 as claimed. (§IX.A.1.e; *see also* §§IX.A.1.h, IX.A.1.i; Ex. 1005, 6:3-14, FIGS. 2 (above), 3A (below), 5A (below), 9 (above).)



(Ex. 1005, FIG. 3A (annotated).)



(*Id.*, FIG. 5A (annotated).)

- I) **receiving, using the receiver circuit, a frequency-modulated third communication from the inductive charger based on the second protocol; and**

141. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. *Sogabe* in view of *Azancot* discloses the “microcontroller” (§§IX.A.1.e, IX.A.1.i) is configured for “**receiving, using the receiver circuit, a frequency-modulated third communication from the inductive charger.**” For example, *Sogabe* discloses that “data communication” from the power transmission device 10 (the “**inductive charger**” as I discussed previously (*see* my above analysis at §§IX.A.1.c)) “to the power receiving side is realized by a frequency modulation.” (Ex. 1005, 23:55-59 (“In FIG. 9, data communication from the power transmission side to the power receiving side is realized by a frequency modulation while data communication from the power receiving side to the power transmission side is realized by a load modulation.”); *see also id.*, 8:59-62 (“For example, if data is transmitted from the power transmission device 10 by frequency modulation, the detection circuit 59 detects the data by detecting a variation in the frequency.”).) The frequency modulation occurs by the power transmission device changing output power frequency to send data to the power receiving device 40. (*Id.*, 23:60-24:3, FIG. 10A.)

142. Frequency modulation is used to transmit signals to the power receiving device 40 in the normal power transmission mode (“**second mode**”) in accordance with communication conditions specifying frequency modulation communication. (*Id.*, 8:58-62 (“The detection circuit 59 detects data transmitted from the power

transmission device 10. For example, if data is transmitted from the power transmission device 10 by frequency modulation, the detection circuit 59 detects the data by detecting a variation in the frequency.”.)

Here, the communication condition includes a communication method between the power transmission device 10 and the power receiving device 40, and the communication parameters of the method. The communication method may include various modulation methods such as frequency modulation and load modulation, and methods other than modulation methods. For example, a communication method using the RF-ID tag may be employed. The communication parameters are ones used in those communication methods. Examples of the parameters include a frequency used for a frequency modulation in a case of frequency modulation, and a threshold for detecting a load fluctuation in a case of load modulation. When the communication between the power transmission device 10 and the power receiving device 40 are performed by a frequency modulation, as an example, the communication condition setting section 34 sets a frequency (f2) used in the frequency modulation as a communication parameter in the communication condition.

(*Id.*, 9:38-56.) (*See also id.*, 10:6-27, 11:44-12:16, 23:60-24:3, 24:18-23.)

143. Detection circuit 59/60 (“**receiver circuit**”) of the power receiving control device 50 of the inductive charging receiver “detects data transmitted from the power transmission device 10.” (Ex. 1005, 8:58-62.)

Specifically, as shown in FIG. 10A, for example, when data “1” is transmitted to the power receiving side, the power transmission section 12 generates an alternating-current voltage having a frequency f_1 . On the other hand, when data “0” is transmitted, the power transmission section 12 generates an alternating-current voltage having a frequency f_2 . Then, the frequency detection circuit 60, on the power receiving side, detects the frequency change so as to determine data “1” or “0.” As a result, data communication by the frequency modulation from the power transmission side to the power receiving side can be realized.

(*Id.*, 23:60-24:3; *see also* FIGS. 2, 9; *see* my above analysis at §IX.A.1.d) Thus, the detection circuit 59/60 (“**receiver circuit**”) of the power receiving control device 50 of the inductive charging receiver detects data transmitted from the power transmission device 10 such that any of the frequency-modulated signals that are sent to the power receiving device 40 from the power transmission device 10 (data, interruption requests, etc.) in the second mode are a “**third communication from the inductive charger**” that is received “**using the receiver circuit**” (Ex. 1005, 10:6-17, 17:3-5, FIG. 5B).

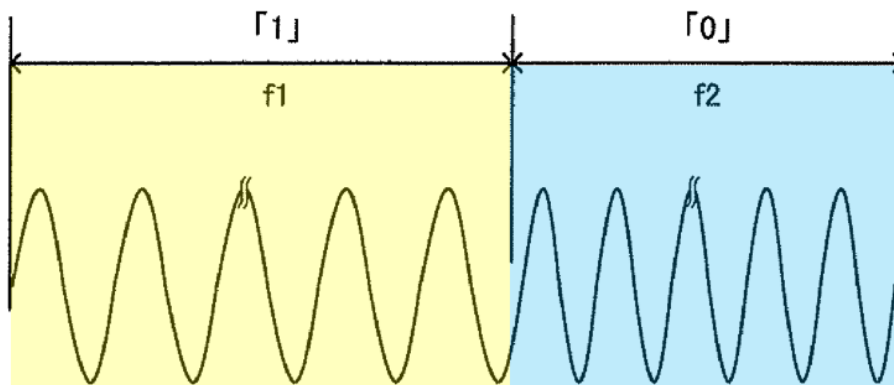


FIG.10A

(*Id.*, FIG. 10A (annotated) (illustrating an example of a frequency-modulated signal that is sent to power receiving device 40).)

144. *Sogabe* as modified by *Azancot* also discloses and/or suggests that such a “third communication” is received, using the receiver circuit (circuit 59/60), by the microcontroller of the electronic device. For instance, *Sogabe* discloses that the controller 52 “performs” the “frequency detection” and/or other processing required for recognizing data that the power transmission device transmits and otherwise “control[ing] the power receiving device” (Ex. 1005, 8:44-53.) Specifically, *Sogabe* explains,

The controller 52 (on the power receiving side) controls the power receiving device 40 and the power receiving control device 50. The controller 52 can be realized by an ASIC circuit such as a gate array, a micro computer with a program operating on the micro computer, or the like. The controller 52 controls the

power feeding control section 48 and storage of the storing section 53. Specifically, the controller 52 controls various sequences and performs a determination processing required for position detection, frequency detection, load modulation, full charge detection, and the like.

(*Id.*) (*See also id.*, 22:8-11 (“A detailed structural example of the embodiment is shown in FIG. 9. Hereinafter, the elements described in FIG. 2 are indicated by the same numerals and the description thereof is omitted.”), 22:28-37 (“An oscillation circuit 24 generates a clock for the primary side. A driving clock generating circuit 25 generates a driving clock defining the driving frequency. A driver control circuit 26, based on the driving clock from the driving clock generating circuit 25 and a frequency set signal from the controller 22, generates a control signal having a desired frequency. Then, the control signal is outputted to first and second power transmission drivers of the power transmission section 12 so as to control the first and the second power transmission drivers.”).) Further, *Sogabe* discloses,

Specifically, as shown in FIG. 10A, for example, when data “1” is transmitted to the power receiving side, the power transmission section 12 generates an alternating-current voltage having a frequency f_1 . On the other hand, when data “0” is transmitted, the power transmission section 12 generates an alternating-current voltage having a frequency f_2 . Then, the frequency detection circuit 60, on the power receiving side, detects the frequency change so as to determine data “1” or “0.” As a result,

data communication by the frequency modulation from the power transmission side to the power receiving side can be realized.

(*Id.*, 23:60-24:3; *see also id.*, FIG. 10A.) Thus, a person of ordinary skill in the art would have been motivated, for reasons explained above, to configure the *Sogabe-Azancot* device/system such that controller 52 is implemented with a microcontroller. (See my above analysis at §IX.A.1.e). The microcontroller/controller of the modified device/system would have been used to process the data the transmitter transmits via frequency modulation, consistent with understood microcontroller use. (See also, e.g., Ex. 1005, 8:44-53, 22:8-11, 22:28-37, 23:60-24:3, FIGS. 2, 9; Ex. 1012, ¶¶0059, 0061; Ex. 1013, ¶¶0023-0024; Ex. 1014, FIGS. 10-11; Ex. 1033, ¶0062; Ex. 1034, ¶0097.)

145. Given the modified *Sogabe* device/system, the third communication would have been received during the normal power transfer stage, it is “based on the second protocol,” which, as I discussed above in Section IX.A.1(i), is the communication method used for normal power transmission that is determined based on the communication condition received during the setup stage, which may include the frequencies used to encode the data sent from the power transmitter to the power receiver. (See my above analysis at §IX.A.1.i; Ex. 1005, 8:58-62 (“The detection circuit 59 detects data transmitted from the power transmission device 10. For

example, if data is transmitted from the power transmission device 10 by frequency modulation, the detection circuit 59 detects the data by detecting a variation in the frequency.”), 10:6-27, 11:56-61 (“In this way, information is exchanged in communication under the initial communication condition before the start of the normal power transmission so as to set communication condition after the start of the normal power transmission, whereby communication after the start of the normal power transmission can be performed by using the communication condition”), 16:30-36 (“After the start of normal power transmission, the communication condition is switched to the communication condition set in the setup processing shown in FIG. 4A from the initial communication condition. That is, as shown in FIG. 5B, communication after the start of normal power transmission is performed by using the communication condition set in the setup processing.”), 24:17-23 (“In FIGS. 10A and 10B, data communication from the power transmission side to the power receiving side is realized by the frequency modulation while data communication from the power receiving side to the power transmission side is realized by the load modulation. However, another modulation method or other methods may be employed.”), FIG. 10A.)

146. Thus, for reasons I explained in this section, and above, a person of ordinary skill in the art would have been motivated, and had good reason, to configure the “microcontroller” (§IX.A.1.e) in the *Sogabe-Azancot* device/system to

be configured for “receiving, using the receiver circuit (circuit 59/60 (§IX.A.1.d)), a frequency-modulated third communication from the inductive charger (power transmission device 10 (§IX.A.1.g)) like that claimed. (§§IX.A.1.i-k.)

147. In my opinion, a person of ordinary skill in the art would have had the skills and rationale in light of the teachings/suggestions of *Sogabe*, *Azancot*, in context of a person of ordinary skill in the art’s state of art knowledge, to implement the above-modification while considering design tradeoffs and techniques/technologies with a reasonable expectation of success, especially given such modification would have involved known technologies/techniques foreseeably resulting in an electronic device having a microcontroller configure to operate in a “second mode of operation” (§IX.A.1.i) to receive, using the receiver circuit (§IX.A.1.d), a frequency-modulated third communication from the inductive charger based on the second protocol, consistent with the teachings and suggestions of *Sogabe* and *Azancot*. (See my analysis and discussions above in this section; see also my analysis and discussions in §§IX.A.1.a-k.)

- m) wherein the first mode of operation is associated with a first power level and the second mode of operation is associated with a second power level, and**
- n) wherein the first power level and the second power level are different.**

148. In my opinion, the *Sogabe-Azancot* combination discloses and/or suggests these limitations. As I discussed above for limitations 15(f) and 15(i), the first mode of operation corresponds to the setup stage, whereas the second mode of operation is the normal transmission mode or a combination of the setup stage and the normal transmission mode as performed in the modified *Sogabe-Azancot* device/system. (See my above analysis at §§IX.A.1.f, IX.A.1.i; see also §§IX.A.1.a-1.) The setup stage (“first mode of operation”) is associated with a “low power” level, whereas during normal power transmission, power is transmitted at the level corresponding to the power receiving device:

In this way, information is exchanged in communication under the initial communication condition before the start of normal power transmission so as to set communication condition after the start of normal power transmission, whereby communication after the start of normal power transmission can be performed by using the communication condition. Therefore, communication can be performed with an optimum communication condition in accordance with each of the period before the start of normal power transmission and the period after the start of normal power transmission. As a result, quality of communication can be improved. **For example, before the start of normal power transmission, information (negotiation information, set up information) communication may be performed while the temporary power transmission is performed at low power**

under the initial communication condition. After the start of normal power transmission, information communication may be performed while power is transmitted at levels corresponding to the plurality kinds of the power receiving devices having different power specifications. In this case, setting different communication conditions between the temporary power transmission period before the start of normal power transmission and the normal power transmission period allows communication errors and EMI noises to be reduced. As a result, quality of communication can be improved.

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As shown in FIG. 3A, first, the power transmission device 10 starts temporary power transmission (power transmission for detecting a position) before starting normal power transmission. With this temporary power transmission, a power supply voltage is supplied to the power receiving device 40, so that the power receiving device 40 is turned on. The temporary power transmission is performed, for example, by using a driving voltage (VFO as the default of VF) and a driving frequency (f01 as the default of f1) already having being set in the storing section 23 as an initial transmission condition. The power receiving device 40, for example, determines whether or not a positional relation between the primary coil L1 and the secondary coil L2 is appropriate. Specifically, the power receiving device 40 determines whether or not the positional relation between the

primary coil L1 and the secondary coil L2 is that is shown in FIG. 1B, for example.

....

For example, when normal power transmission (a charge) is performed, the power receiving device 40 transmits a start frame to the power transmission device 10. The power transmission device 10 issues the normal power transmission start command (a charge start command) so as to transmit it to the power receiving device 40. The power receiving device 40 transmits a response command for the normal power transmission start command to the power transmission device 10. In this way, the command processing on the normal power transmission by the power transmission device 10 and the power receiving device 40 is executed. In this case, the normal power transmission is performed by using the driving voltage (VF) and the driving frequency in the transmission condition set in the setup processing shown in FIG. 4A. As a result, a power transmission system can be realized that corresponds with multiple power specifications.

....

In the communication mode, if upper application data is communicated between the hosts 2 and 4, the communication condition may be set to the initial communication condition (a communication condition in the temporary power transmission period before the start of normal power transmission), for

example. The transmission condition of contactless power transmission may be set to the initial transmission condition. In other words, it is preferable that commands (e.g., communication interruption request, full charge detection, and recharge confirmation commands) be transmitted by using the communication condition and the transmission condition that are set in the setup processing since the commands are transmitted during the normal power transmission period. On the other hand, in the communication mode in which application data is communicated, the default communication condition and the default transmission condition are used to enable more safety and reliable communication to be performed since the power supply to the load 90 can be stopped in the communication mode, whereby the communication condition and the transmission condition that are set in the setup processing are not necessarily used. That is, in the communication mode, the communication condition and the transmission condition in the temporary power transmission period is used. In the temporary power transmission period, a priority is given to the reliability of the communication than the transmission efficiency of the power transmission. For example, the driving frequency and the driving voltage are set to a lower level. As a result, for example, data transmission errors can be reduced, whereby the liability of the communication can be improved.

(Ex. 1005, 11:56-12:13, 14:36-51, 16:14-29, 17:18-47, FIGS. 3A, 5A.) Therefore, the first mode of operation is associated with the “low power” level (“**first power**

level”) corresponding to setup, whereas the second mode of operation is associated at least with the power level for normal power transmission appropriate for the power receiving device (“**second power level**”). Thus, the *Sogabe-Azancot* combination discloses/suggests limitation 15(m).

149. The *Sogabe-Azancot* combination discloses and/or suggests limitation 15(n) for the reasons I discussed above, where the “low power” level and the power level during normal power transmission are different.

2. Claim 20

- a) **The electronic device of claim 15, wherein the microcontroller is further configured for detecting the presence of a foreign object between the inductive charger and the inductive charging receiver of the electronic device during operation by either reporting one of output power or voltage or by reporting a fault condition to the inductive charger to terminate charging.**

150. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation.

151. As I explained above for claim 15, the *Sogabe* system would have been modified in view of *Azancot* such that controller 52 is implemented using a microcontroller similar to that disclosed/suggested by *Azancot*. (See my above analysis at §IX.A.1.e.) Consistent with the teachings of *Sogabe*, the microcontroller of the *Sogabe-Azancot* device/system would have thus been configured to control

power receiving device 40, including data transmission of the power receiving device through load modulation, etc. (*Id.*; Ex. 1005, 8:44-53, 22:8-11, 7:50-55, 23:10-26.) As configured, the microcontroller of the electronic device would control the power transmission device 40 to, for example, terminate charging. (Ex. 1005, FIG. 12, S70, 26:44-58; §§IX.A.1.e.)

152. *Sogabe* further discloses that the power transmission device 10 is configured to “detect[] whether or not a foreign object is inserted between the primary coil L1 and the secondary coil L2” and cut off power if a foreign object is detected. (Ex. 1005, 15:11-18; *see also id.*, 7:34-45 (“The controller 22 (on the power transmission side) controls the power transmission device 10 and the power transmission control device 20. The controller 22 can be realized by an ASIC circuit such as a gate array, a micro computer with a program operating on the micro computer, or the like. The controller 22 controls power transmission using the power transmission section 12, storage of the storing section 23, and the detection circuit 29. Specifically, the controller 22 controls various sequences and performs a determination processing required for power transmission, load state detection (data detection, foreign object detection, removal detection, and the like), a frequency modulation, and the like.”); §IX.A.1.e.) That is, the power transmission side can stop power transmission when a foreign object is detected between PTD10 and the secondary coil L2 of the “**inductive charging receiver**” (comprising, for example,

secondary coil L2, power receiving section 42, etc.) of PRD40. (Ex. 1005, 8:23-36, 15:11-18, 7:34-35 (“The controller 22 (on the power transmission side) controls the power transmission device 10 and the power transmission control device 20.”), 23:6-9, 25:26-29 (“If the negotiation frame is determined to be inappropriate in the step S5 or a foreign object is detected in the step S6, the power transmission side stops power transmission so as to return to the step S1.”), 26:34-43 (“After the start of normal power transmission, in the periodic authentication period performed by the periodic load modulation, the power transmission side performs takeover state detection, which the detection is caused by a metal foreign object and the like having a large area (step S47). Subsequently, removal detection and foreign object detection are performed (steps S48 and S49). If any takeover is detected in the periodic authentication, or a removal or a foreign object is detected, the power transmission is stopped so as to return to the step S1.”), FIGS. 2, 9; §§IX.A.1.b, e.)

153. Although *Sogabe* discloses that the wireless power system can detect foreign objects, it does not explicitly disclose that the microcontroller of the electronic device that receives power can detect that a foreign object is between the transmitter and receiver by reporting output power, etc. to the transmission side as claimed. Thus, *Sogabe* does not explicitly disclose that the **“microcontroller is further configured for detecting the presence of a foreign object between the inductive charger and the inductive charging receiver of the electronic device**

during operation by either reporting one of output power or voltage or by reporting a fault condition to the inductive charger to terminate charging.”

However, in my opinion, a person of ordinary skill in the art would have been motivated, and had good reason, to implement such features in the *Sogabe-Azancot* device/system in view of *Azancot*.

154. *Azancot* discloses how an electronic device can detect that a foreign object is between a wireless power transmitter and a receiver of the electronic device by reporting output power, etc. to the transmission side. (Ex. 1006, FIG. 7.) Namely, *Azancot* discloses an electronic device that is “configured for detecting the presence of a foreign object between [an] inductive charger and [an] inductive charging receiver of [an] electronic device during operation.”⁸ For instance, *Azancot* discloses a system for detecting when a “conductive sheet of metallic foil 5800” (“foreign object”) hazard “is introduced between [a] primary coil 5220” of an inductive charger “and the secondary coil 5260” of an inductive charging receiver of an electrical device 5290 (“electronic device”). (Ex. 1006, 13:38-58, 14:58-15:3,

⁸ As explained below, *Azancot* discloses that its electrical device reports power output, etc. to terminate charging as claimed and even presents a warning to users when it detects a foreign object hazard. (Ex. 1006, 13:65-14:3, 14:48-57, 15:6-11, 15:44-60, FIGS. 6b, 7.)

13:54-58, FIG. 6b; *see* my above analysis at §IX.A.1.e.) Electrical device 5290, upon detecting the hazard, “displays a warning 5294 on its visual display 5296” (“Attention!!”) “or emits a warning sound,” as illustrated in the below figure and explained below:

The processor 5162 may assess the level of the hazard detected by processing the various signals received according to a predetermined logical sequence. If necessary, the processor 5162 may trigger a circuit-breaker 5280 thereby cutting off the primary coil 5220 from the power supply 5240. Depending on the nature of the hazard, the processor 5162 may additionally or alternatively alert a user to the hazard. The alert may be a visual or audio alarm for example, such as a buzzer or light incorporated in the power transmission surface, or a signal sent to the computer 5290 which displays a warning 5294 on its visual display 5296 or emits a warning sound.

(Ex. 1006, 15:22-33, FIG. 6b.)

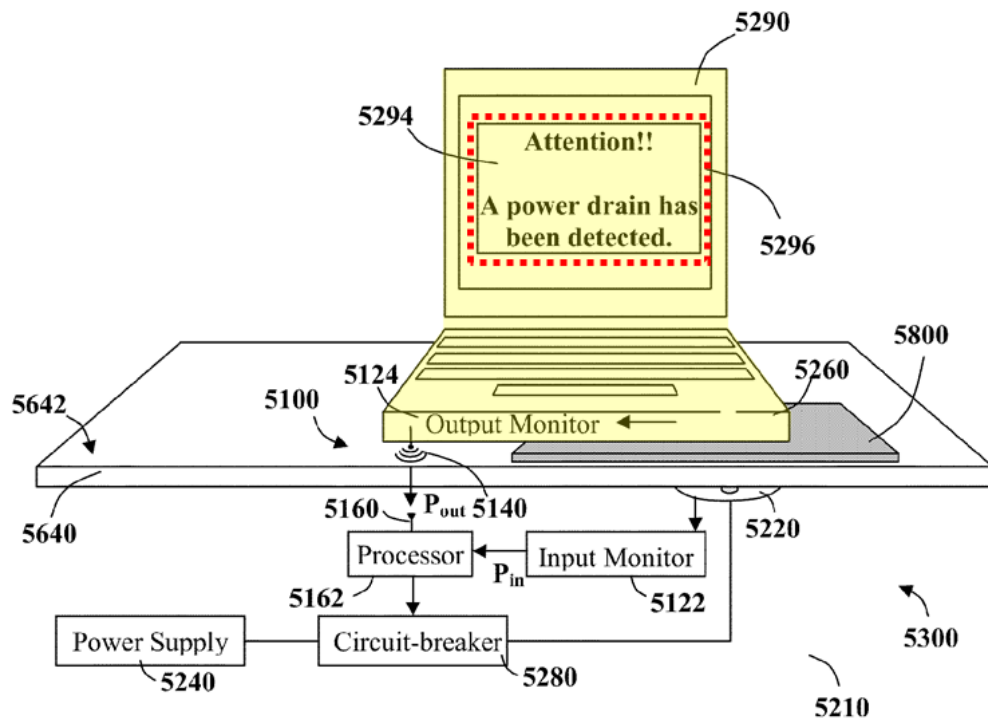


Fig. 6b

(*Id.*, FIG. 6b (annotated).)

155. *Azancot* further discloses that electrical device 5290 detects the presence of the foreign object “by either reporting one of output power or voltage or by reporting a fault condition to [an] inductive charger to terminate charging.” For instance, *Azancot* discloses that a processor 5160 receives a P_{OUT} value from an output monitor 5124 of electronic device 5290 (“reporting...output power”) and a measured input power P_{IN} from input monitor 5122:

The output power monitor 5124 communicates with the processor 5162 via a signal transfer system 5100 comprising a transmitter 5140 incorporated within the electrical device 5290

which is configured to transmit a signal to a receiver 5160 incorporated within the power outlet 5210.

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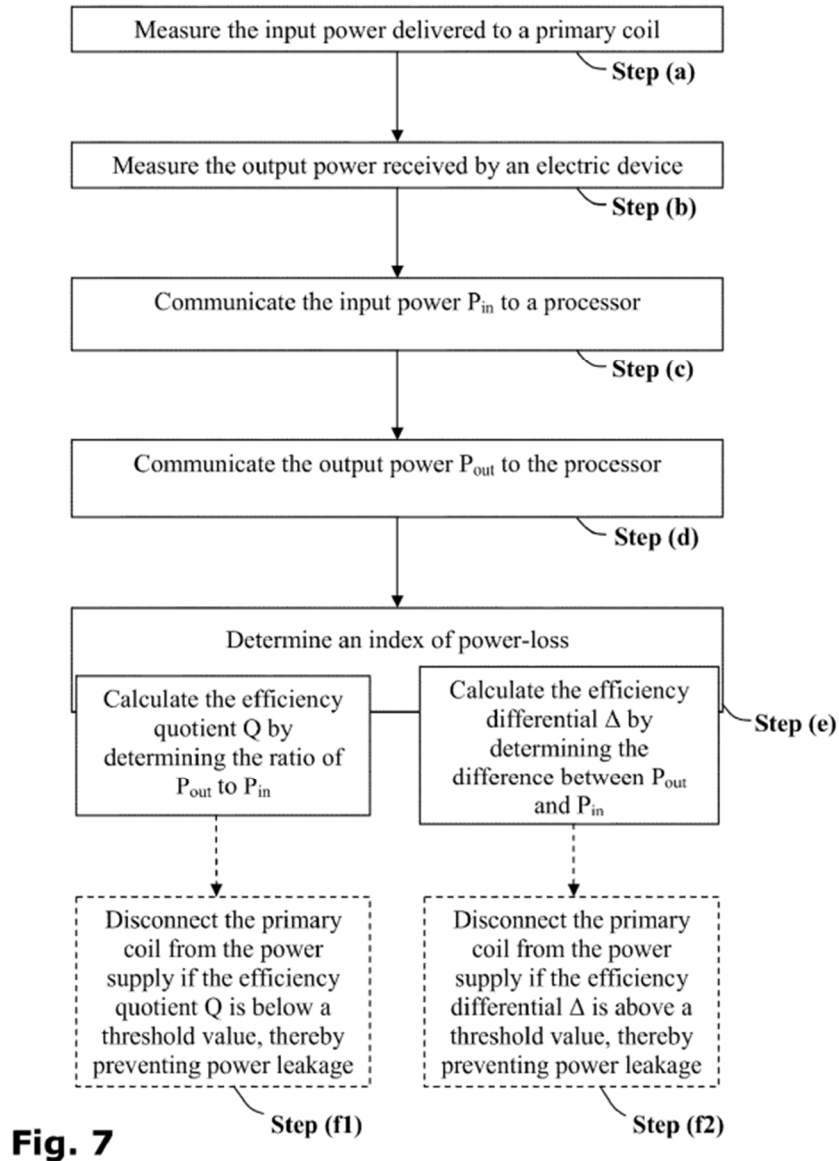
The processor 5162 is configured to receive the values of the input power P_{in} , directly from the input power monitor 5122, and the output power P_{out} , via the receiver 5160. The processor 5162 then calculates the efficiency quotient Q . In normal usage as represented in FIG. 6 a, the processor records an efficiency quotient Q higher than a predetermined threshold so power transmission continues uninterrupted. When the efficiency quotient Q falls below a predetermined threshold, this indicates that power is being drawn from the primary coil 5220 by some power drain other than the secondary coil 5260.

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In contradistinction to previous systems known to the inventors, embodiments of the present invention measure the efficiency quotient Q . Consequently, when a power drain is introduced, such as that shown in FIG. 6 b, for example, the output power P_{out} received by the secondary coil 5260 is lower than normal and the efficiency quotient Q may therefore drop below the predetermined threshold. The efficiency monitor 5300 is thus able to detect the hazard.

(Ex. 1006, 13:65-14:3, 14:48-57, 15:6-11; *see also id.*, 15:44-60, FIGS. 5, 6b; §IX.A.1.e.) When an efficiency differential Δ (which is “the difference between

P_{OUT} and P_{IN} ”) is above a threshold, efficiency monitor 5300 detects that the conductive sheet 5800 hazard is between the wireless power base system and the electronic device 5290 and the charging side disconnects the primary coil from the power supply to prevent power leakage and accordingly terminates charging. (Ex. 1006, 13:27-29, 13:65-14:3, 14:48-57, 15:6-11, 15:44-60, FIGS. 6b, 7.) As I explained previously, electrical device 5290, upon detecting the hazard by reporting the P_{OUT} value, “displays a warning 5294 on its visual display 5296” (“Attention!!”). (Ex. 1006, 15:22-33, FIG. 6b.)



(*Id.*, FIG. 7.)

156. In light of such teachings/suggestions, and further to the reasons I explained for claim 15 (regarding modifications to *Sogabe*'s device/system in view of *Azancot* (§IX.A.1)), a person of ordinary skill in the art would have been motivated and had good reason to configure the "microcontroller" in the *Sogabe*-

Azancot device/system to provide similar functionalities. Indeed, given that the microcontroller of the *Sogabe-Azancot* device/system would have been configured to control power receiving device 40 and transmits data to control the power transmitter, as I explained above (Ex. 1005, 8:44-53, 22:8-11, FIG. 12, S70, 26:44-58; Ex. 1006, 10:20-21, 7:21-30, 3:6-23, 10:4-19, 13:10-29, 15:34-60, FIG. 5, 7; §§IX.A.1.e-f), and in light of the foreign object detection disclosures/guidance of *Azancot* (discussed above), a person of ordinary skill in the art would have been motivated to further configure the “microcontroller” for detecting the presence of a foreign object between the inductive charger (power transmission device 10) and the inductive charging receiver of the electronic device during operation by either reporting one of output power or voltage or by reporting a fault condition to the inductive charger to terminate charging, like that claimed. Such a skilled person would have recognized that there was a known problem with foreign objects interfering with wireless power systems, that *Azancot*’s teachings addressed such issues, and that combining the teachings of *Sogabe* and *Azancot* was within the skill/capability of such a skilled person.

157. In my opinion, a person of ordinary skill in the art would have been motivated to modify the *Sogabe* system in view of the above-discussed *Azancot* power difference control features to efficiently prevent power leakage in the modified *Sogabe* device. (Ex. 1006, 2:53-58, 15:44-61.) A person of ordinary skill

in the art also would have appreciated that further modifying the *Sogabe* system in view of *Azancot*'s hazard detection teachings as described would have improved the modified *Sogabe* device/system (§IX.A.1) by minimizing/eliminating a need to vary the load on the power receiving side during a periodic authentication state to detect a foreign object. (Ex. 1006, 2:53-58, 15:44-61; Ex. 1005, 29:14-30.) Furthermore, such a skilled person would have also appreciated that configuring the microcontroller to provide features similar to *Azancot*'s efficiency differential threshold functionalities would have increased the efficiency and usability of the modified *Sogabe* device/system by enabling it to recognize that not all improper or low load conditions would necessitate turning off power flow. (Ex. 1006, 2:53-58, 15:44-61.)

158. A person of ordinary skill in the art would have had a reasonable expectation of success in implementing such a differential foreign object detection system in the modified *Sogabe* device/system (§IX.A.1). For instance, *Sogabe* recognizes problems with foreign objects being placed between a power transmitter and an electronic device and using a microcontroller to control wireless power flow, transmit control data, etc. (Ex. 1005, 15:11-18, 8:44-53, 23:8-11; §§IX.A.1.e-f), and *Azancot* discloses a beneficial system for detecting hazards based on a difference between a measured input power and a received output power as I previously discussed. The modification would have been a predictable combination of known

components according to known methods (*e.g.*, input and output power based hazard detection), and would have produced the predictable result of the microcontroller in the modified device/system being further configured for detecting the presence of a foreign object between the inductive charger and the inductive charging receiver of the electronic device during operation by either reporting one of output power or voltage or by reporting a fault condition to the inductive charger to terminate charging as claimed and consistent with the teachings of *Sogabe-Azancot*.

3. Claim 21

- a) **The electronic device of claim 15, wherein one of the first mode of operation and the second mode of operation is a proprietary mode of operation.**

159. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation for at least two reasons. **First**, a person of ordinary skill in the art would have recognized that *Sogabe*'s normal power transmission mode and setup power transmission mode, which may be the first or second modes of operation, are uniquely provided to increase compatibility with other contactless power systems as proprietary power modes. (*See* my above analysis at §§IX.A.1.f, i; Ex. 1005, 30:5-32:57, FIGS. 3A-5C, 11-12.) **Second**, a person of ordinary skill in the art would have recognized that *Sogabe*'s first and/or second modes of operation did not comprise then-standard modes of operation as proprietary modes of operation. (*See* my above analysis at §§IX.A.1.f, i; Ex. 1005, FIGS. 3A-5C, 11-12.) *Sogabe*'s

disclosures are consistent with such a skilled person's state-of-art knowledge at the time, and also with discussions in the '777 patent, which disclose that a "proprietary" mode of operation may include a mode that did not make use of then-standard modes of operation. (Ex. 1001, 56:55-60 (distinguishing Bluetooth and other standard protocols from "proprietary" protocols); *see, e.g.*, Ex. 1007, 4:18-25 (distinguishing "proprietary" protocols from then-standard protocols such as Bluetooth).) Consistent with such teachings in *Sogabe* and known in the art, and for similar reasons explained for claim 15, a person of ordinary skill in the art would have configured the *Sogabe-Azancot* device/system to provide similar features. (§IX.A.1.)

4. Claim 23

- a) **The electronic device of claim 15, wherein the received power is within a first frequency range for the first mode of operation and within a second frequency range for the second mode of operation.**

160. In my opinion, the *Sogabe-Azancot* combination discloses and/or suggests this limitation.⁹ As I discussed above for claim elements 15(f) and 15(i),

⁹ The language of claim 23 does not appear to place any boundaries on the claimed first and second frequency ranges, such as an upper or lower limit or whether they overlap, etc.

in the modified *Sogabe* device (and consistent with *Sogabe*'s teachings), the first mode of operation corresponds to the setup stage, where the second mode of operation is the normal transmission mode or a combination of the setup stage and the normal transmission mode. (See my above analysis at §§IX.A.1.f, IX.A.1.i.) The setup stage ("first mode of operation") uses an initial "f01" or "f02" operating frequency for the transfer of power to the electronic device, whereas during normal power transmission, the operating frequency for the transfer of power is an "f1" or "f2" frequency. (Ex. 1005, 10:18-27, 14:41-67, 15:34-50, 21:7-12, 23:60-24:3, FIG. 10A.) Therefore, the received power in the first mode of operation in the *Sogabe-Azancot* device/system has a frequency f01 and/or f02, where f01 and f02 are "within a first frequency range" (the lower bound of the range is a frequency less or equal to both f01 and f02, and the upper bound is a frequency greater than or equal to both of f01 and f02). (§IX.A.1.) The received power in the second mode of operation has a frequency f1 and/or f2, where f1 and f2 are "within a second frequency range" (the lower bound of the range is a frequency less or equal to both f1 and f2, and the upper bound is a frequency greater than or equal to both of f1 and f2). Accordingly, for reasons I explained for claim 15 and above, the *Sogabe-Azancot* combination discloses/suggests the limitations of claim 23.

B. Ground 2: *Sogabe* in view of *Azancot* and *Walley* discloses and/or suggests claims 17 and 21

1. Claim 17

- a) The electronic device of claim 15, wherein the communication transmitter circuit and the communication receiver circuit in the electronic device are configured to communicate with different types of inductive chargers based on communications exchanged with different types of inductive chargers.**

161. In my opinion, the *Sogabe-Azancot* combination in view of *Walley* discloses and/or suggests this limitation. *Sogabe* discloses that the power transmission side can communicate with “various types of power receiving devices” using different “communication condition[s]” to charge various devices via contactless power transmission. (Ex. 1005, 9:15-31; *see also id.*, 10:39-11:16 (describing how a power transmission device can communicate with and charge different “kinds of power receiving devices”), FIGS. 1, 2, 9.) A communication condition may specify a modulating power output frequency (*e.g.*, f_1 , f_2) used for communication using frequency modulation or may specify thresholds used for communication using load modulation to use when charging and communicating with a power receiving device, as appropriate for a given type of receiver. (*Id.*, 9:38-61, 13:41-51, 15:32-50, 16:14-29; *see also id.*, 10:39-11:16, FIGS. 1, 2, 9, 12.)

162. Focusing on the compatibility and interoperability features of the power transmission side, *Sogabe* does not explicitly disclose that the power receiving side

includes an electronic device that is similarly compatible with various types of wireless power transmission devices. (*See generally* Ex. 1005.) While *Sogabe* does not explicitly disclose that the **“communication transmitter circuit and the communication receiver circuit in the electronic device are configured to communicate with different types of inductive chargers based on communications exchanged with different types of inductive chargers,”** it is my opinion that a person of ordinary skill in the art would have been motivated and had good reason to modify the *Sogabe-Azancot* device/system to implement such features in view of *Walley* (which discloses features relating to universal wireless power receivers that are compatible with various types of chargers). (Ex. 1007, FIG. 1.)

163. Before the alleged time of invention, persons of ordinary skill in the art were mindful of interoperability issues for wireless power devices. (Ex. 1007, 1:56-67 (“While...organization[s] are attempting to establish standards regarding the control channel protocol, currently, vendors are free to use whatever protocol they chose, making compatibility issues between different vendors’ wireless power products.”); Ex. 1037, 1:51-54 (“[A] need exists for a chargeable device configured to detect one or more wireless chargers and, thereafter, determine an optimal charging solution for receiving a charge.”).) Accordingly, wireless power receiving

devices were designed with compatibility and flexibility in mind. (Ex. 1035, 19:3-20, 21:7-18, FIGS. 10-11; Ex. 1037, FIG. 10, 11:55-13:14.)

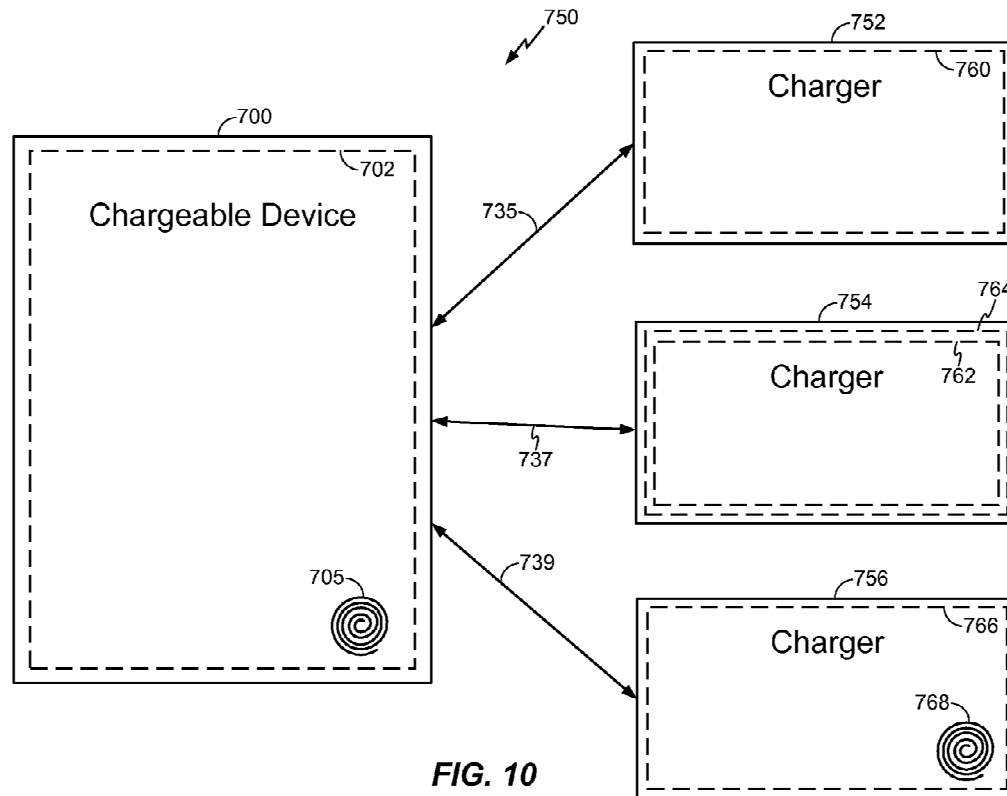


FIG. 10

(Ex. 1037, FIG. 10 (illustrating a chargeable device 700 that is compatible with different types of chargers 752, 754, and 756).)

164. *Walley* discloses features configured in an attempt to reduce compatibility issues for wireless power receiving devices. Namely, *Walley* discloses wireless power receivers that are compatible with a variety of wireless power transmitters. (Ex. 1007, FIG. 1; §VIII.C.) Specifically, *Walley*, similar to *Sogabe* (see my above analysis at §§IX.A.1.a, c-d) and *Azancot*, discloses devices 12 and 14, which receive wireless power to charge a battery from a wireless power transmit

unit 10. (Ex. 1007, 3:34-44, 7:5-13, FIG. 1.) As shown in annotated Figure 1 below, each device includes a wireless power (WP) transceiver comprising a respective “transmitter section” and a “receiver section” and corresponding hardware (“communication transmitter circuit and” “communication receiver circuit in [an] electronic device”). (Ex. 1007, 4:42-5:44, FIG. 1.)

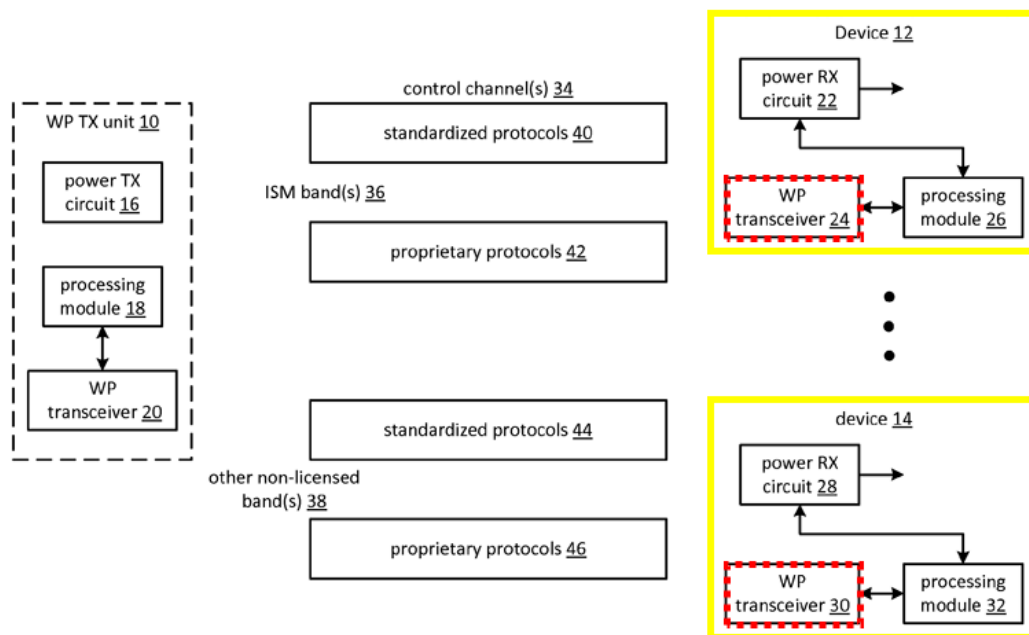


FIG. 1

(Ex. 1007, FIG. 1 (annotated).)

165. *Walley* further discloses that the wireless power receiving device transceivers are “configured to communicate with different types of inductive chargers based on communications exchanged with different types of inductive chargers.” For instance, *Walley* discloses that “the receive unit...functions to identify [a] control channel protocol used by the wireless power transmit unit”

because wireless power transmit units may use different control channel protocols for control channel communications (“different types of inductive chargers”). (Ex. 1007, 6:6-21.) The receive unit, using its “transmitter” and “receiver section[s],” may identify a control channel protocol used by a transmit unit by receiving set-up communications from transmit units, exchanging/transceiving protocol negotiation information with transmit units, etc. (*Id.*, 4:42-5:44, 5:60-6:60, FIG. 1.) After identifying what protocol a given wireless power transmitter uses, the receive unit configures its transceiver “to implement one or more...standard communication protocols and/or one or more...proprietary communication protocols” that is/are used by a specific/unique type of transmit unit and can communicate/exchange various wireless power control information with the transmit unit. (Ex. 1007, 4:42-5:44, 5:60-6:60, 9:59-10:22, FIGS. 1, 6.) In this way, a “communication transmitter circuit and” a “communication receiver circuit in the electronic device are configured to communicate with different types of inductive chargers based on communications exchanged with different types of inductive chargers.”

166. In view of *Walley*, and consistent with the state of the art, a person of ordinary skill in the art would have been motivated to configure the communication transmitter circuit and the communication receiver circuit in the electronic device of the *Sogabe-Azancot* system to communicate with different types of inductive chargers based on communications exchanged with different types of inductive

chargers. A person of ordinary skill in the art would have been motivated to do so as it would have increased the utility of the electronic device and would have allowed the electronic device to be charged by chargers in other known wireless charging systems using understood standard and proprietary protocols. (Ex. 1007, 1:54-2:15, 3:47-55, 4:15-25, FIG. 1.) Furthermore, and as I explained previously, such a modification would have increased wireless power receiving device compatibility/interoperability, which was a well-understood and desired feature before the alleged time of invention. (Ex. 1007, 1:54-2:15, 3:47-55, 4:15-25, FIG. 1; Ex. 1035, 19:3-20, 21:7-18, FIGS. 10-11; Ex. 1037, 1:51-54 FIG. 10, 11:55-13:14.)

167. A person of ordinary skill in the art would have had the skills and rationale in light of the teachings/suggestions of *Sogabe*, *Azancot*, and *Walley*, in context of a person of ordinary skill in the art's state of art knowledge, to implement such features while considering design tradeoffs and techniques/technologies with a reasonable expectation of success, especially given such modification would have involved known technologies/techniques (*e.g.*, wireless power receivers/electronic devices that are compatible with various protocols and transmit units), foreseeably resulting in an electronic device having a communication transmitter circuit and a communication receiver circuit configured to communicate with different types of inductive chargers based on communications exchanged with different types of

inductive chargers, consistent with the teachings and suggestions of *Sogabe-Azancot-Walley*.

2. Claim 21

- a) **The electronic device of claim 15, wherein one of the first mode of operation and the second mode of operation is a proprietary mode of operation.**

168. It is my opinion that the *Sogabe-Azancot* combination discloses and/or suggests claim 21 (*see* my above analysis at §IX.A.3). Nonetheless, I have been asked to assume a scenario wherein the *Sogabe-Azancot* combination does not disclose and/or suggest claim 21. As to that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to implement such a feature in view of *Walley*.

169. *Walley*, similar to *Sogabe* and *Azancot*, discloses using a “microprocessor” or “micro-controller” to control a wireless power transmitter or receiver device (device 12 or 14) that is capable of operating using different protocols, including “proprietary” protocols, comprising various bi-directional messaging standards. (§IX.A.1.e; Ex. 1007, 3:47-55 (“The processing modules 18, 26, 32 of the WP TX unit 10 and in each of the devices 12-14 may each be a single processing device or a plurality of processing devices. Such a processing device may be a microprocessor, micro-controller, digital signal processor, microcomputer, central processing unit, field programmable gate array, programmable logic device,

state machine, logic circuitry, analog circuitry, digital circuitry, and/or any device that manipulates signals (analog and/or digital) based on hard coding of the circuitry and/or operational instructions.”), 4:15-55 (“**The WP TX unit 10 communicates with the WP transceivers 24, 30 of the devices 12-14 via one or more control channels 34 that use one or more frequencies in the ISM bands 36 and/or one or more frequencies in another non-licensed frequency band(s) 38. The communication via the control channel 34 may use one or more standardized protocols 40, 44 and/or one or more proprietary protocols 42, 46.** For example, the standardized protocols 40, 44 may include Bluetooth (2400 MHz), HIPERLAN (5800 MHz), IEEE 802.11 (2400 MHz and 5800MHz), and IEEE 802.15.4 (personal area networks using 915 MHz or 2400 MHz).... Each of the WP power transceivers 20, 24, 30 (e.g., in the WP TX unit 10 and in each of the devices 12-14) includes baseband processing (which may be done by the corresponding processing module 18, 26, 32), a radio frequency (RF) and/or a millimeter wave (MMW) transmitter section, and an RF and/or MMW receiver section. In an example of operation, the baseband processing converts outbound data into outbound symbol stream in accordance with one or more wireless communication standards (e.g., GSM, CDMA, WCDMA, HSUPA, HSDPA, WiMAX, EDGE, GPRS, IEEE 802.11, Bluetooth, ZigBee, universal mobile telecommunications system (UMTS), long

term evolution (LTE), IEEE 802.16, evolution data optimized (EV-DO), proprietary protocol, etc.).”), FIG. 1.)

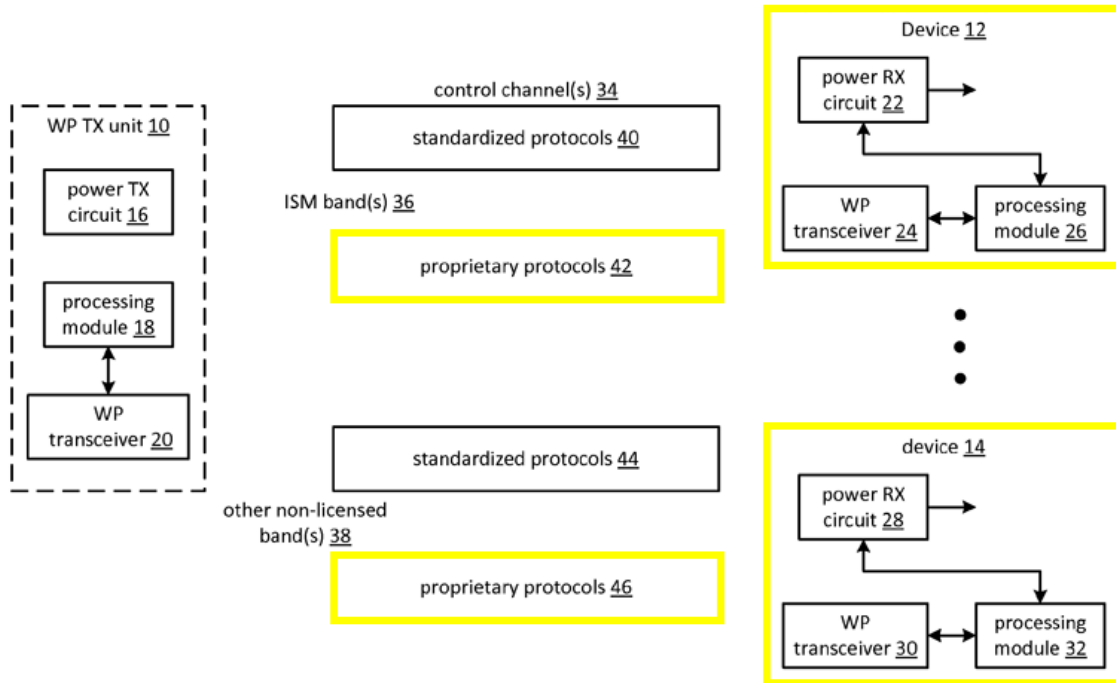


FIG. 1

(*Id.*, FIG. 1 (annotated).)

170. *Walley* further explains how the receive unit can be configured to work with multiple protocols:

When the receive unit transceiver 24, 30 is capable of communication using the control channel protocol, the processing module coordinates configuration of the receive unit transceiver to transceive the communication regarding the wireless power magnetic field via the control channel.

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FIG. 6 is a schematic block diagram of an embodiment of a wirelessly powered device 108 that includes the power RX circuit 110, an RF and/or MMW data processing module 112 (which may be implemented within the processing module) and the RF and/or MMW transceiver 114. The RF and/or MMW data processing module 112 includes an outbound symbol conversion module 116, a baseband control module 118, a transceiver control module 120, and an inbound symbol conversion module 122. The RF and/or MMW transceiver 114 includes a transmitter 124 and a receiver 126. The transmitter 124 includes a low IF (e.g., 0 to a few MHz) bandpass filter 128, a mixing module 130, a power amplifier (PA) 132, and an RF bandpass filter 134. The receiver 126 includes an RF bandpass filter 136, a low noise amplifier (LNA) 138, a mixing module 140, and a low IF bandpass filter 142. If the transmitter 124 and receiver 126 share an antenna, the transceiver 114 further includes a TX/RX isolation circuit 144 (e.g., a circulator, a transformer balun, a TX/RX switch, etc.).

In an example of operation, the data processing module 112 configures itself based on the communication protocol being implemented and the corresponding data modulation. In addition, the transceiver control module provides control signals to the transceiver 114 to adjust one or more of the components thereof based on the protocol being implemented. In this regard, the data processing module 112 and the transceiver 114 may be configured to implement one or more of the standard

communication protocols and/or one or more of the proprietary communication protocols. Note that the device 108 may include one or more configurable RF/MMW data processing modules 112 and/or one or more configurable RF/MMW transceivers 114.

(*Id.*, 6:40-53, 9:59-10:22.)

171. In light of such teachings, a person of ordinary skill in the art would have been motivated and had good reason to configure the *Sogabe-Azancot* device/system such that the second mode of operation (§IX.A.1.i) comprises one proprietary protocol in order to increase the interoperability and universal features of the *Sogabe-Azancot* device/system to better work with other known wireless charging systems using understood/known proprietary protocols. (Ex. 1007, 1:54-2:15, 3:47-55, 4:15-25, FIG. 1.) As I explained previously, such a modification would have increased device compatibility, which was a well-understood and desired feature before the alleged time of invention. (See my above analysis at §IX.B.1.) Moreover, such a modification would have been a predictable combination of known components according to known methods (*e.g.*, wireless power receivers/electronic devices that are compatible with various proprietary protocols), and would have produced the predictable result of one of the first mode of operation and the second mode of operation being a proprietary mode of operation.

C. Ground 3: *Sogabe* in view of *Azancot* and *Baarman* discloses and/or suggests claim 22

1. Claim 22

- a) The electronic device of claim 15, wherein the microcontroller is further configured for receiving a ping from an inductive charger and sending, in response to the ping, a responsive communication identifying one of the first mode of operation and the second mode of operation.**

172. In my opinion, the *Sogabe-Azancot* combination in view of *Baarman* discloses and/or suggests this limitation. As I discussed above, *Sogabe* in view of *Azancot* discloses and/or suggests an electronic device (such as a cell phone or power receiving device) operating in a setup power transmission mode and a normal power transmission mode, which correspond to first and second power modes. (§§IX.A.1.f, i.)

173. Although *Sogabe* (including as modified with *Azancot*) does not explicitly disclose that the microcontroller of the modified electronic device receives a ping from the power transmission device and sends, in response to the ping, a responsive communication identifying one of the first mode of operation and the second mode of operation, a person of ordinary skill in the art would have been motivated to implement such features in view of *Baarman*.

174. Similar to *Sogabe* and *Azancot*, *Baarman* discloses a “wireless charging system.” (Ex. 1008, Title, Abstract, FIG. 1, ¶0030; *see also* §VIII.D.) *Baarman*’s

system comprises an inductive power supply 12 (“**inductive charger**”), which includes a controller 32 and a tank circuit 34 that includes primary coil 16, that transmits wireless power to charge remote control 14 (“**electronic device**”), which comprises a controller 80:

A remote control system 10 having an inductive charging system in accordance with an embodiment of the present invention is shown in FIG. 1. The system generally includes an inductive power supply 12 and a battery-operated remote control 14. The inductive power supply 12 generates an electromagnetic field capable of wirelessly transmitting power to the remote control 14. The remote control 14 includes a secondary power supply circuit 60 capable of receiving power and delivering it in a usable form when in the presence of an appropriate electromagnetic field. The power induced in the secondary circuit 60 is rapidly stored in a charge storage capacitor 72. The power stored in the charge storage capacitor 72 is used to charge the battery 100 over an extended timeframe suitable for battery charging. Accordingly, power can be quickly stored in the charge storage capacitor 72 and used to continue to charge the battery 100 even after the remote control 14 is removed from the inductive power supply 12. In some applications, the power stored in the charge storage capacitor 72 may be used to provide a short-term source of power for the remote control 14. For example, in some applications, the remote control 14 may be capable of drawing power directly from the charge storage capacitor 72. In such

embodiments, the remote control 14 can be charged sufficiently to function much more quickly than would be required if the system relied solely on battery charging.

....

As noted above, the remote control system 10 includes an inductive power supply 12 that produces an electromagnetic field capable of inducing electrical power in an appropriate remote device, such as the remote control 14. Although described in connection with a specific inductive power supply 12, the present invention is configurable for use with essentially any inductive power supply capable of conveying the necessary power. Referring now to FIG. 1, the inductive power supply 12 of the illustrated embodiment generally includes a controller 32 and a tank circuit 34. The controller 32 of this embodiment is capable of supplying power to the tank circuit 34 at different operating frequencies, which allows the controller 32 to vary the power provided to the remote control 14. In alternative embodiments, the controller 32 may be capable of varying the duty cycle instead of, or in addition to, the operating frequency. The tank circuit 34 of this embodiment is a series resonant tank circuit having a primary coil 16 and a capacitor 38. The tank circuit 34 may alternatively be other forms of resonant and non-resonant tank circuits, such as parallel resonant tank circuits. The inductive power supply 12 of this embodiment receives power from an external DC power supply 22. The external DC power supply 22 may be a conventional DC power supply capable of

receiving 110V AC input and providing output power at 19V DC.

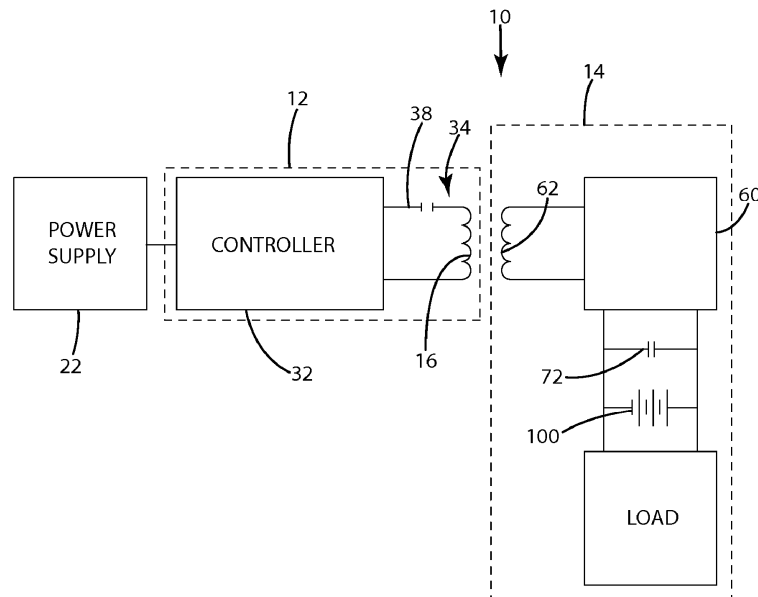
....

The remote control 14 is a battery-operated remote control that includes a secondary power circuit 60 that receives power from the inductive power supply 12 and uses the power to rapidly charge a charge storage capacitor 72. For example, in one embodiment, the remote control 14 may be a television remote control for wirelessly changing the channel of a television. The secondary power circuit 60 utilizes the power stored in the charge storage capacitor 72 to charge the battery 100 of the remote control 14 over an appropriate timeframe. In the illustrated embodiment, the secondary power circuit 60 generally includes a secondary coil 62, a rectifier 64, a charging switch 66, a current sense amplifier subcircuit 68, a voltage sense subcircuit 70, a charge storage capacitor 72, a VCC regulator subcircuit 74, a voltage boost subcircuit 76, a switch driver subcircuit 78, a controller 80, a communications subcircuit 82, a temperature sense subcircuit 84 and an A/D voltage reference subcircuit 86. In the illustrated embodiment, the secondary coil 62 is a generally conventional center-tapped coil of wire, such as Litz wire. The characteristics of the secondary coil 62 (e.g. wire size, wire type, number of turns, shape of coil) will vary from application to application to achieve the desired functionality. The secondary coil 62 may be essentially any component in which a voltage is induced in the presence of a magnetic field,

such as the field generated by the inductive power supply 12. For example, the secondary coil 62 may be replaced by a printed circuit board coil or a stamped coil. The rectifier 64 rectifies the AC power induced in the secondary coil 62 to provide DC power. The rectifier 64 may be essentially any circuitry capable of converting AC power into DC power, but in the illustrated embodiment is a full-wave rectifier having two diodes 88 a-b. The charging switch 66 is operable to selectively control the supply of DC power from the rectifier 64 to the charge storage capacitor 72. The charging switch 66 may be a FET that is opened and closed by operation of switch driver subcircuit 78. The switch driver subcircuit 78 may be essentially any driver capable of controlling operation of the charging switch 66. In the illustrated embodiment, the switch driver subcircuit 78 cooperates with the voltage boost subcircuit 76 to operate the charging switch 66. The switch driver subcircuit 78 of the illustrated embodiment 78 includes a transistor 90 that is actuated by a control signal from controller 80. When the transistor 90 closes, the output of the voltage boost subcircuit 76 drops to ground, thereby opening the charging switch 66. In the illustrated embodiment, the voltage boost subcircuit 76 is a conventional voltage doubler that converts the AC voltage from the secondary coil 62 to a higher DC voltage. The output of the voltage boost subcircuit 76 is used by the switch driver subcircuit 78 to operate the charging switch 66. The current sense amplifier subcircuit 68

measures the current being applied to the charge storage capacitor 72.

(*Id.*, ¶¶ 0030, 0032, 0038, FIGS. 1-2A, 3B.)



(*Id.*, FIG. 1.) Controller 32 may be a dsPIC30F2023 or similar microcontroller; controller 80 may be an ATTINY44V-10MU or similar microcontroller (“**microcontroller**”). (*Id.*, FIG. 2A, 3B.) For more context, the ATTINY44V-10MU is a known microcontroller manufactured by Microchip Technology.

175. *Baarman* discloses “**wherein the microcontroller is further configured for receiving a ping from an inductive charger.**” For instance, *Baarman* discloses “the inductive power supply enters a ping state 202 by periodically applying a relatively small amount of power to the tank circuit 34. The amount of power in each ping is typically sufficient to enable a remote control 14

with a depleted battery 100 to generate a feedback signal to identify its presence within the electromagnetic field.” (Ex. 1008, ¶0048, FIG. 4.) The controller 80 receives the ping because the ping is used to power the microcontroller to generate a feedback signal. (*Id.*, ¶¶0032, 0039, 0048, 0055, FIGS. 1, 2A, 2C, 3A, 3B.) The microcontroller also receives the ping through monitoring the current and voltage of the ping when the primary side controls tank circuit 34 to output the power ping. (*Id.*, ¶¶0032, 0039, 0048, FIGS. 1, 2A, 2C, 3A, 3B.)

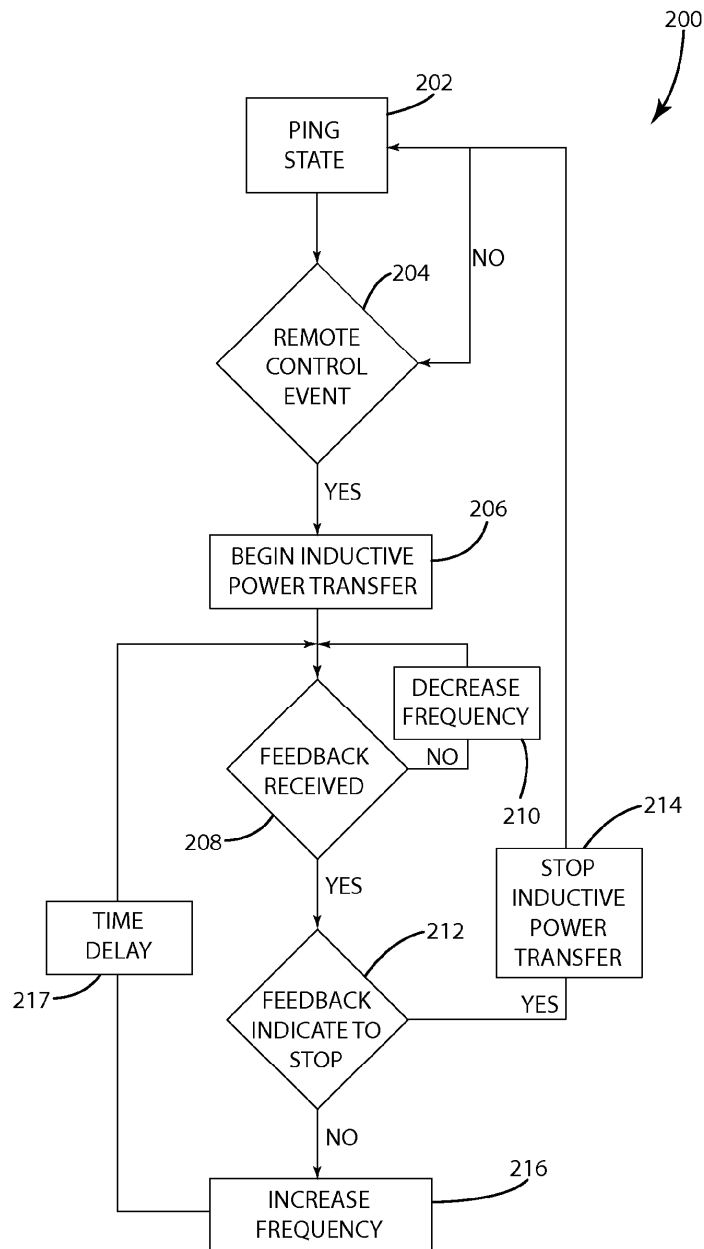


Fig.4

(*Id.*, FIG. 4.)

176. *Baarman* further discloses “**sending, in response to the ping, a responsive communication.**” For instance, *Baarman* discloses “[t]he amount of

power in each ping is typically sufficient to enable a remote control 14 with a depleted battery 100 to generate a feedback signal” and that a “feedback signal [is] generated by the remote control 14 in response to the ping” (“**sending, in response to the ping, a responsive communication**”):

The method of operation 200 of the inductive power supply 12 of the illustrated embodiment will now be described in connection with FIG. 4. To reduce the energy consumed by the system 10 when a compatible remote control is not present, the inductive power supply 12 method of operation includes a “pinging” process to determine when an appropriate remote control 14 is present in the electromagnetic field. As shown in FIG. 4, the inductive power supply enters a ping state 202 by periodically applying a relatively small amount of power to the tank circuit 34. The amount of power in each ping is typically sufficient to enable a remote control 14 with a depleted battery 100 to generate a feedback signal to identify its presence within the electromagnetic field. Alternatively, the ping may include a smaller amount of power, and the power may accumulate in the charge storage capacitor 72 or battery 100 over time to eventually provide sufficient power for the remote control 14 to identify itself to the inductive power supply 12. The nature and content of the feedback signal and other communications are discussed in more detail below. The inductive power supply 12 monitors the current in the tank circuit 34 for communications from the remote control 14 to determine when a compatible remote

control 14 is present 204. As noted above, the controller 32 monitors for communications via the current sense transformer subcircuit 54.

When a communication signal indicative of the presence of a compatible remote control 14 is received, the inductive power supply 12 begins inductive power transfer 206 at a specific start frequency. This start frequency may be stored in memory within the inductive power supply 12 or it may be communicated to the inductive power supply 12 by the remote control 14, for example, within the feedback signal generated by the remote control 14 in response to the ping.

(*Id.*, ¶¶0048-0049.) Controller 80 sends the feedback signal by “selectively open[ing] and clos[ing] FET 96 to create a data stream”:

The secondary power circuit 60 “awakens” in the presence of the ping transmitted by the inductive power supply 12. Upon awakening, the secondary power circuit 60 sends 252 an identification signal back to the inductive power supply 12. As described elsewhere, the secondary power circuit 12 creates feedback signals by selectively applying the communication load 98 to the secondary coil 62. The controller 80 selectively opens and closes FET 96 to create a data stream on the electromagnetic field in accordance with the communication protocol described in more detail below. In the illustrated embodiment, data is transmit to the inductive power supply 12 in data packets. Before generating a data packet, the controller 80 disconnects the charge

storage capacitor 72 from the secondary coil 62. The secondary power circuit 60 disconnects the charge storage capacitor 72 through switch driver subcircuit 78. The controller 80 outputs a signal that closes transistor 90, thereby dropping the output of the voltage boost subcircuit 76 to ground, which in turn opens the charging switch 66. Once open, the charge storage capacitor 72 is effectively isolated from the secondary coil 62 and the communication load 98. The charging switch 66 is held open for a period sufficient to send the data packet. After the data packet is sent, the charging switch 66 is again closed, allowing power to flow to the charge storage capacitor 72. As noted above, the inductive power supply 12 responds to the identification signal by beginning inductive power supply.

(*Id.*, ¶0055, FIGS. 3A, 3B.)

177. The *Baarman* feedback signal, which is sent in response to a ping, is “**a responsive communication identifying one of the first mode of operation and the second mode of operation.**” Prior to beginning a normal power mode, the *Baarman* system enters the pinging process wherein a “small amount of power” is transmitted to power remote control 14. (Ex. 1008, ¶0048.) And when a feedback signal is received by the inductive power supply 12, it “begins inductive power transfer” via normal operation. (*Id.*, ¶0049) *Baarman* further discloses that the feedback signal includes normal power mode operation parameters, including a power output frequency and a “period” of time for controlling wireless power during

a normal mode of operation following a pinging process. (*Id.* ¶¶0049-0050.) The feedback signal thus identifies a normal power transmission mode (“**a responsive communication identifying one of the first mode of operation and the second mode of operation**”). (Ex. 1008, ¶¶0048-50, FIGS. 1, 4.)

178. The *Baarman* pinging and feedback signal configuration to identify a normal mode of operation is consistent with the disclosure of the ’777 patent. The ’777 patent does not provide any specific example or explanation regarding the claim 22 limitation for sending, in response to a ping, a responsive communication identifying one of a first mode of operation and a second mode of operation as recited in claim 22. (*See generally* Ex. 1001.) Instead, the ’777 patent generally discloses that a “charger can periodically start and apply a ping voltage 200 of pre-determined frequency and length to the charger coil....The receiver is then activated, and may begin to send back communication signals....In response to the receiver providing information regarding output power or voltage, etc. the charger can modify voltage, frequency, duty cycle of the charger coil signal or a combination of the above.” (*Id.*, 20:25-61.) *Baarman*, which uses a feedback signal that identifies a normal mode of operation, similarly discloses a receiver that wakes up in response to a ping and sends back signals for a charger to modify a voltage, frequency, etc. output, consistent with what is disclosed by the ’777 patent. (Ex. 1008, ¶¶0048-50, FIGS. 1, 4.)

179. Understanding and appreciating that the *Sogabe* system as modified by *Azancot* discloses operating in a setup power transmission mode and a normal power transmission mode (which correspond to first and second power modes) and that *Baarman* discloses responding to a ping with a communication identifying a normal mode of operation, a person of ordinary skill in the art would have been motivated and had good reason to configure the microcontroller of the *Sogabe* system (as modified by *Azancot*) for receiving a ping from an inductive charger and sending, in response to the ping, a responsive communication identifying one of the first mode of operation and the second mode of operation. In combination, the microcontroller of the electronic device of the *Sogabe-Azancot* system (*see my above analysis at §IX.A.1.e*) would have been configured to transmit a feedback signal similar to that of *Baarman*, which identifies the normal mode of operation in response to a ping, such that a setup power transmission mode would not be needed to negotiate operating power, etc. (Ex. 1008, ¶¶0048-50, FIGS. 1, 4; Ex. 1005, FIGS. 2-5C, 9.)

180. A person of ordinary skill in the art would have been motivated to implement such ping and responsive signaling (similar to that disclosed by *Baarman* as explained), such as to reduce the complexity of the wireless power setup process disclosed by *Sogabe* while still maintaining universal interoperability and compatibility features. (Ex. 1008, ¶¶0048-49, FIGS. 1, 4; Ex. 1005, FIGS. 2-5C, 9, 11-12 (disclosing exemplary details of the negotiation and setup process).)

Determining whether to make use of the *Sogabe* negotiation and setup processes via pinging and responsive signaling identifying a normal mode also would have decreased low power transmission time in favor of normal power transmission time and optimized charging. (Ex. 1008, ¶¶0047-49, FIGS. 1, 4; Ex. 1005, FIGS. 2-5C, 9.) Further, using such pinging and responsive identifying communications as I explained also would have reduced risks associated with powering an improper device, as the feedback signals help identify compatible devices. (*Id.*, ¶¶0047-49; Ex. 1005, FIGS. 3A-5C.) Furthermore, a person of ordinary skill in the art would have appreciated that the pinging process also would have helped “reduce the energy consumed by the system...when a compatible remote control is not present.” (*Id.*, ¶¶0047-48; Ex. 1005, FIGS. 3A-5C.)

181. A person of ordinary skill in the art would have had a reasonable expectation of success in having the microcontroller include pinging and responsive signaling similar to that as disclosed by *Baarman* as described. Indeed, using pinging and responsive signaling to identify power modes like that disclosed by *Baarman* was well-understood. (Ex. 1010, 46-48; Ex. 1036, ¶0253 (“FIG. 20 shows an exemplary timing diagram to illustrate the method of FIG. 19. FIG. 20(a) shows the system when a foreign object is place on the system. The system starts in mode A 1902. It sees an inductance change and then goes into mode B 1904 for three ‘pings’. These ‘pings’ can be of a different time interval to the polling of the Sense

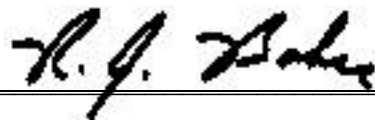
Circuit 206. As no device is detected, the system goes back to mode A 1902. FIG. 20(b) shows the system when a valid device is placed on the system. In this example, the device does not authenticate on the first ‘ping’, but it is able to on the second ‘ping’.”), FIG. 20a-b.) Here, the modification would have been a predictable combination of known components according to known methods (*e.g.*, pinging and responsive signaling identifying a normal mode of operation to begin a normal wireless power transfer mode), and would have produced the predictable result of the microcontroller being further configured for receiving a ping from an inductive charger and sending, in response to the ping, a responsive communication identifying one of the first mode of operation and the second mode of operation.

X. CONCLUSION

182. In summary, it is my opinion that all of the features recited in claims 15, 17, and 20-23 of the '777 patent are disclosed and/or suggested by the prior art.

183. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: June 27, 2023

By: 

R. Jacob Baker, Ph.D., P.E.