

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**

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	BACKGROUND AND QUALIFICATIONS	1
III.	MATERIALS REVIEWED	5
IV.	PERSON OF ORDINARY SKILL IN THE ART AND THE TIME OF THE ALLEGED INVENTION	9
V.	TECHNICAL BACKGROUND	10
A.	Electronic Circuits and Components.....	11
B.	Contactless Power/Data Transfer	18
1.	Inductance and Inductive Coupling	19
2.	Applications of Contactless Power/Data Transfer.....	23
3.	Controlling and Regulating Contactless Power/Data Transfer	30
4.	Universal Wireless Charging Using Multiple Protocols	34
5.	Wireless Charging Using Uni-directional and Bi- directional Protocols	42
VI.	OVERVIEW OF THE '777 PATENT	48
VII.	CLAIM CONSTRUCTION	49
VIII.	OVERVIEW OF THE PRIOR ART	49
A.	Sogabe (Ex. 1005)	50
B.	Azancot (Ex. 1006).....	57
C.	<i>Walley</i> (Ex. 1007).....	59
D.	<i>Baarman</i> (Ex. 1008).....	60
E.	<i>Muratov</i> (Ex. 1009)	62

IX. THE PRIOR ART DISCLOSES OR SUGGESTS ALL RECITED FEATURES OF CLAIMS 1-3, 5-11, 13, 14, AND 24 OF THE '777 PATENT	63
A. Ground 1: <i>Sogabe</i> in view of <i>Azancot</i> discloses and/or suggests claims 1-3, 5, 6, 9-11, 13, 14, and 24.....	63
1. Claims 1 and 24.....	63
a) 1(a)/24(a): A [base] system for inductive charging of an electronic device comprising an inductive charging receiver and a battery electrically coupled to the inductive charging receiver, the [base] system comprising:	64
b) 1(b)/24(b): an inductive charging coil;.....	68
c) 1(c)/24(c): a coil drive circuit electrically coupled to the inductive charging coil, wherein the coil drive circuit provides power to the inductive charging coil by switching a voltage input to the inductive charging coil at an operating frequency;	70
d) 1(d)/24(d): a current detection circuit electrically coupled to the inductive charging coil; and.....	74
e) 1(e)/24(e): a microcontroller, wherein the microcontroller is configured for:	79
f) 1(f)/24(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:	96
g) 1(g)/24(g): receiving, using the current detection circuit, a first communication from the inductive charging receiver of the electronic device, wherein the first communication is based on the first protocol; and	115

- h) 1(h)/24(h): regulating power delivered to the battery of the electronic device in response to the received first communication; and 117
- i) 1(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: 118
- 24(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 comprises bi-directional messaging, wherein the second mode of operation comprises: 118
- j) 1(j)/24(j): receiving, using the current detection circuit, a second communication from the inductive charging receiver of the electronic device, wherein the second communication is based on the second protocol; 125
- k) 1(k)/24(l): transmitting, by modulating the operating frequency with the coil drive circuit, a frequency-modulated third communication to the inductive charging receiver of the electronic device, wherein the frequency-modulated third communication is based on the second protocol; [and] 129
- l) 1(l)/24(k): regulating power delivered to the battery of the electronic device in response to the received second communication; [and] 133
- m) 1(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 135

n)	1(n): wherein the first power level and the second power level are different.....	135
o)	24(m): wherein the operating frequency for the first mode of operation is associated with a first frequency range and the operating frequency for the second mode of operation is associated with a second frequency range, and	136
p)	24(n): wherein the first frequency range and the second frequency range are different.	136
2.	Claim 2.....	137
a)	The base system of claim 1, wherein the base system is configured to communicate with different types of inductive charging receivers using different inductive charging protocols.	137
3.	Claim 3.....	139
a)	The base system of claim 1, wherein the electronic device is a mobile device, watch, headset, robot, vehicle, appliance, light or battery.	139
4.	Claim 5.....	139
a)	The base system of claim 1, wherein the first mode of operation is a subset of the second mode of operation.	139
5.	Claim 6.....	140
a)	The base system of claim 1, wherein one of the first mode of operation and the second mode of operation is a proprietary mode of operation.	140
6.	Claim 9.....	141
a)	The base system of claim 1, wherein the microcontroller is further configured for detecting	

	the presence of a foreign object between the inductive charger of the base system and the inductive charging receiver of the electronic device, wherein the determination is made based on a difference between a measured input power to the inductive charger and a received output power at the inductive charging receiver of the electronic device.	141
7.	Claim 10	148
	a) The base system of claim 1, wherein the base system operates in one of the first mode of operation and the second mode of operation depending on the power output level of the inductive charging receiver.	148
8.	Claim 11	149
	a) The base system of claim 1, wherein the operating frequency for the first mode of operation is within a first frequency range and the operating frequency for the second mode of operation is within a second frequency range, and wherein the first frequency range and the second frequency range are different.	149
9.	Claim 13	150
	a) The base system of claim 1, wherein the received first communication for the first mode of operation and the received second communication for the second mode of operation are different.	150
10.	Claim 14	151
	a) The base system of claim 1, wherein the frequency range of the power delivered to the battery for the first mode of operation is based on the first protocol and the frequency range of the power delivered to	

	the battery for the second mode of operation is based on the second protocol.....	151
B.	Ground 2: <i>Sogabe</i> in view of <i>Azancot</i> and <i>Walley</i> discloses and/or suggests claim 6	152
1.	Claim 6	152
a)	The base system of claim 1, wherein one of the first mode of operation and the second mode of operation is a proprietary mode of operation.	152
C.	Ground 3: <i>Sogabe</i> in view of <i>Azancot</i> and <i>Baarman</i> discloses and/or suggests claim 7	155
1.	Claim 7	155
a)	The base system of claim 1, wherein the microcontroller is further configured for sending a ping to the electronic device through the inductive charging coil to determine which of the first mode of operation and second mode of operation to use, wherein the determination is made based on the received communication from the inductive charging receiver of the electronic device in response to the ping.	155
D.	Ground 4: <i>Sogabe</i> in view of <i>Azancot</i> and <i>Muratov</i> discloses and/or suggests claim 8	165
1.	Claim 8	165
a)	The base system of claim 1, wherein one of the first mode of operation and the second mode of operation is based on a Wireless Power Consortium standard.....	165
X.	CONCLUSION.....	169

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 1-3, 5-11, 13-14, and 24 (“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. 1009	U.S. Patent No. 9,294,153 (“ <i>Muratov</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. 1035	U.S. Patent No. 8,234,509 (“ <i>Gioscia</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>WangI</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> ”)

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.)

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 1-3, 6-7, 9-11, 13-14, and 24 and July 12, 2011 to October 12, 2011 for claims 5 and 8. 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 1-3, 5-11, 13, 14, and 24 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 1-3, 6-7, 9-11, 13-14, and 24 and July 12, 2011 to October 12, 2011 for claims 5 and 8. 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 1-3, 6-7, 9-11, 13-14, and 24 and July 12, 2011 to October 12, 2011 for claims 5 and 8). 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 (emphasis in original).) The potential difference is also called voltage and is expressed in units of volts. (*Id.*, 10.)

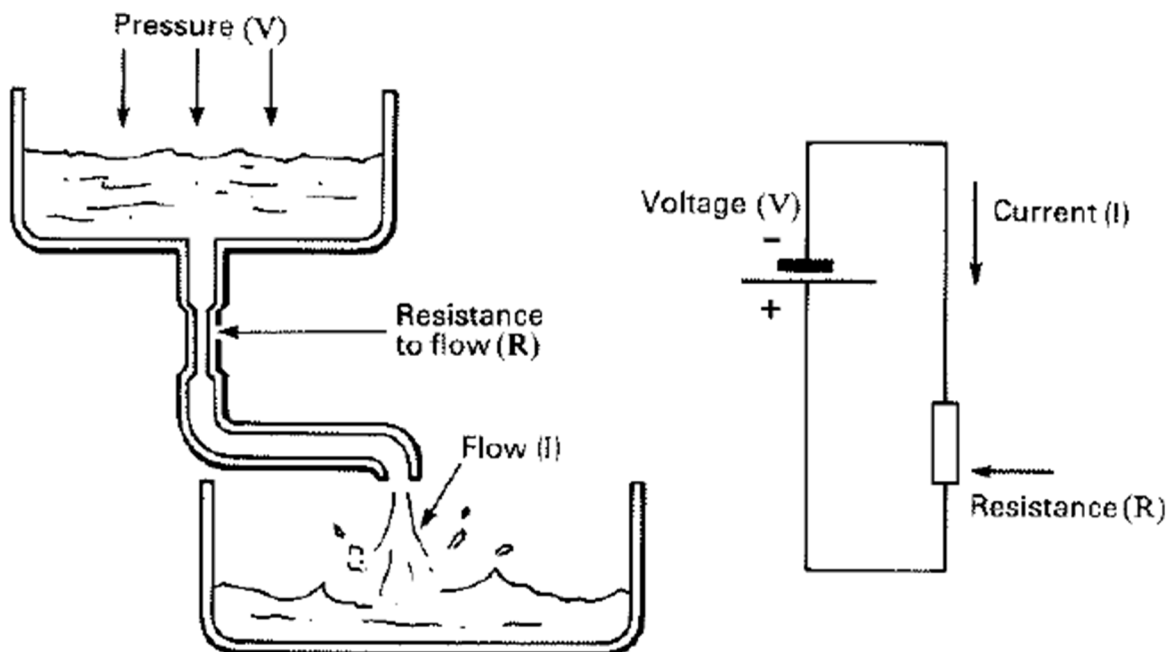
28. Additionally, a person of ordinary skill would have known that resistance is another fundamental concept involved in the flow of electrons. “Resistance is a property of all materials that reduces the flow of electricity through them,” so that “[t]he higher the resistance, the more difficult it is 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.

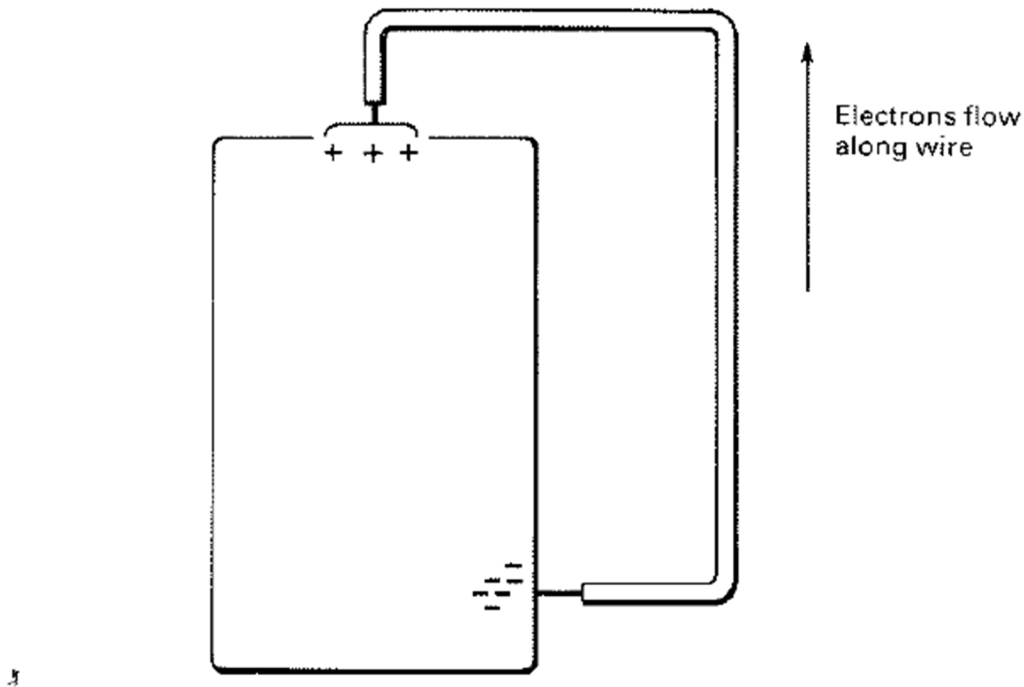
fig 2.5 a plumbing analogy: voltage, current and resistance all have their equivalents in the water system



(*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*

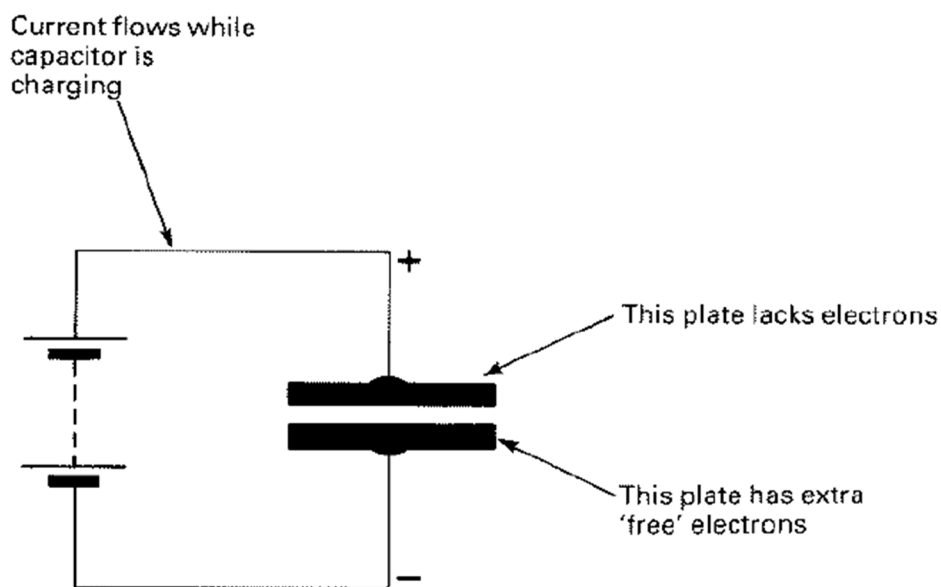


(*Id.*, FIG. 2.3.) A person of ordinary skill would have known that without such a closed path (*e.g.*, as shown above in Figure 2.3), current cannot flow. (*Id.*, 8-11, FIGS. 2.3-2.5.)

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*



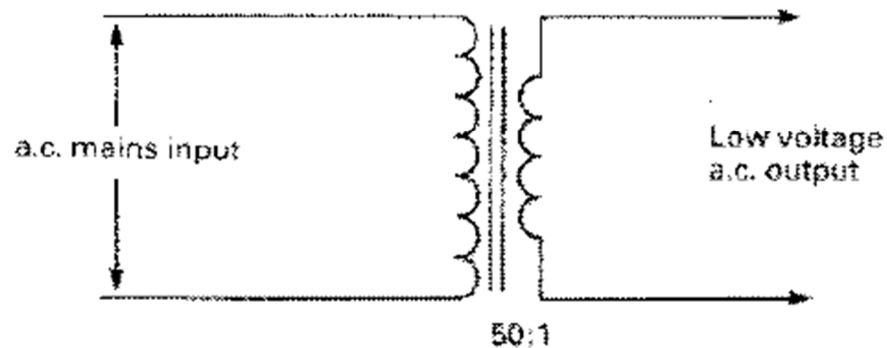
(*Id.*, FIG. 3.8.) A person of ordinary skill would have known that “[i]n this state the capacitor is said to be *charged*,” and [i]f the charged capacitor is connected in a

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).)

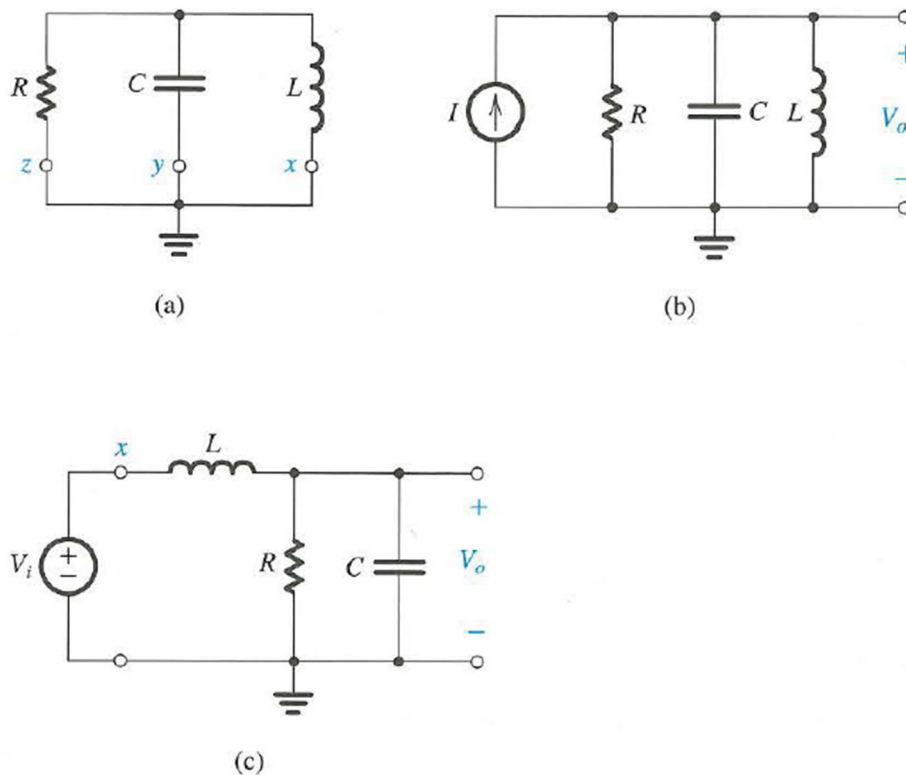


Fig. 11.17 (a) The second-order parallel LCR resonator. (b) and (c) Two ways for exciting the resonator of (a) without changing its *natural structure*. The resonator poles are the poles of V_o/I and V_o/V_i .

(*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.)

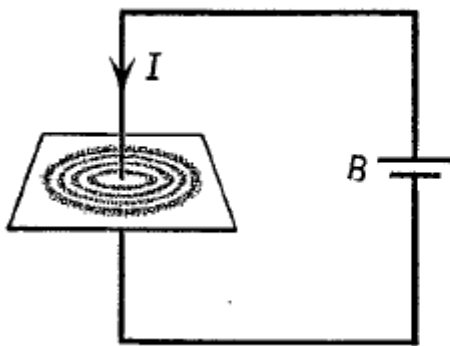
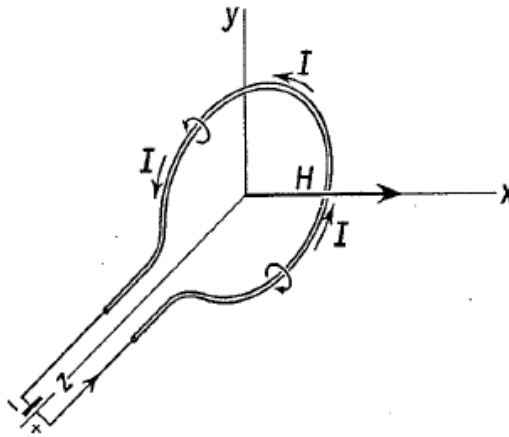


Fig. 30-2 Pattern formed by iron filings showing the circular magnetic field around a wire carrying current.

(*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.)

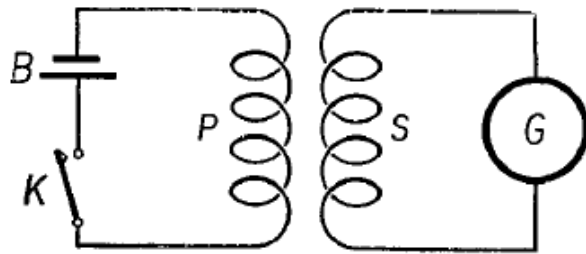


Fig. 32-3 Faraday's experiment on electromagnetic induction.

(*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.*)

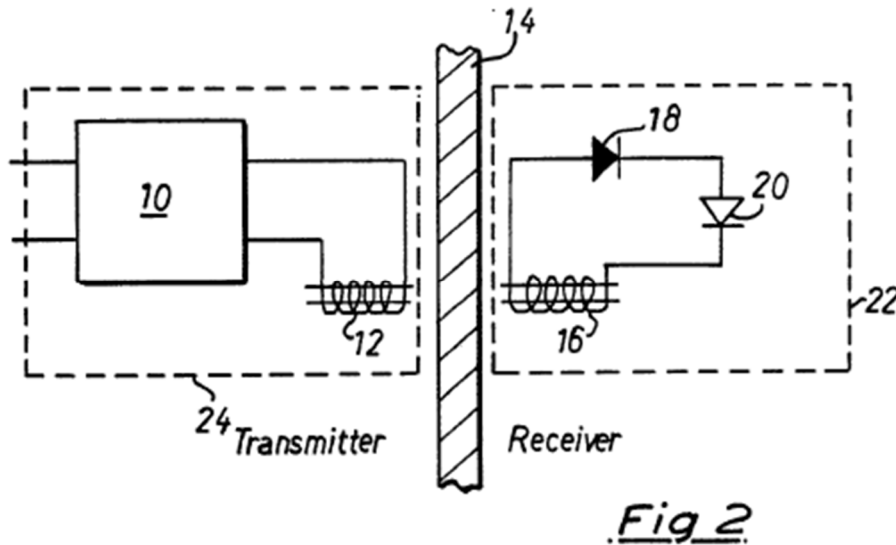
44. Therefore, in order to maintain current in the secondary circuit, the current in the first circuit can be continuously varied. By varying the current in the first circuit, the magnetic field (and therefore, magnetic flux) generated by the primary coil P is continuously varied, thereby inducing a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

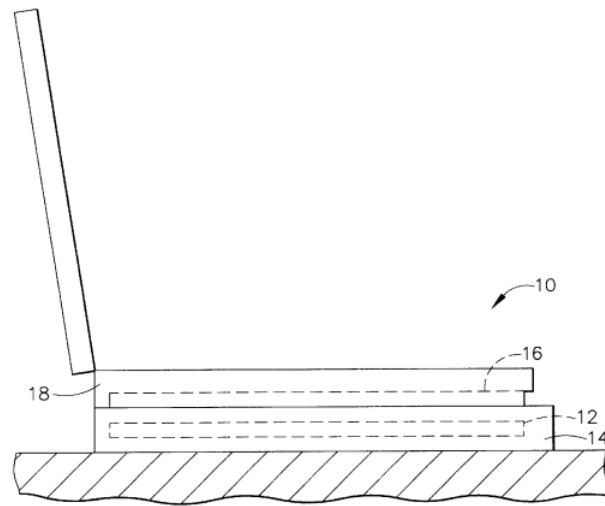


FIG. 1

(*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.

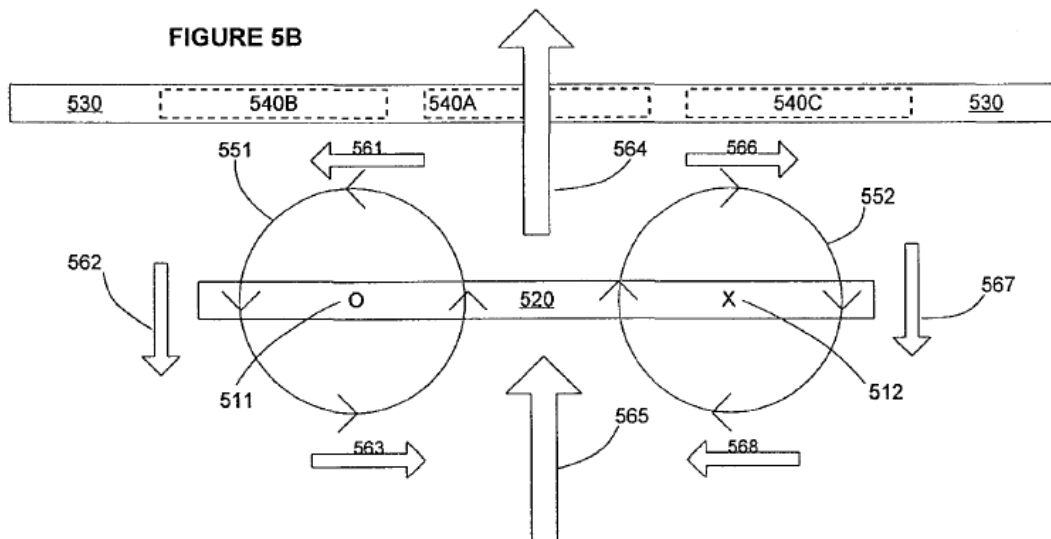
(Ex. 1047, Abstract.)

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.

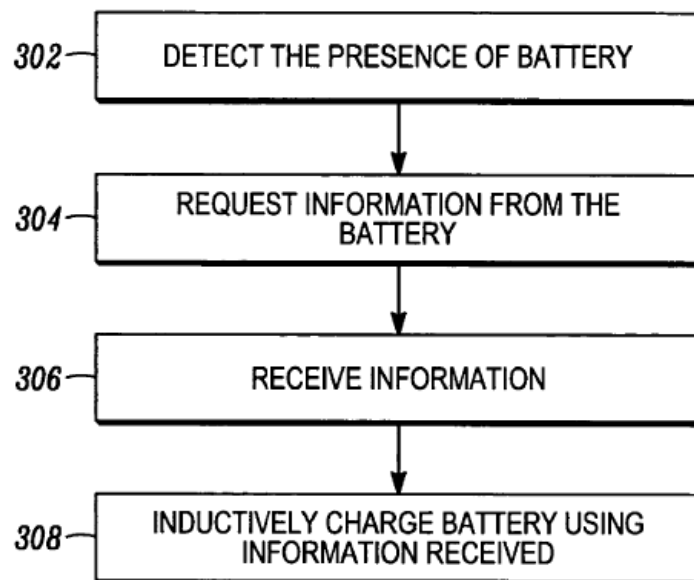
(*Id.*, 8:55-9:52.)



(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.)

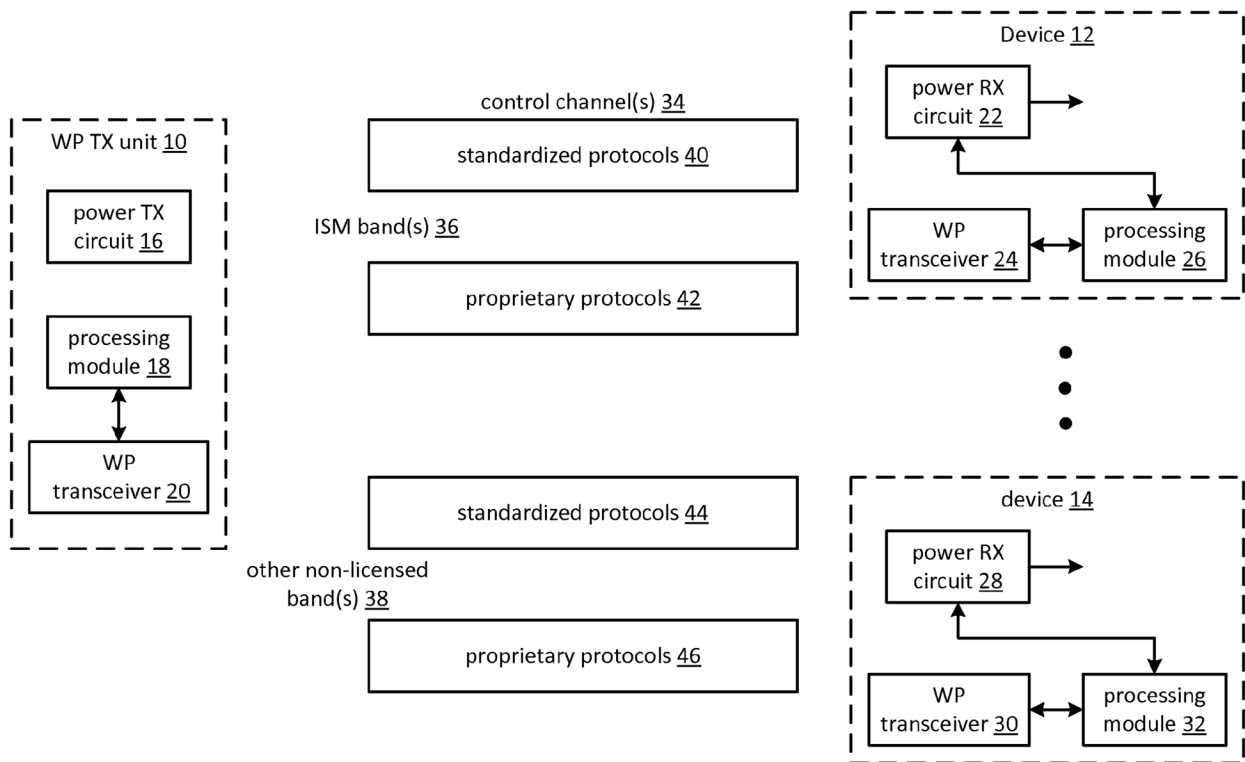


FIG. 1

(*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.)

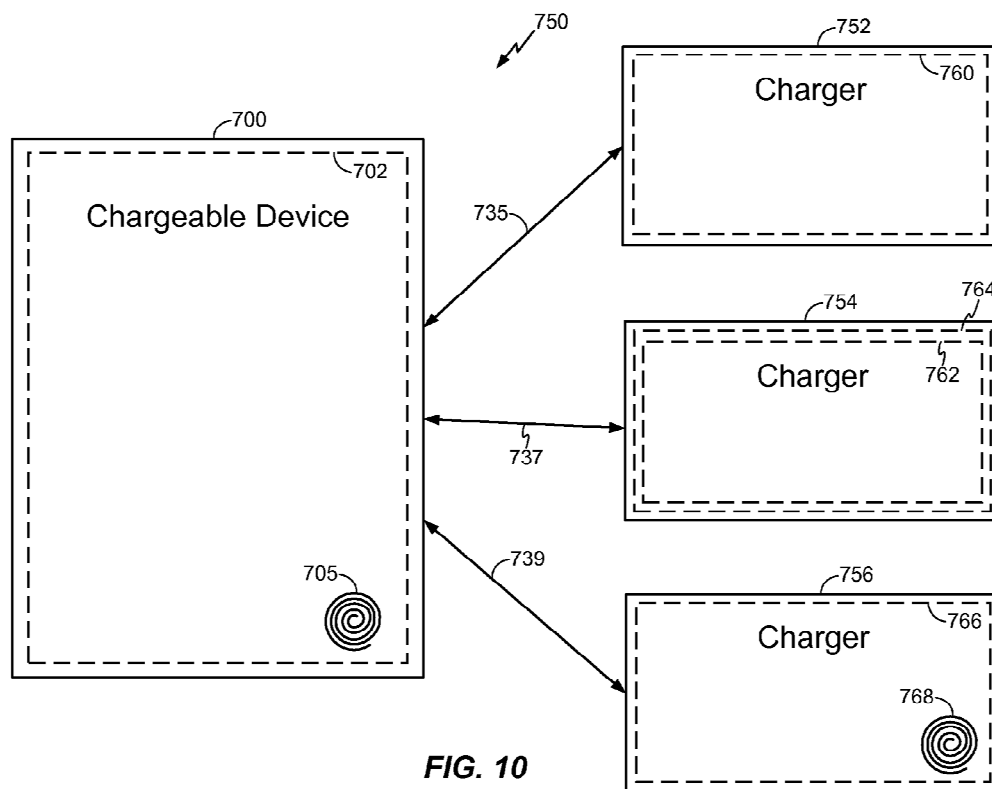
57. *Jakubowski* also discloses that a wireless power charger can include a mechanical button to easily switch between charging protocols to support compatibility with different types of wireless power devices:

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.)

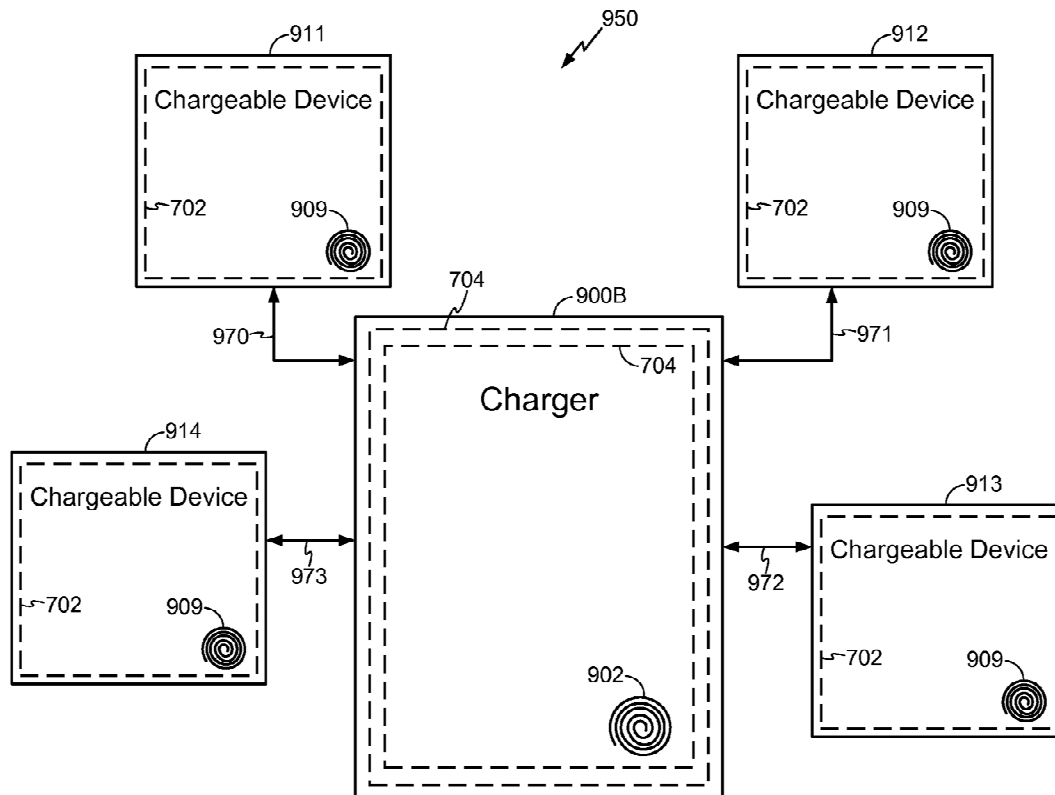


FIG. 16

(*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.**

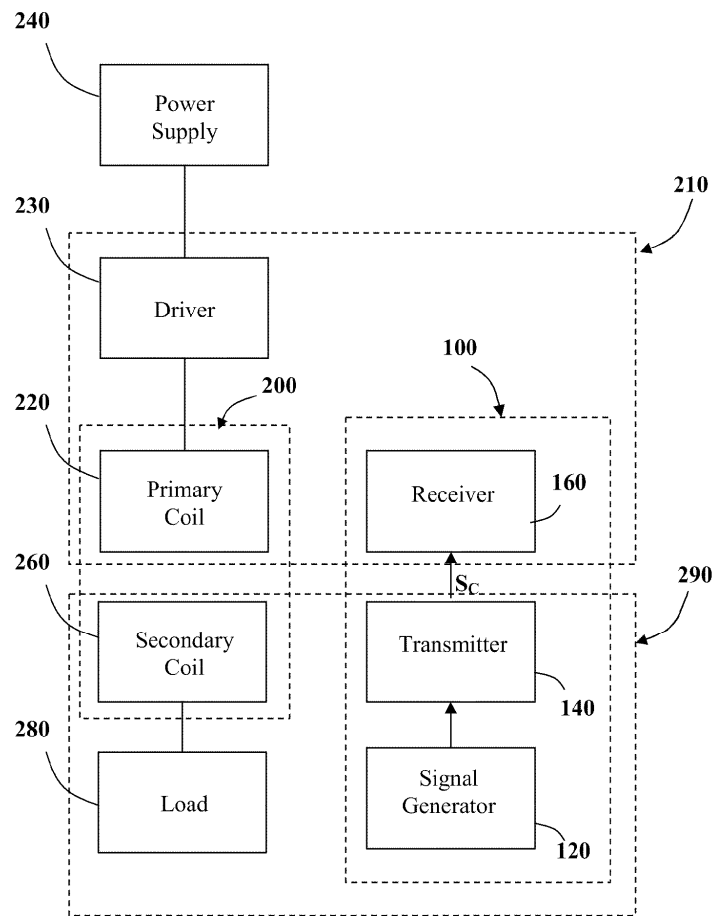
(Ex. 1035, 19:3-20, 21:7-18, FIGS. 10-11.)

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:

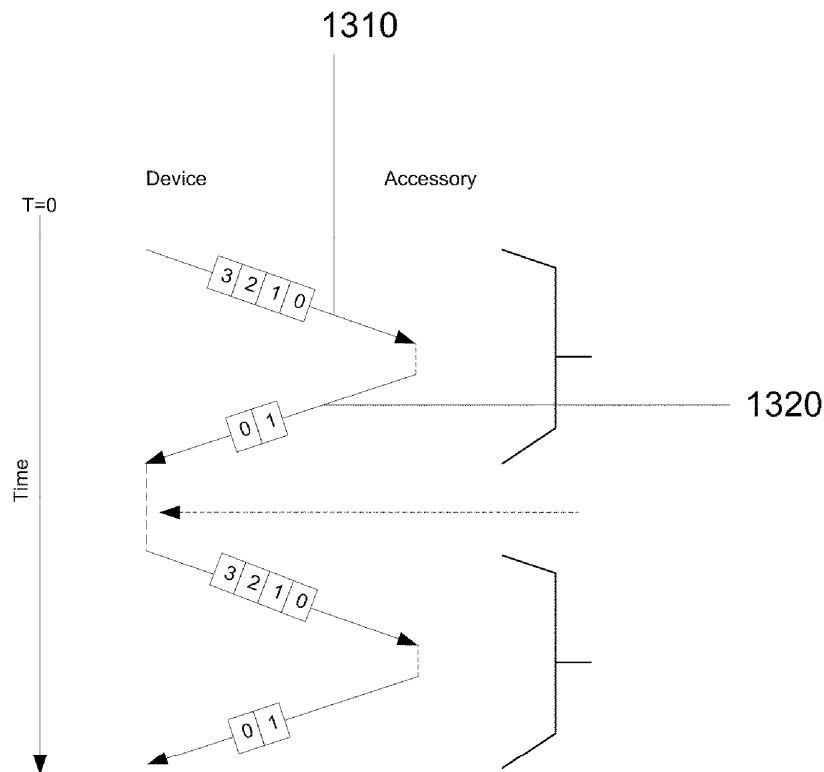


FIG. 13

(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 and July 12, 2011 to October 12, 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

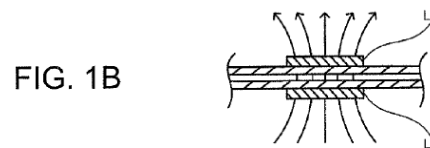
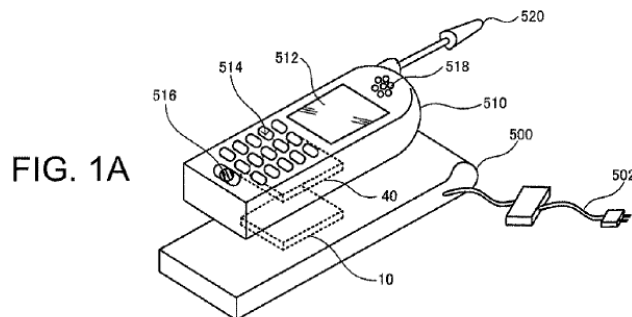
69. I rely on the disclosures and analysis thereof of the prior art discussed in this Section VIII for my opinions regarding their respective teachings and

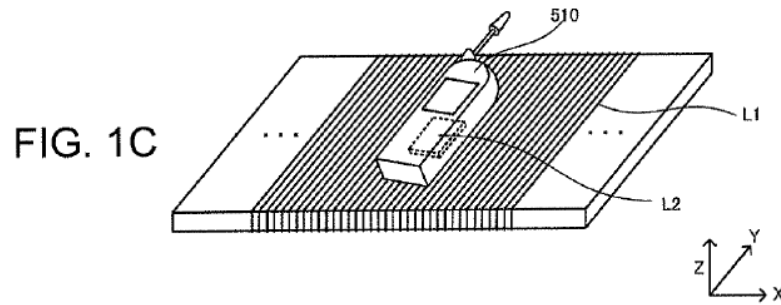
suggestions as applied to the challenged claims of the '777 patent below in Section IX. Accordingly, the following discussions are incorporated into my analysis below in Section IX.

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 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).)

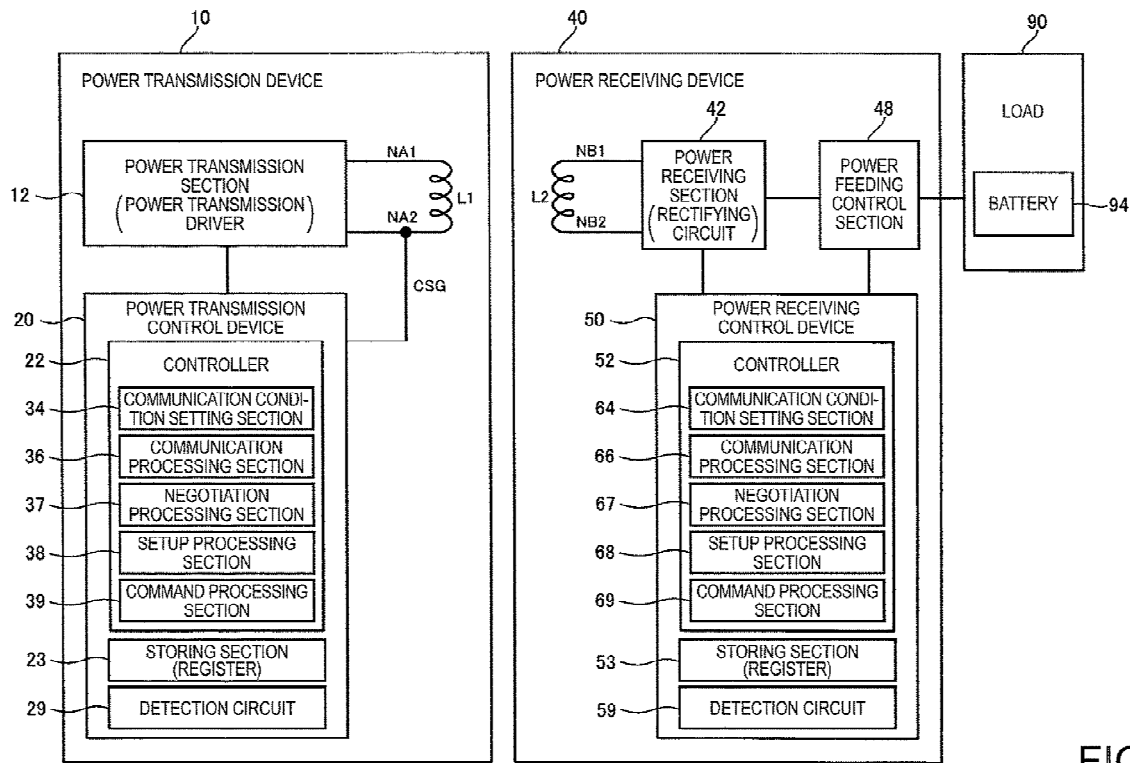


FIG. 2

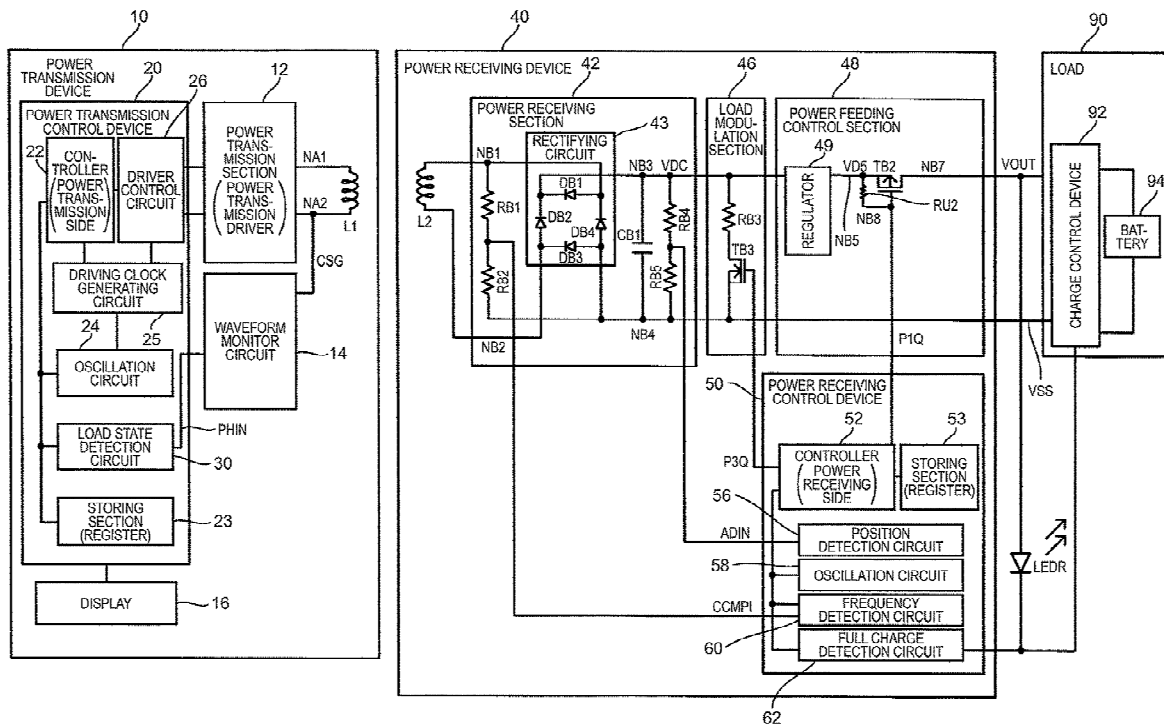


FIG. 9

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

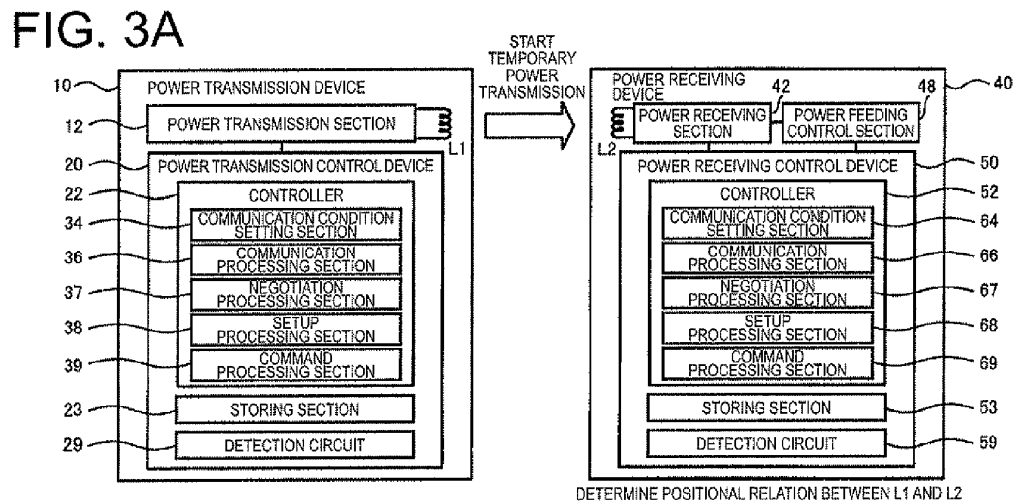
receiving device 40 (storing section 53) has communication condition information most suitable for the power transmission of 0.5 watts. Therefore, the communication under the optimum communication condition for the contactless power transmission of 0.5 watts can be performed by the following manner. 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.

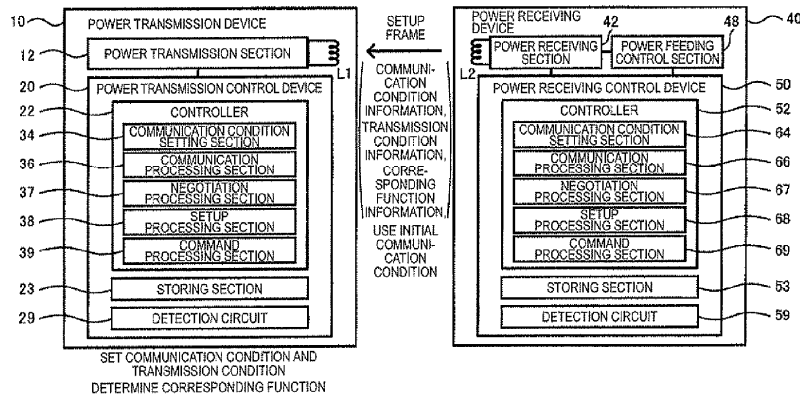
(*Id.*, 10:45-11:16.)

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.)



(*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

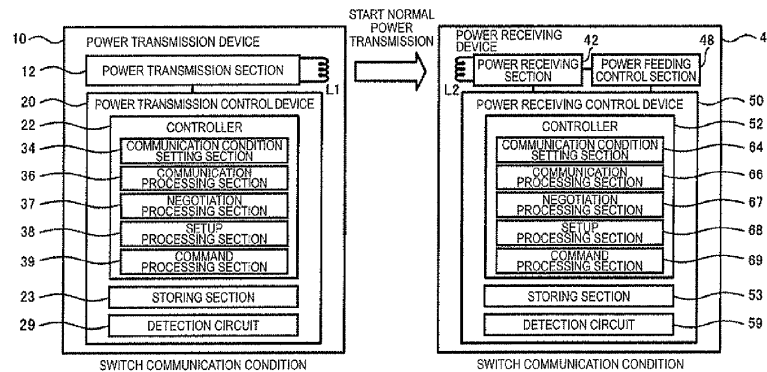
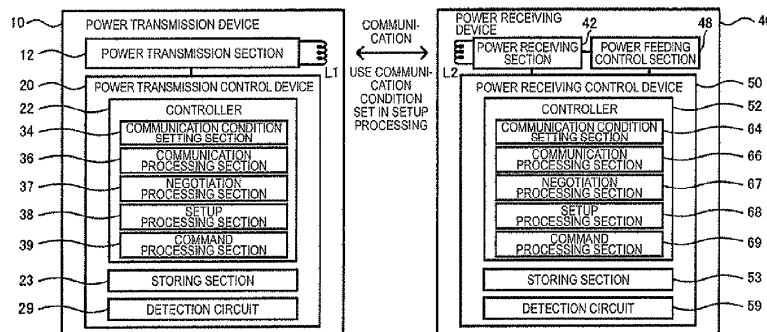


FIG. 5B



(*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.)

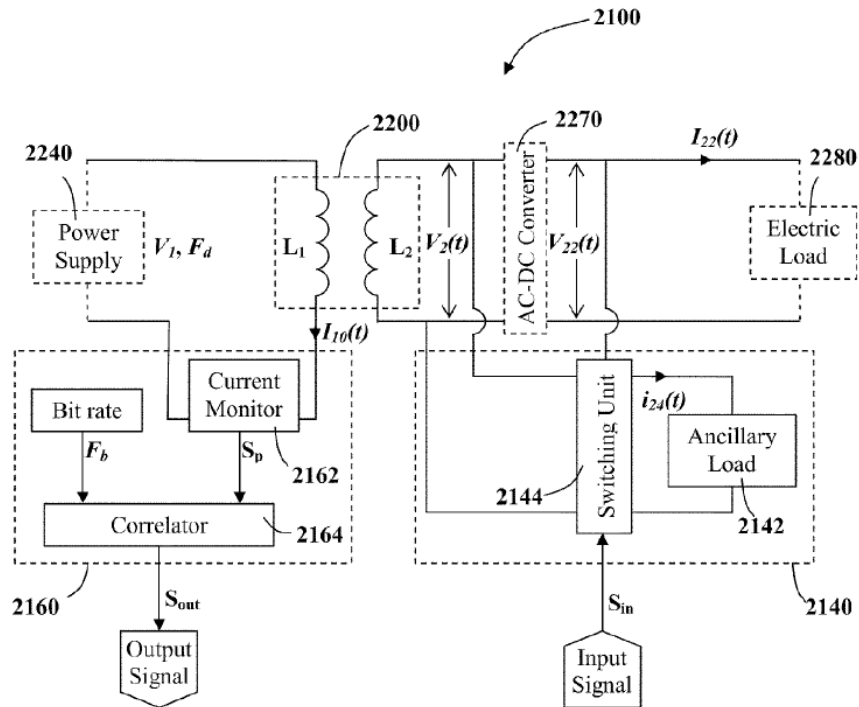


Fig. 2a

(*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.)

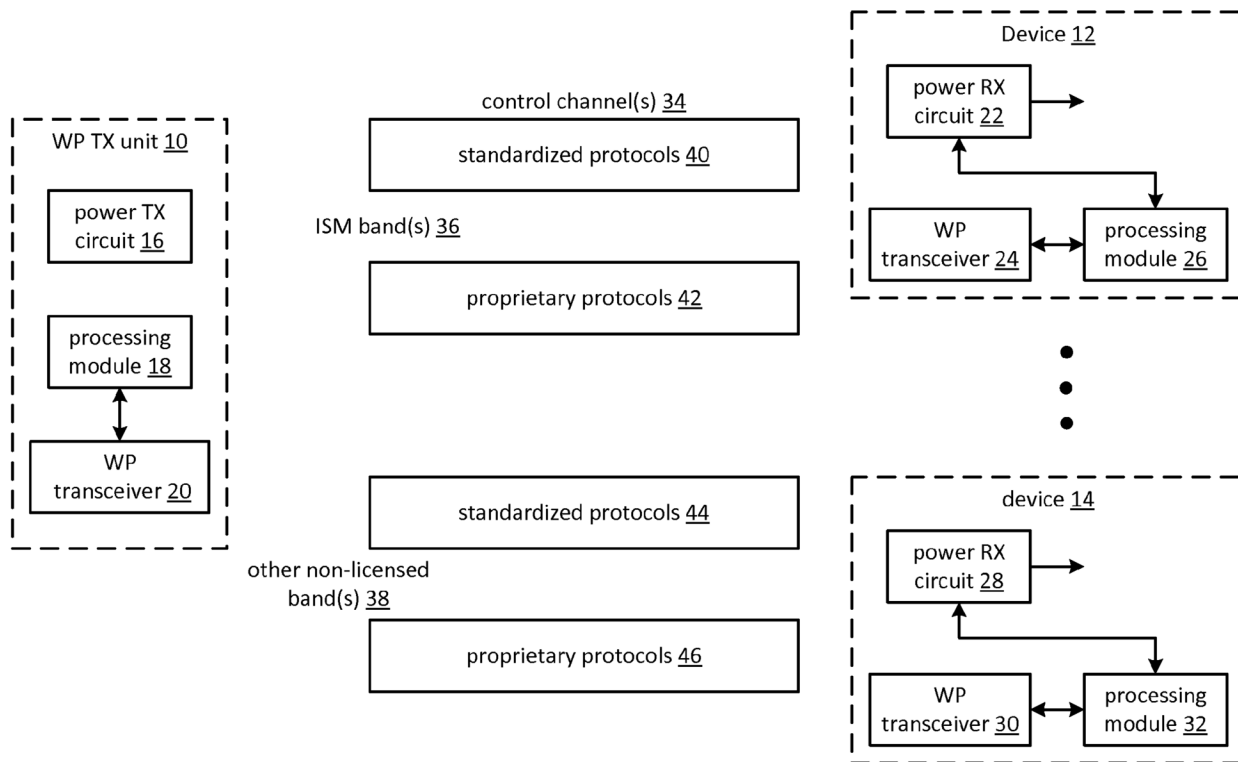


FIG. 1

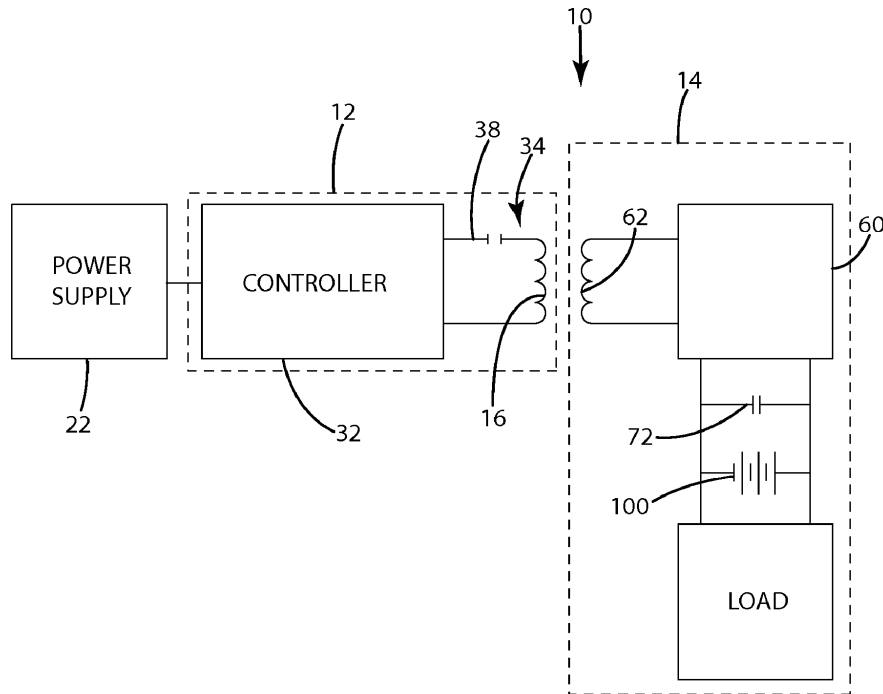
(*Id.*, FIG. 1.)

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.)

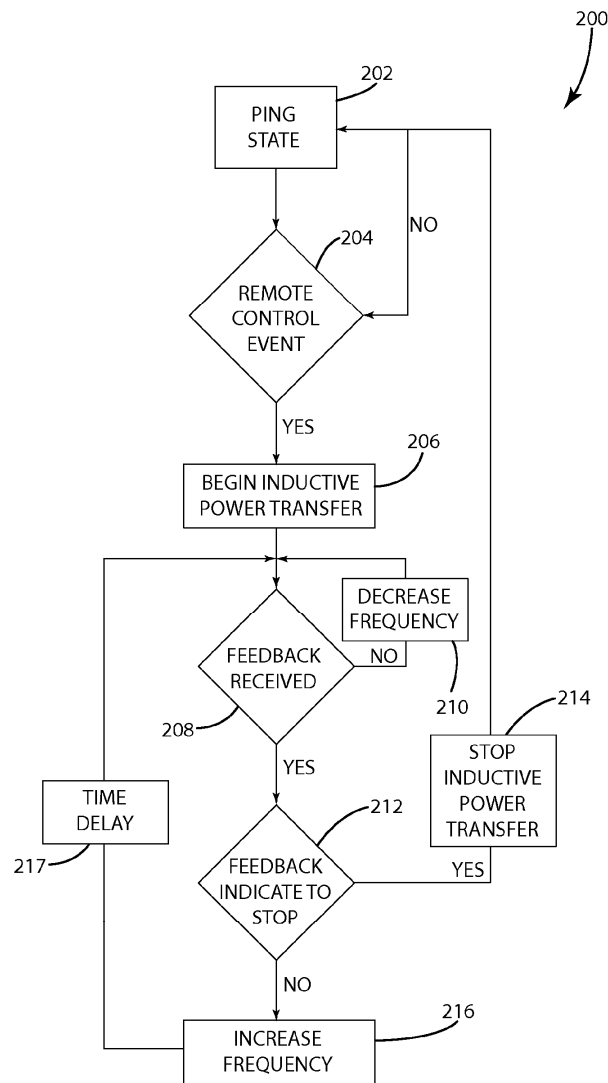


Fig.4

(*Id.*, FIG. 4.)

E. *Muratov* (Ex. 1009)

85. I understand that *Muratov* is an issued United States patent. (Ex. 1009, Cover.) My understanding is that *Muratov* was filed February 22, 2011 and issued March 22, 2016. (*Id.*)

86. *Muratov* discloses using the understood and adopted Wireless Power Consortium/Qi standard. (*See generally* Ex. 1009.) For instance, *Muratov* discloses “Qi establishes a common language for inductive chargers and devices to talk to one another. So any device with a Qi-enabled accessory or with Qi built directly into it can charge on any Qi inductive charging pad.” (*Id.*, 2:13-16.) Prior to the Qi standard, two wireless power devices “had to be designed specifically for each other, but devices and chargers designed to support the standard established by the WPC [could] be freely interchanged.” (*Id.*, 2:20-26; *see also id.*, 7:6-9.)

IX. THE PRIOR ART DISCLOSES OR SUGGESTS ALL RECITED FEATURES OF CLAIMS 1-3, 5-11, 13, 14, AND 24 OF THE '777 PATENT²

A. Ground 1: *Sogabe* in view of *Azancot* discloses and/or suggests claims 1-3, 5, 6, 9-11, 13, 14, and 24

1. Claims 1 and 24³

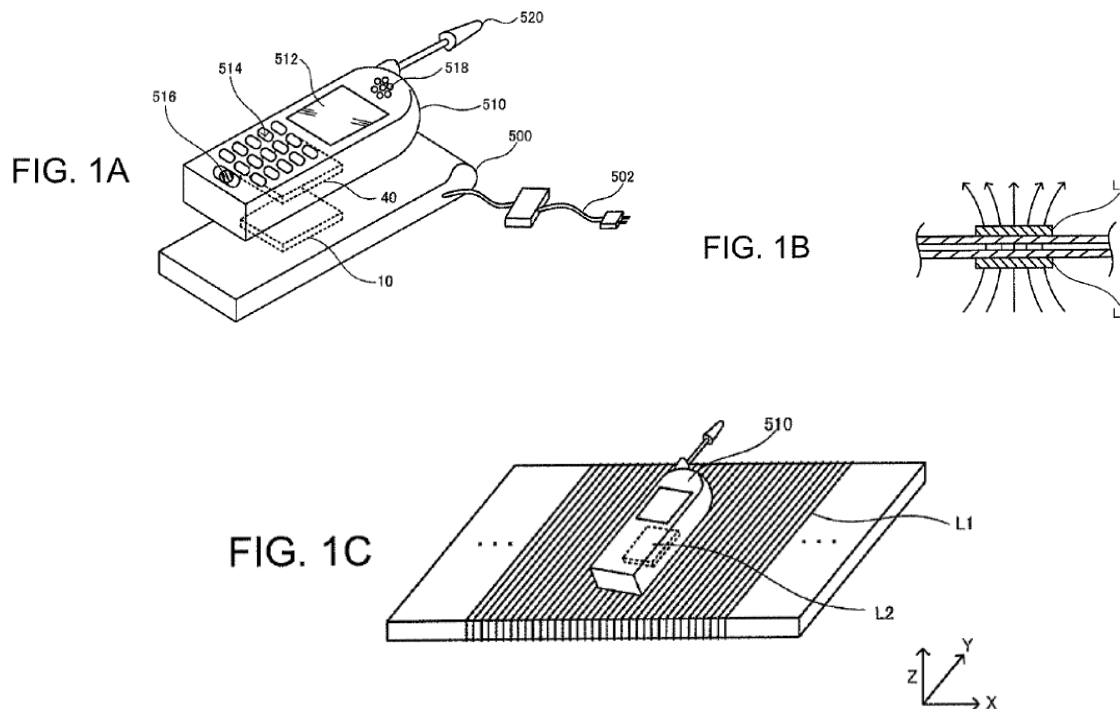
² In this section (Section IX), I refer to exhibits other than those identified prior art reference(s) that disclose and/or suggest the claimed limitations. Such exhibits reflect the state of the art known to a person of ordinary skill in the art at the time of the alleged invention. (*See also* my discussions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

³ Claim 24 substantively tracks claim 1. The differences between the claim language is represented/identified by **blue highlighting**. Limitations 1(m)-1(n) and 24(m)-24(n) are addressed separately. (*See* my discussions in §§IX.A.1(m)-(p).)

- a) **1(a)/24(a):** A **[base]** system for inductive charging of an electronic device comprising an inductive charging receiver and a battery electrically coupled to the inductive charging receiver, the **[base]** system comprising:

87. I have been asked to assume a scenario where the preamble is limiting. Under that assumption, it is my opinion that *Sogabe* discloses these limitations. (See below and my discussions above in §VIII.A.)

88. For instance, *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 illustrated below in FIGS. 1A-1C (below). (Ex. 1005, 1:43-5:7, 5:59-6:38, FIGS. 1A-1C.)



89. The charger/cradle includes a power transmission device 10 (“PTD10”) and the cell phone (or other device) (“electronic device”) includes a power receiving device 40 (“PRD40”) coupled to a load/battery 90/94 (“battery”). (*Id.*, 5:16-19 (“FIG. 2 is a structural example of a power transmission device, a power transmission control device, a power receiving device, and a power receiving control device according to an embodiment.”), 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; FIG. 2 (annotated below).)

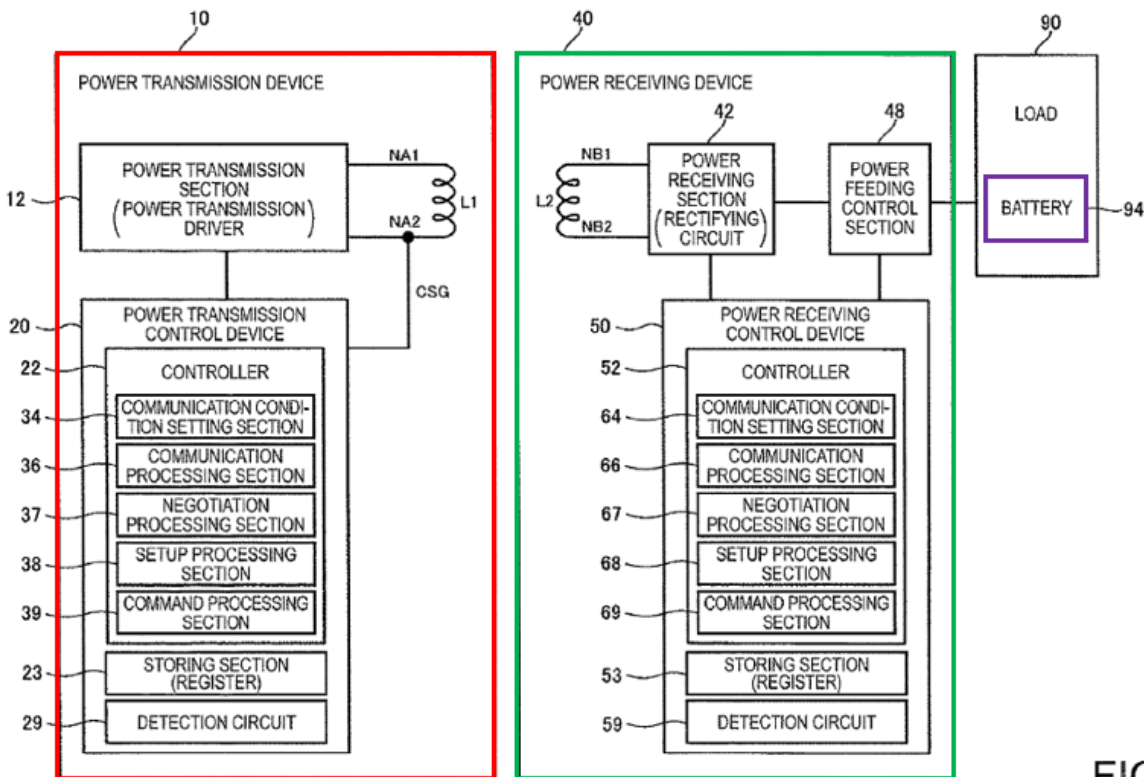


FIG. 2

(See also *id.*, FIG. 9 (annotated below), 5:33-35 (“FIG. 9 is a specific structural example of the power transmission device, the power transmission control device, the power receiving device, and the power receiving control device according to the embodiment.”), 22:7-24:17 (describing additional component details of an exemplary system including **PTD10** and **PRD40**).)

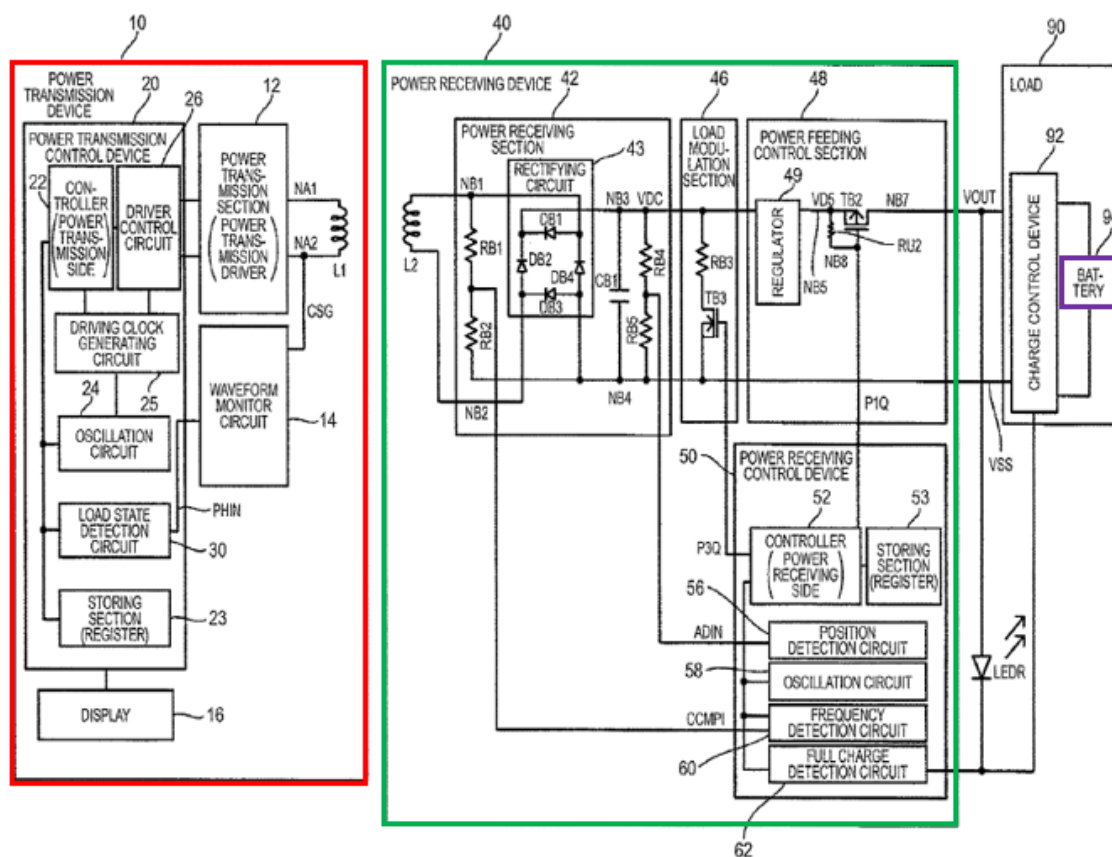


FIG. 9

90. As I discuss further below, *Sogabe* describes how the components within **PTD10** and **PRD40** operate to wirelessly charge or power **battery 94** of the “electronic device” (*e.g.*, cell phone), via electromagnetically coupled primary coil L1 and secondary coil L2. (*see* my discussions in §§IX.A.1(b)-(p), Ex. 1005, 6:56-14:32; *e.g.*, *id.*, 8:13-22 (**PRD40** includes power receiving section 42 (“PRS42”), power feeding control section 48 (“PFCS48”), and power receiving control device 50 (“PRCD50”), although the “structures” of **PRD40** and PRCD50 “are not limited to those shown in FIG. 2, and various modification, 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”), 8:23-36 (PRS42 converts ac voltage of secondary coil L2 into DC voltage “to charge a battery 94” coupled to PRD40); *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”).)

91. In my opinion, the apparatus (*e.g.*, charger/cradle) including PTD10, or PTD10 itself, is both a “base system” (1(a)) and a “system” (24(a)) as claimed. (*Id.*, 5:60-63, FIGS. 1A.) The apparatus including PRD40 (*e.g.*, cell phone 510 or other similar type of device (*id.*, 6:9-14 (“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.”)) and battery 94 (“battery”) is an “electronic device,” wherein the battery is “electrically coupled to” an “inductive charging receiver” (*e.g.*, PRD40 or PRS42, PFCS48, and PRCD50). Also, the charger apparatus with PTD10, cell phone apparatus PRD40 and its load/battery 90/94, collectively is also a “system” (24(a)). (*See my below analysis in §§IX.A.1(b)-(p).*)

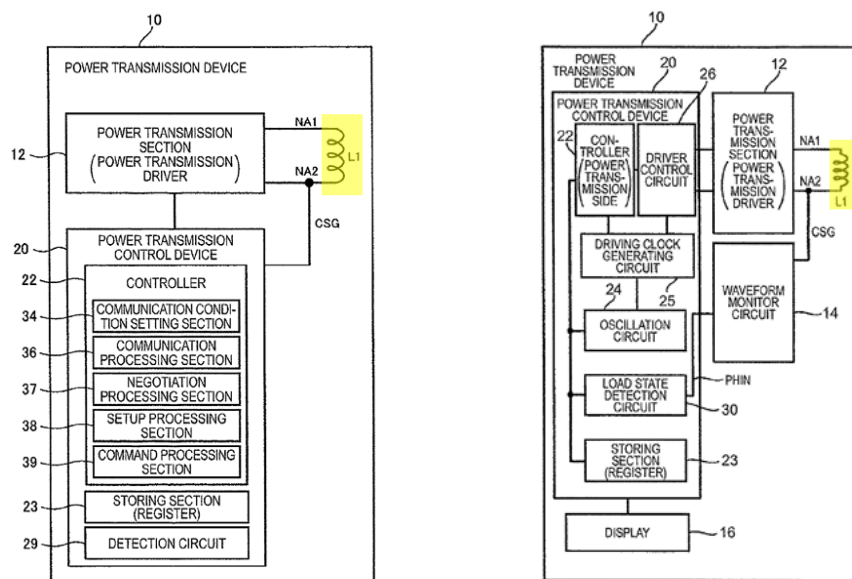
b) 1(b)/24(b): an inductive charging coil;

92. In my opinion, *Sogabe* discloses this limitation. For instance, *Sogabe* discloses that the “base system”/“system” (§IX.A.1(a)) includes a “primary coil L1”

(“inductive charging coil”) that is used to inductively transmit power in a contactless manner:

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.

(Ex. 1005, 6:15-22; *see also id.*, 1:20-23 (“The contactless power transmission makes it possible to perform transmission of electric power by utilizing electromagnetic induction without using metal contact.”), 6:50-57, FIGs. 2, 9.)
Figures 2 and 9 (below) illustrate examples of such a primary coil L1.



(*Id.*, FIGs. 2, 9 (annotated and excerpted).)

- c) **1(c)/24(c): a coil drive circuit electrically coupled to the inductive charging coil, wherein the coil drive circuit provides power to the inductive charging coil by switching a voltage input to the inductive charging coil at an operating frequency;**

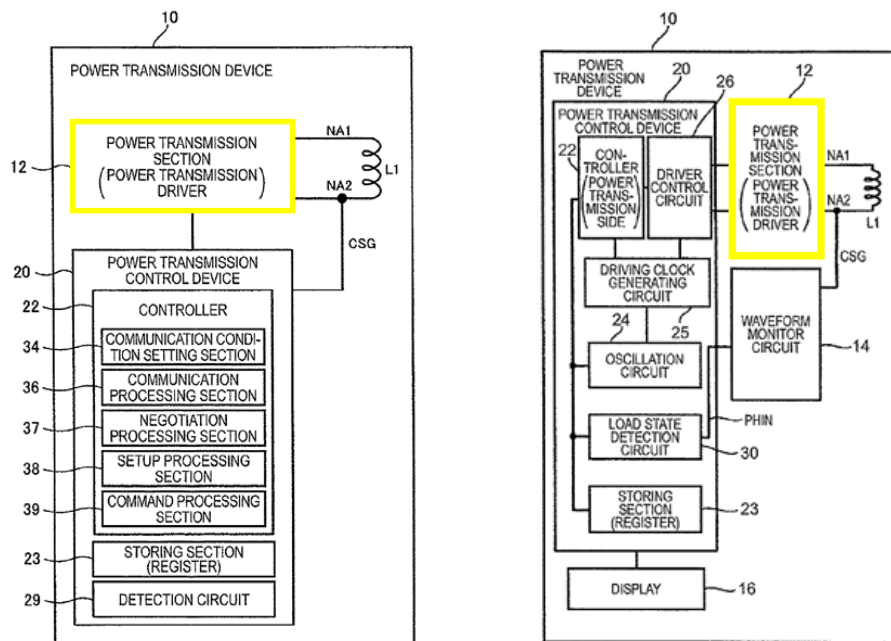
93. In my opinion, *Sogabe* discloses this limitation. For instance, *Sogabe* discloses that the “base system”/“system” (§IX.A.1(a)) includes power transmission section 12 (“**PTS12**”) (“coil drive circuit”) that includes a power transmission driver to supply an “AC voltage having a predetermined frequency at transmitting power” to the primary coil L1 (“electrically coupled to the inductive charging coil”):

The power transmission device 10 (a power transmission module, a primary module) may include the primary coil L1, a power transmission section 12, and the power transmission control device 20. The structures of the power transmission device 10 and the power transmission control device 20 are not limited to those shown in FIG. 2, and various modifications, such as omitting a part of components (e.g., the primary coil), adding another component (e.g., a waveform monitor circuit), and changing connections, can be made.

The power transmission section 12 generates an alternating-current (AC) voltage, and supplies it to the primary coil L1. Specifically, the power transmission section 12 generates an AC voltage having a predetermined frequency at transmitting power while generates an AC voltage having a frequency varied

corresponding to data at transmitting the data, thereby supplying it to the primary coil L1. **The power transmission section 12 may include, for example, a first power transmission driver for driving one end of the primary coil L1, a second power transmission driver for driving the other end of the primary coil L1, and at least one capacitor forming a resonance circuit together with the primary coil L1.** Each of the first and the second power transmission drivers included in the power transmission section 12 is an inverter circuit (a buffer circuit) composed of, for example, a power MOS transistor, and is controlled by the power transmission control device 20.

(Ex. 1005, 6:56-7:14, FIGs. 2, 9.)



(*Id.*, FIGs. 2, 9 (annotated and excerpted).)

94. *Sogabe* explains that **PTS12** includes a power transmission driver for driving each of the two ends of the primary coil, where the power transmission drivers are inverter circuits:

The power transmission section 12 may include, for example, a first power transmission driver for driving one end of the primary coil L1, a second power transmission driver for driving the other end of the primary coil L1, and at least one capacitor forming a resonance circuit together with the primary coil L1. **Each of the first and the second power transmission drivers included in the power transmission section 12 is an inverter circuit (a buffer circuit) composed of, for example, a power MOS transistor, and is controlled by the power transmission control device 20.**

(*Id.*, 7:4-14.) *Sogabe* explains that the drivers receive a “control signal” that is driven at a desired driving frequency to control the driver:

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.**

(*Id.*, 22:28-37.) This control signal causes the drivers in the **PTS12** to output an AC voltage to drive the primary coil L1 (“inductive charging coil”), such that the “coil drive circuit provides power to the inductive charging coil by switching a voltage input to the inductive charging coil at an operating frequency,” as claimed. (*Id.*, 6:65-7:14, 22:28-37.)

95. *Sogabe* further discloses that **PTS12** may provide power to the primary coil by switching the voltage input at a frequency “f1” during normal power transmission and a frequency “f01” during a setup phase. (Ex. 1005, 14:41-46 (“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.”), 15:34-50, 16:14-29, 17:41-47.)

96. A person of ordinary skill in the art would have appreciated *Sogabe*’s use of inverters to drive the coil at a desired frequency would have been consistent with conventional power transmission circuits of wireless power transmitters of the time. (Ex. 1006 (confirming such a skilled person’s state-of-art knowledge), 10:55-60 (“[A] direct current voltage source 2242 is intermittently connected to a primary coil L1 by a switch 2244. This produces a varying voltage signal V1(t) in the primary coil L1 which induces a secondary voltage V2 in a secondary coil L2.”), 10:63-67 (“The switch 2244 is controlled by a driver 2248 which receives a pulsing signal Fd

from a clock 2246. The pulsing signal Fd determines the frequency with which the direct current voltage source 2242 is connected to the primary coil L1.”), FIG. 2A; Ex. 1008, ¶0033 (“The controller 32 outputs control signals to a driver circuit 51 that controls the timing of the switching circuit 53. The driver circuit 51 includes driver electronics 50 a-b, and the switching circuit 53 includes FETs 52 a-b. The timing of the control signals to the driver electronics 50 a-b controls the timing of FETs 52 a-b and consequently the operating frequency of the tank circuit 34. ... The controller 32 produces control signals that alternately open and close the FETs 52 a-b to alternately connect the tank circuit 34 to VIN or ground at the desired operating frequency.”), FIG. 2C; *see also* my discussions above in §VIII.D; Ex. 1010, pp. 12-14.) Such conventional driver use, like that described by *Sogabe*, was well-understood in the art.

97. Thus, for the reasons I explained above, it is my opinion that *Sogabe* discloses a coil drive circuit electrically coupled to the inductive charging coil, wherein the coil drive circuit provides power to the inductive charging coil by switching a voltage input to the inductive charging coil at an operating frequency, like that claimed.

- d) **1(d)/24(d): a current detection circuit electrically coupled to the inductive charging coil; and**

98. In my opinion, *Sogabe* discloses this limitation. For instance, *Sogabe* discloses that the “base system”/“system” (§IX.A.1(a)) includes a power transmission control device 20 (**PTCD20**) that includes a detection circuit 29, which in the specific structural example shown in figure 9 corresponds to load state detection circuit 30:

The power transmission control device 20 performs various controls of the power transmission device 10, and can be realized by an integrated circuit (IC) device or the like. **The power transmission control device 20 may include a controller 22, a storing section 23, and a detection circuit 29.**

(Ex. 1005, 7:26-30.)

The detection circuit 29 detects data transmitted from the power receiving device 40. For example, if data is transmitted from the power receiving device 40 by load modulation, the **detection circuit 29 detects the transmitted data by detecting a load state on the power receiving side** (power receiving device or foreign object).

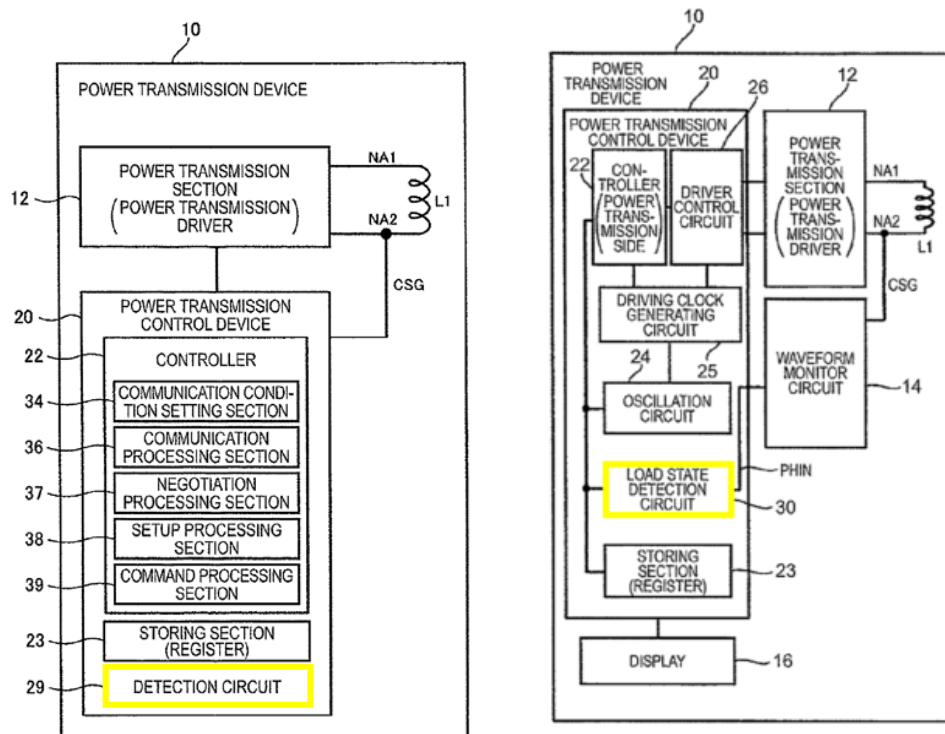
(*Id.*, 7:50-55.)

The induced voltage signal PHIN is capable of being detected as a waveform by the **load state detection circuit 30 of the power transmission control device 20.**

(*Id.*, 22:23-24.)

As for the **load state detection circuit 30**, the detection method is not limited to the pulse width detection method (phase detection method). Various methods such as the **current detection method** and the peak voltage detection method can be employed.

(*Id.*, 22:53-57; see also *id.*, 22:8-11, FIGs. 2, 9.)



(*Id.*, FIGs. 2, 9 (annotated and excerpted).)

99. As can be seen below in figure 14A and explained, that detection circuit 30 is coupled to the coil L1 and “detects current flowing at the coil terminal” (“current detection circuit electrically coupled to the inductive charging coil”),

where *Sogabe* further discloses that such current detection can be used as a communication method to receive data from the power receiving side:

The detection circuit 29 detects data transmitted from the power receiving device 40. For example, if data is transmitted from the power receiving device 40 by load modulation, the **detection circuit 29 detects the transmitted data by detecting a load state on the power receiving side** (power receiving device or foreign object). The load state detection can be realized by detecting variations in the waveform of an induced voltage signal (a coil terminal signal) of the primary coil L1. For example, a variation in a load state (a load current) on the power receiving side (the secondary side) induces a variation in the waveform of the induced voltage signal. The detection circuit 29 detects the variation in the waveform, and outputs a detection result (detection result information) to the controller 22.

(*Id.*, 7:50-63; *see also id.*, 20:41-46 (“The system information transferred in the negotiation phase shows methods for detecting load state on the power transmission side and the power receiving side. **Examples of the method for detecting the load state include** the pulse width detection method (the phase detection method), the **current detection method**, the peak voltage detection method, and the combination thereof.”), 20:53-57, 28:17-19 (“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.”)⁴, 28:19-26 (“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.”).)

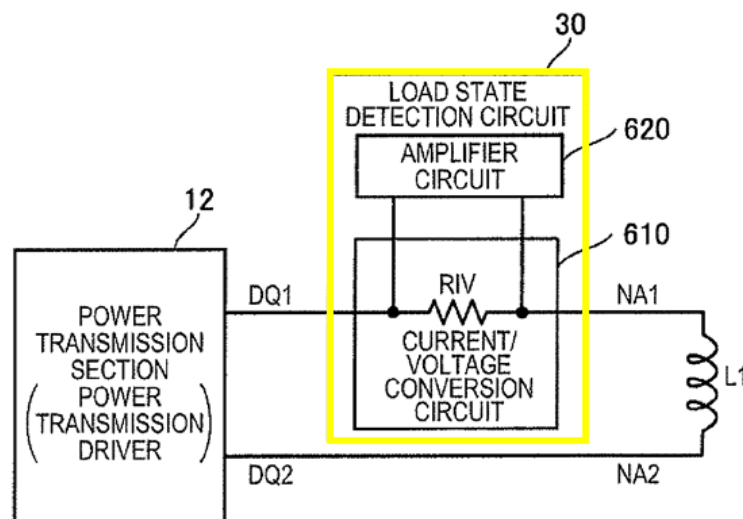


FIG.14A

(*Id.*, FIG. 14A (annotated).)

100. It is my opinion that *Sogabe*’s disclosure is consistent with that of the ’777 patent, which discloses using a current detection circuit to detect data

⁴ All emphasis is added unless noted otherwise.

transmissions from a receiver device. (Ex. 1001, 12:47-57 (“[T]he charger also includes a circuit that measures the current through ... the charger coil (in this case a current sensor is shown in the figure as an example). Various demodulation methods for detection of the communication signal on the charger current ... are available.”).)

101. Thus, for the reasons I explained above, it is my opinion that *Sogabe* discloses a current detection circuit electrically coupled to the inductive charging coil, like that claimed.

e) **1(e)/24(e): a microcontroller, wherein the microcontroller is configured for:**

102. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. *Sogabe* discloses PTD10 includes a controller 22 that 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.” (Ex. 1005, 7:36-38, 7:28-30, 7:34-35.) Controller 22 controls PTD 10 of charger 500 (or a similar wireless power charger apparatus). (Ex. 1005, 7:34-38 (“The controller 22 (on the power transmission side) controls the power transmission device 10 and the power transmission control device 20.”), 22:8-11, FIGS. 2, 9.)

103. While a person of ordinary skill in the art would have understood that *Sogabe* discloses that controller 22 may be realized using a variety of standard

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

104. A person of ordinary skill in the art would have understood that the “ASIC circuit” and “micro computer” disclosed by *Sogabe* as the controller 22 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.

105. 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 such a skilled person’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. Further, 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.)

106. 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.”), 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.) 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 L_2 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 SM . The ancillary load 2142 is intermittently connected to the secondary coil L2 at a rate determined by the modulated signal SM .

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.)

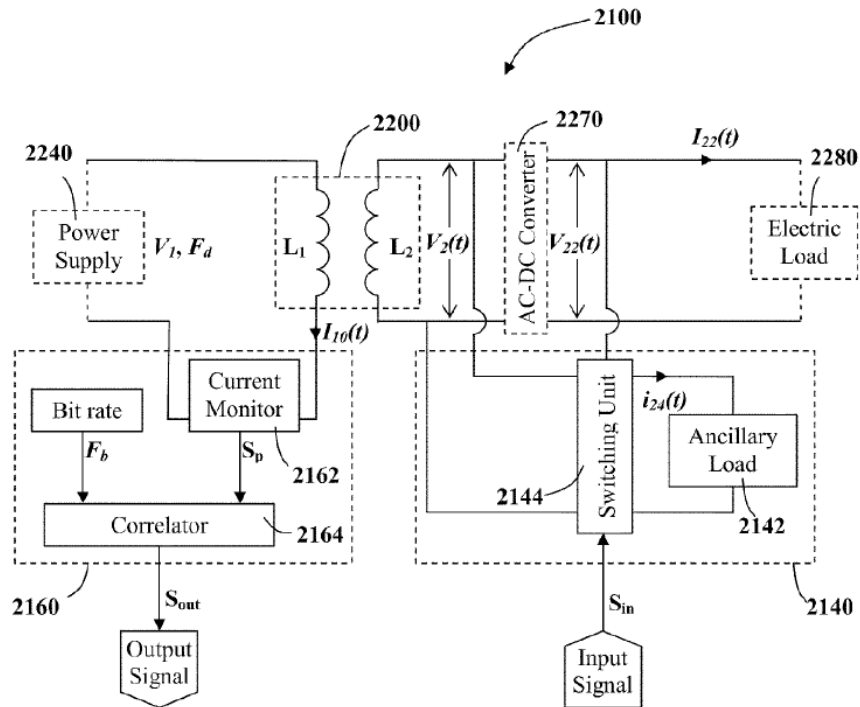


Fig. 2a

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

107. *Azancot* also discloses that the circuitry on the device driving the primary coil L_1 that transmits power also includes a understood and then conventional flyback power source 2240F comprising a driver 2248, and a current monitor 2162 (Ex. 1006, 8:9-11 (“The inductive energy coupling is typically a device wherein the primary coil is galvanically isolated from said secondary coil.”), 10:38-11:3, FIGs. 2A, 2D), similar to the base system disclosed by *Sogabe* (see my above analysis in §§IX.A.1.a-d). *Azancot* further discloses that circuitry controlling the primary coil L_1 includes a conventional microcontroller 2168, which is used to

control the power that is wirelessly transmitted to the load 2280 in the device receiving the power:

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 F_b . The resulting output signal S_{out} is passed to a microcontroller 2168 which may use the output signal S_{out} 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.

An exemplary use of the receiver circuit 2160 of FIG. 2 c is highlighted in FIG. 2 d which shows the receiver circuit 2160 configured to control a flyback power source 2240F. In a flyback converter, a direct current voltage source 2242 is intermittently connected to a primary coil L_1 by a switch 2244. This produces a varying voltage signal $V_1(t)$ in the primary coil L_1 which induces a secondary voltage V_2 in a secondary coil L_2 (FIG. 2 a). The secondary coil L_2 is generally connected to a smoothing

circuit such the AC-DC converter 2270 shown in FIG. 2 b to produce a DC output.

The switch 2244 is controlled by a driver 2248 which receives a pulsing signal F_d from a clock 2246. The pulsing signal F_d determines the frequency with which the direct current voltage source 2242 is connected to the primary coil L_1 . The power delivered to the primary coil L_1 may be regulated by varying the duty cycle of the switch 2244. The duty cycle is the proportion of the time between pulses during which the switch 2244 is closed.

(Ex. 1006, 10:38-11:14; *see also id.*, 8:9-11 (“The inductive energy coupling is typically a device wherein the primary coil is galvanically isolated from said secondary coil.”), FIGs. 2c-d.)

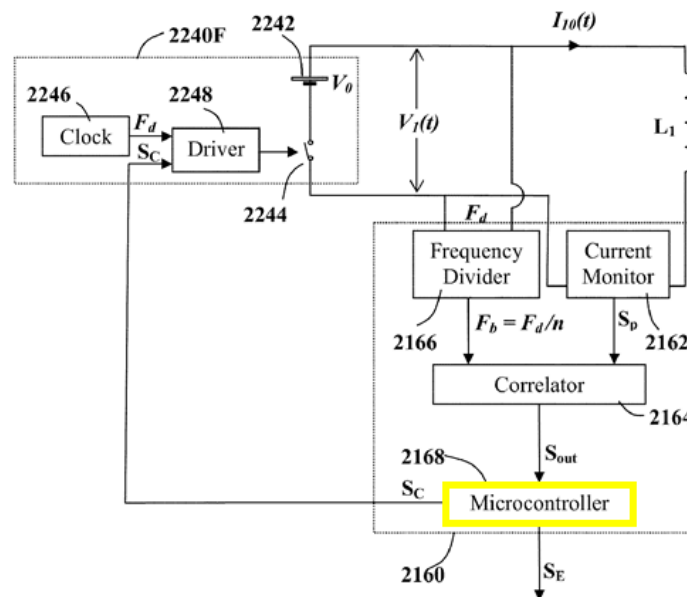


Fig. 2d

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

108. *Azancot* also discloses that microcontroller 2168 of the power transmission side can process feedback signals from the device receiving power, such that the power receiving device is able to control power that is output by the transmission side. (*Id.*, 8:9-11 (“The inductive energy coupling is typically a device wherein the primary coil is galvanically isolated from said secondary coil.”), 8:60-65, 10:11-37, 10:38-52, 11:4-14, FIGs. 2a, 2d.) More specifically, *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 (the wireless power coupling) to a receiver circuit 2160 on the power transmission side. (*Id.*, 9:58-63, 10:20-37, FIG. 2B.) For instance, *Azancot* discloses:

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.) The data sent from the power receiving circuit to the power transmitting circuit can then be used by the microcontroller to regulate and/or control power output. (*Id.*, 10:38-11:14, FIGs. 2C, 2D.)

109. 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 transmission 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 combination 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 such an implementation 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 nothing more than a simple substitution to obtain a predictable microcontroller-based implementation.

110. In my opinion, 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, 7:36-38 (“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.”)). Further, *Azancot* (consistent with the state of the art disclosures I discussed above) discloses using microcontrollers to control similar wireless power systems as previously discussed. (See my discussions above in this section.) 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.)

111. 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 a wireless power system comprising a microcontroller for controlling the system, as known and disclosed in the prior art (as I explained above).

112. Such reasons, motivations, and expectation of success relating to implementing such a “microcontroller” in the modified *Sogabe* system/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 claims 1 and 24. (See §§IX.A.1.f-n.)

- f) **1(f)/24(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:**

113. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I explain 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. For more context, *Sogabe* explains the following:

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.

(Ex. 1005, 9:7-15.) *Sogabe* also explains that

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.

(*Id.*, 11:56-12:13; *see also* 3:54-4:65, 10:38-54.)

114. 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.)

115. *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.)

116. 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.)

117. During setup processing, a communication condition setting section 34 and a communication processing section 36 included in the controller 22 (that controls the PTD 10 as I discussed previously) 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.)

118. 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.⁵ (See my below analysis in §§IX.A.1.g-h.)

119. As I explained previously, the *Sogabe-Azancot* system comprises a microcontroller that controls the operation of power transmission device 10. (See my above analysis in §IX.A.1.e.) For more context, *Sogabe* discloses the following:

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.

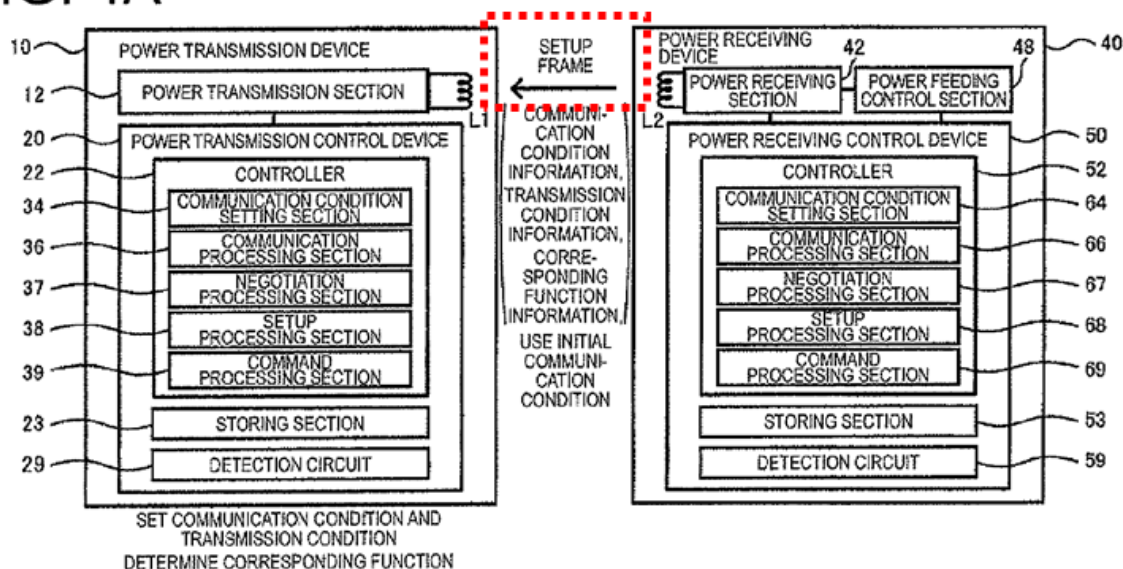
(Ex. 1005, 7:34-45, FIGs. 2, 9.) Given that a microcontroller of the *Sogabe-Azancot* system controls and operates the power transmission device, the *Sogabe-Azancot*

⁵ In a parent application, PO 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.)

combination discloses and/or suggests the microcontroller “operating in a first mode of operation using a first protocol” as claimed in claim element 1/24(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/system would have been configured to operate in such a first mode of operation that includes processes like those recited in claim elements 1/24(g)-(h) and (m)-(n). (*See* my analysis below in this section, and in §§IX.A.1.g-h, m-n.)

120. Moreover, *Sogabe*’s setup stage communication method “comprises 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 discussed previously. (Ex. 1005, 11:33-55, 16:14-16, 25:64-26:2.)

FIG. 4A



(Ex. 1005, FIG. 4A (illustrating uni-directional messaging during setup operation).)

121. 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. (Ex. 1005, 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.”).)

122. 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 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. (Ex. 1005, 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.”).)

123. For more context, *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.)

124. Furthermore, the power receiving device 40 sends the “start frame,” which is never sent by the power transmission device. (Ex. 1005, 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.)

125. 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, claims 1 and 24 state that 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 1(i), which recites a “second protocol” that “***defines*** bi-directional messaging.” (See my below discussion in §IX.A.1(i).) Moreover, such an understanding is also consistent with the 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.)

126. It is my opinion that even if claim elements 1(f)/24(f) are interpreted such that *only* uni-directional messaging can be used in the first protocol, such a protocol would have been suggested in view of *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 to be used after the start of normal charging are 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 had good reason 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* 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.)

127. I have been asked to assume a 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 in §IX.A1(e); Ex. 1006, 8:60-65 (“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.”), 9:58-63 (“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.”), 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 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*. In my opinion, 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.)

128. 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, like 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.

129. For instance, *Azancot* explains:

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.

(Ex. 1006, 10:20-37; *see also id.*, 3:4-22, 7:21-37.)

130. 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.

131. Moreover, allowing the power transmission device to process such uni-directional control messages would have increased the interoperability and compatibility of the *Sogabe* wireless power transmission 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* 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.) And 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 (“While the above referenced standards organization 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. 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).)

132. 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 explain how universal wireless charging systems were established and desired. (§V.B.5.)

133. 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 configuring and implementing a system such as that described by *Sogabe*.

134. 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, 7:36-38 (“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”), 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 previously discussed. A person of ordinary skill in the art would have appreciated and understood that the modified system, based on such collective teachings and suggestions, would have been a foreseeable combination of known technologies and techniques (*e.g.*, using a microcontroller processing signals to control wireless power output), that would have understandably led to a base system/system comprising 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) **1(g)/24(g): receiving, using the current detection circuit, a first communication from the inductive charging receiver of the electronic device, wherein the first communication is based on the first protocol; and**

135. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. (*See* my discussions above for claim elements 1/24(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

“receiving” communications from a power receiving device 40 “using the current detection circuit” because, as I explained previously, detection circuit 29/30 (“current detection circuit”) detects data that is transmitted from a power receiving device 40 by “detecting a load state by current detection.” (See my above analysis in §IX.A.1.d; Ex. 1005, 7:50-8:5, 28:18-29.) Such communications include “communication condition information” or “start frame” sent during the setup stage, where *Sogabe* discloses that either communication (“first communication”) from the power receiver to the transmitter can utilize such current detection-based data transfers during the setup stage. (See my above analysis in §IX.A.1.f; Ex. 1005, 14:61-67, 28:11-29.) These communications are also received by the microcontroller of the *Sogabe-Azancot* system through the detection circuit 29/30 (“using the current detection circuit”) in order for the microcontroller to regulate power output, etc. based on the messages (“[microcontroller configured for] receiving, using the current detection circuit,...”). (§IX.A.1.e-f; Ex. 1005, 7:34-45, 7:50-8:6, 22:58-23:5, 28:17-29, FIGs. 2, 9, 14A; Ex. 1006, FIGs. 2B, 2D.) 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 conditions.

136. It is my opinion that 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 a system 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-p.)

h) 1(h)/24(h): regulating power delivered to the battery of the electronic device in response to the received first communication; and

137. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I discussed above, the received first communication includes the “communication condition information” that includes information regarding how power transfer is to be performed once normal power transfer begins. (§IX.A.1.e-g; Ex. 1005, 10:45-11:16.) In response to the received information, the controller (e.g., microcontroller of the *Sogabe-Azancot* system) regulates power delivered to battery 94 of the power receiving device 40 because the power transmission device 10 begins to output power with a VF driving-voltage at an f1 driving frequency that charges battery 94 based on the communication condition information (e.g., suitable for 0.5 watts or 15 watts). (*Id.*, 8:28-36, 10:45-11:16, 15:34-50, 16:24-27, FIGs. 2,

9; *see* my above analysis in §IX.A.1.e-f.) In addition, power transmission device 10 begins the output power based on “[i]f the start frame is transmitted,” such that the controller similarly regulates power delivered to battery 94 of the power receiving device in response to the start frame message. (Ex. 1005, 8:28-36, 10:45-11:16, 15:34-50, 16:24-27, 26:3-25; *see supra* §IX.A.1.e-f.) The microcontroller of the *Sogabe-Azancot* system facilitates the power regulation. (Ex. 1005, 7:34-45; *see* my above analysis in §IX.A.1.e-f.)

138. For similar reasons, the power receiving device 40 also regulates power delivered to its battery 94 in response to the first communications I discussed above because power receiving device 40 “regulate[s] so as to generate a power supply voltage ... to charge ... battery 94” when the communication condition information or start frame adjusts the power that is output by the power transmission device. (Ex. 1005, 8:28-36, FIGs. 2, 9, 11, 12.)

- i) **1(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:**

24(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 comprises bi-directional messaging, wherein the second mode of operation comprises:

139. 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 in §IX.A.1.f; Ex. 1005, 3:54-4:65, 9:7-15, 10:38-54.)

140. 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 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).)

141. As I explained above for claim element 1/24(e), the reasons, motivations, and expectation of success relating to implementing and configuring a “microcontroller” in the modified *Sogabe* system 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* system/device to operate in the “second mode of operation” as claimed in claims 1/24. (See my analysis above for claim element 1/24(e) and discussions below for claim elements 1/24(j)-(n).)

142. 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 id.*, 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 power transmission device 10 communicates with the PRD40 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.

....

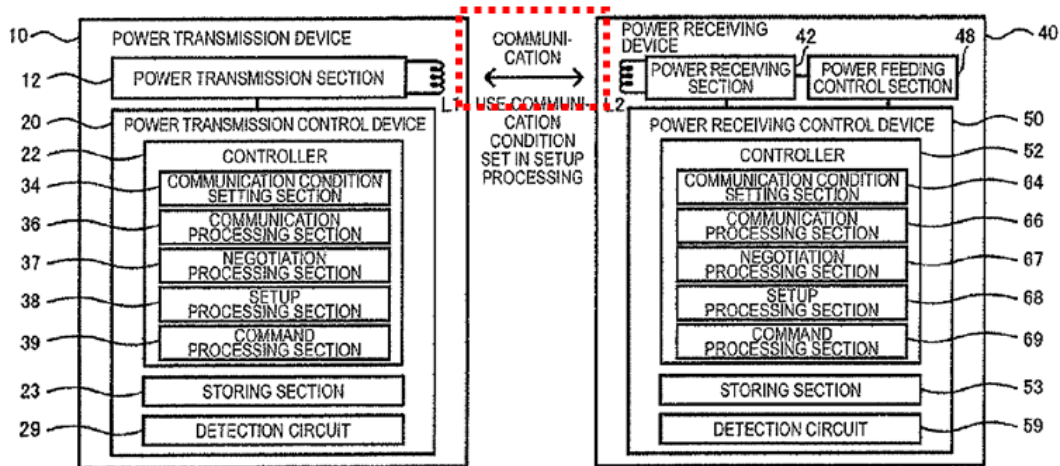
After the start of normal power transmission, the communication condition is switched to the communication condition set in the setup processing shown in FIG. 4A from the initial communication condition. That is, as shown in FIG. 5B, communication after the start of normal power transmission is performed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

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

143. *Sogabe* further discloses that communication during the normal power transmission “comprises” and “defines” “bi-directional messaging.” For instance, *Sogabe* discloses 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).)

144. As I explained previously, the *Sogabe-Azancot* system includes a microcontroller that controls the operation of the power transmission device 10. (*See* my above analysis in §IX.A.1.e; Ex. 1005, 7:34-45, FIGs. 2, 9.) Because the microcontroller of the *Sogabe-Azancot* system controls and operates the power

transmission 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 for the reasons discussed immediately above.

145. 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 a system 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) **1(j)/24(j): receiving, using the current detection circuit, a second communication from the inductive charging receiver of the electronic device, wherein the second communication is based on the second protocol;**

146. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. *Sogabe* discloses “receiving” communications from the power receiving

device 40 (“inductive charging receiver of the electronic device”) “using the current detection circuit” because, as I explained previously, detection circuit 29/30 (“current detection circuit”) detects data that is transmitted from a power receiving device 40 by “detecting a load state by current detection.” (See my above analysis in §IX.A.1.d; Ex. 1005, 7:50-8:5, 28:18-29.)

147. Such communications (“second communication”) include, for example, a “full charge detection” command, 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*. (Ex. 1005, 3:4-16, 9:62-10:5, 26:23-43, 13:52-58, 17:3-47; 19:55-59, 19:60-20:4.) *Sogabe* further discloses that these communications from the power receiver to the transmitter during the normal communication/transmission condition can be performed using current detection-based data transfers. (See my above analysis in §IX.A.1.i; Ex. 1005, 2:59-3:3, 16:30-36, 19:20-32, 23:55-59, 28:11-29.)

148. In addition, in my opinion, a person of ordinary skill in the art would have had good reason, in view of *Azancot* and the state of the art knowledge by such a person, to include further communications during normal charging that are provided from the power receiving device to the power transmission device that inform the power transmission device as to the power requirements of the power receiving device so that the power transmission device can adapt the characteristics

of the power transfer to meet the needs of the receiving device. For example, a person of ordinary skill in the art would have recognized that *Azancot* discloses sending such data regarding the power requirements of the receiving device (load/battery), where such data includes operating voltage, operating current, and operating temperature, where this data “may be pertinent to regulating efficient power transmission.” (Ex. 1006, 7:21-29, 8:44-57.) *Azancot* further discloses that such data that is sent from the power receiving device to the power transmission device during active power transfer (during operation of the load) can be used to regulate the power supply that provides the power to the primary coil L_1 of the power transmission device. (*Id.*, 10:20-25.)

149. In my opinion, a person of ordinary skill in the art would have been motivated to include such power requirement data in communications from the power receiving device to the power transmission device in a system like that of *Sogabe* in order to provide efficient power transfer as disclosed by *Azancot*. (*Id.*, 2:29-35, 7:21-29.) Such a skilled person would also have been motivated to send communications regarding temperature to, for example, prevent overheating of the receiving device during charging. (Ex. 1006, 11:48-51.) The communication of such data in the *Sogabe-Azancot* combination would have been according to the second protocol since it would have been done during normal power transmission

corresponding to when the battery is being charged, consistent with the teachings of *Sogabe*.

150. Moreover, a person of ordinary skill in the art would have been motivated to use the established load state current detection signaling method of *Sogabe*, which is consistent with that of *Azancot*, in order to deliver this information from the receiver device to the transmission device. In my opinion, such a combination is nothing more than the application of a known technique (sending data regarding power receiving device charging state/requirements) in a similar system (*Sogabe*'s power transfer system) to achieve a predictable result (power transfer system with improved efficiency and lower risk of overheating). Based on *Azancot*'s disclosure of sending such information and the teachings of both *Azancot* and *Sogabe* regarding how to transfer such information in a power transfer system, such a skilled person would have had a reasonable expectation of success.

151. For reasons that I explained above concerning the modified *Sogabe* system, such communications would have been received by the microcontroller of the *Sogabe-Azancot* system through the detection circuit 29/30 ("current detection circuit") in order for the microcontroller to regulate power output, etc. based on the messages. (§IX.A.1.e-f; Ex. 1005, 7:34-45, 7:50-8:6, 22:58-23:5, 28:17-29, FIGs. 2, 9, 14A.)

152. The *Sogabe-Azancot* combination further discloses and/or suggests “wherein the second communication is based on the second protocol.” Because the communication is sent 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. (See my above analysis in §IX.A.1.i; Ex. 1005, 17:25-30.) Such features would have been part of the modified *Sogabe* system I discussed above (and below).

153. 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 a system 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.i-p.)

- k) **1(k)/24(i): transmitting, by modulating the operating frequency with the coil drive circuit, a frequency-modulated third communication to the inductive**

charging receiver of the electronic device, wherein the frequency-modulated third communication is based on the second protocol; [and]⁶

154. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. *Sogabe* in view of *Azancot* discloses “transmitting ... a frequency-modulated third communication to the inductive charging receiver of the electronic device.” For instance, *Sogabe* explains that “data communication from the power transmission side to the power receiving side is realized by a frequency modulation.” (Ex. 1005, 23:55-59; *see also id.*, 8:59-64, 9:47-56, 10:18-27, 12:20-25.) Frequency modulation occurs by the power transmission device switching the frequency of the output power to communicate data. (Ex. 1005, 9:51-56, 10:18-27, 23:60-24:3, FIG. 10A.) Moreover, frequency modulation is used to transmit signals in the normal power transmission mode in accordance with communication conditions specifying frequency modulation communication that can be set during the setup stage. (Ex. 1005, 8:58-62, 9:38-56, 10:6-27, 23:60-24:3, 24:18-23.)

⁶ Limitations 1(k)-1(l) are swapped in claim 24 (*i.e.*, 24(l) tracks 1(k); 24(k) tracks 1(l)).

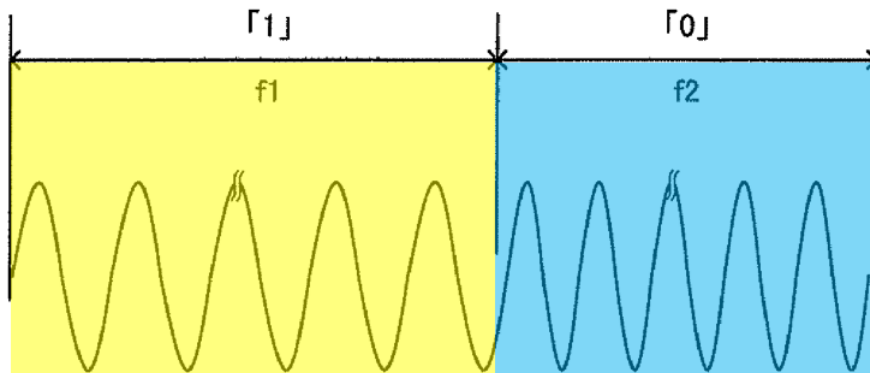


FIG.10A

(Ex. 1005, FIG. 10A (annotated) (illustrating an example of a frequency-modulated signal that is sent to power receiving device 40).)

155. Given that a detection circuit 59 of the power receiving control device 50 of the inductive charging receiver (or another component thereof) “detects data transmitted from the power transmission device 10” (Ex. 1005, 8:58-62, 23:60-24:3, FIGs. 2, 9; *see* my above analysis in §IX.A.1.i), 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.) during the normal power transfer stage in the modified *Sogabe* system would have been a “third communication to the inductive charging receiver of the electronic device.” (Ex. 1005, 10:6-17, 17:3-5, FIG. 5B).

156. The *Sogabe-Azancot* combination discloses or suggests that, in the second mode of operation, the third communication is transmitted “by modulating

the operating frequency with the coil drive circuit.” Similar to as explained above, *Sogabe* further discloses that the controller 22 “performs ... frequency modulation” of the output power and sets frequencies to transmit the communications (Ex. 1005, 7:38-45, 22:8-11, 22:28-37, 23:60-24:3, FIG. 10A), wherein the controller 22 is implemented with a microcontroller per the combination (*see* my above analysis in §IX.A.1.e). The power transmission section 12 (“coil drive circuit”), being controlled by the microcontroller of the *Sogabe-Azancot* system, outputs the data and interruption requests, etc. (“third communication”) via a frequency-modulated AC voltage (an example of which is illustrated above). (Ex. 1005, 6:65-7:14, 7:38-45, 22:8-11, 22:28-37, 23:60-24:3, FIG. 10A; *see* my above analysis in §IX.A.1.c.)

157. Because the third communication would have been sent 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 in the modified *Sogabe* system as I discussed above. (*See* my above analysis in §IX.A.1.i; Ex. 1005, 8:58-62, 10:6-27, 11:56-61, 16:30-36, 24:17-23, FIG. 10A.)

158. 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 the system having a microcontroller configured to operate in a "second mode of operation" (§IX.A.1.i) to transmit, using the coil drive circuit (IX.A.1.c), a frequency-modulated third communication 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.)

I) 1(l)/24(k): regulating power delivered to the battery of the electronic device in response to the received second communication; [and]

159. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I discussed above in §IX.A.1.j, the "received second communication" includes, for example, a "full charge detection" command, an "interrupt request" sent from the power receiving device to the power transmission device, a "periodic authentication" performed by the power receiving device, and a communication during normal charging that informs the power transmission device as to the power requirements of the power receiving device. (See my above analysis in §IX.A.1.j, Ex. 1005, 3:4-16, 9:62-10:5, 26:23-43, 13:52-58, 17:3-47; 19:55-59, 19:60-20:4.)

160. In response to an “full charge detection command,” the microcontroller of the *Sogabe-Azancot* system regulates power delivered to battery 94 of the power receiving device 40 by stopping power transmission by the power transmission device 10 such that battery 94 is no longer charged. (Ex. 1005, 19:55-59, 26:54-57, FIG. 12, S70, S52, FIGs. 2, 9.)

161. In response to the “interrupt request” sent by the power receiver device, the microcontroller of the *Sogabe-Azancot* system regulates power delivered to battery 94 by shifting to a communication mode that uses a temporary power transmission level where the driving frequency and driving voltage applied to the coil are set to a lower level such that priority is given to the reliability of communication during the interrupt as opposed to the transmission efficiency of the power transmission. (*Id.*, 17:3-47.)

162. In response to the “periodic authentication” performed by the power receiving device, the microcontroller of the *Sogabe-Azancot* system regulates power delivered to battery 94 maintaining the transmission of power when the periodic authentication is received, whereas absent receipt of the authentication, power transmission is stopped. (*Id.*, 26:23-43, FIG. 12, S66, S47 (stop power transmission when periodic authentication is not OK).)

163. In response to the communication of data regarding receiving device power requirements (load voltage, load current, temperature, etc.), the

microcontroller of the *Sogabe-Azancot* system regulates power delivered to battery 94 by having the microcontroller adapt the frequency/voltage applied to the coils to meet these requirements or avoid overheating. (See my above analysis in §IX.A.1.j; Ex. 1006, 2:29-35, 10:20-25, 11:48-51.)

- m) **1(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) **1(n): wherein the first power level and the second power level are different.**

164. In my opinion, the *Sogabe-Azancot* combination discloses and/or suggests these limitations. As discussed above for claim elements 1(f) and 1(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. (See my above analysis in §§IX.A.1.f, IX.A.1.i.) 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. (Ex. 1005, 11:56-12:13, 14:36-51, 16:14-29, 17:18-47, FIGs. 3A, 5A.) Therefore, in the modified *Sogabe* system, 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”).

165. The *Sogabe-Azancot* combination thus discloses and/or suggests limitation 1(n) for the reasons I discussed above, where the “low power” level and the power level during normal power transmission are different.

- o) **24(m):** wherein the operating frequency for the first mode of operation is associated with a first frequency range and the operating frequency for the second mode of operation is associated with a second frequency range, and
- p) **24(n):** wherein the first frequency range and the second frequency range are different.

166. In my opinion, the *Sogabe-Azancot* combination discloses and/or suggests these limitations. As I discussed above for claim elements 24(f) and 24(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. (See my above analysis in §§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 output power, whereas during normal power transmission, the operating frequency 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, in the modified *Sogabe* system above, the first mode of operation is associated with a first frequency range

corresponding to f_{01} and f_{02} used during setup, whereas the second mode of operation is associated at least with the second frequency range corresponding to f_1 and f_2 used during normal power transfer.

167. The *Sogabe-Azancot* combination discloses and/or suggests limitation 24(n) for the reasons I discussed above, where first frequency range corresponding to f_{01} and f_{02} and the second frequency range corresponding to f_1 and f_2 are different.

2. Claim 2

- a) **The base system of claim 1, wherein the base system is configured to communicate with different types of inductive charging receivers using different inductive charging protocols.**

168. In my opinion, the *Sogabe-Azancot* combination discloses and/or suggests this limitation. For instance, *Sogabe* discloses that the apparatus including PTD10 such as a charger or the like, or PTD10 itself (“base system”) (*see* my above analysis in §IX.A.1.a; Ex. 1005, FIGs. 2, 9) can communicate with “various types of power receiving devices” (“different types of inductive charging receivers”) using different “communication condition[s]” to charge the devices via contactless power transmission. (Ex. 1005, 9:15-31.) *Sogabe* further explains how a PTD can communicate with and charge different “kinds of power receiving devices”:

Related art contactless power transmission systems are only on the assumption that a single power transmission device

corresponds to a single power receiving device. The related art systems, thus, cannot realize a multi-power corresponding system that can corresponds with a plurality kinds of power receiving devices having different power specifications.

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

....

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.

(*Id.*, 10:39-11:16, FIGs. 1, 2, 9.)

169. The communication condition *Sogabe* discloses may specify a modulating power output frequency (*e.g.*, different frequency f_1 , f_2 values) for communication using frequency modulation or may specify, thresholds used for communication using load modulation when the power transmission device of the PTD10 communicates with a power receiving device, etc. The configurability of these parameters corresponds to the base system being configured to communicate with different types of inductive charging receivers using different inductive charging protocols that *Sogabe* explains. (*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.)

3. Claim 3

- a) **The base system of claim 1, wherein the electronic device is a mobile device, watch, headset, robot, vehicle, appliance, light or battery.**

170. In my opinion, the *Sogabe-Azancot* combination discloses and/or suggests this limitation, at least because *Sogabe* discloses that the electronic device may be a cell phone, etc. or other similar types of devices. (*See* §IX.A.1(a); Ex. 1005, 5:60-65, FIGs. 1, 2, 9.)

4. Claim 5

- a) **The base system of claim 1, wherein the first mode of operation is a subset of the second mode of operation.**

171. In my opinion, the *Sogabe-Azancot* combination discloses and/or suggests this limitation. As I discussed above in §IX.A.1.i, *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.” (See my above analysis in §§IX.A.1.i.) Thus, in the modified *Sogabe* system, for reasons explained, when the “second mode of operation” includes the normal operation mode and the “first mode of operation,” “the first mode of operation is a subset of the second mode of operation” as claimed. (*Id.*)

5. Claim 6

- a) The base system of claim 1, wherein one of the first mode of operation and the second mode of operation is a proprietary mode of operation.**

172. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation for at least two reasons.

173. **First**, *Sogabe*’s setup power transmission mode and normal 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 in §§IX.A.1.f, IX.A.1.i; Ex. 1005, 30:5-32:57, FIGs. 3A-5C, 11-12.) Thus, for similar reasons explained above and here, the modified *Sogabe* system would have included such features.

174. **Second**, *Sogabe*’s first and/or second modes of operation did not comprise then-standard modes of operation and therefore correspond to proprietary

modes of operation in a manner consistent with the disclosure of the '777 patent.
(See my above analysis in §§IX.A.1.f, IX.A.1.i; Ex. 1005, FIGs. 3A-5C, 11-12.)

175. The '777 patent and the state-of-the-art, which disclose that a “proprietary” mode of operation may include a mode that did not use then-standard modes of operation is consistent with *Sogabe*’s proprietary modes. (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).) As such, for similar reasons here and above, the *Sogabe-Azancot* device/system would have provided similar features. (§IX.A.1.)

6. Claim 9

- a) **The base system of claim 1, wherein the microcontroller is further configured for detecting the presence of a foreign object between the inductive charger of the base system and the inductive charging receiver of the electronic device, wherein the determination is made based on a difference between a measured input power to the inductive charger and a received output power at the inductive charging receiver of the electronic device.**

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

177. *Sogabe* in view of *Azancot* discloses and/or suggests “wherein the microcontroller is further configured for detecting the presence of a foreign object

between the inductive charger of the base system and the inductive charging receiver of the electronic device.” Per the *Sogabe-Azancot* combination I discussed for claim 1, the *Sogabe* system controller 22 would have been implemented using a microcontroller, like that disclosed by *Azancot*. (See my above analysis in §IX.A.1.e.) The microcontroller of the *Sogabe-Azancot* system would have been configured to control PTD10, including power output, as disclosed by *Sogabe* and would have been understood by a person of ordinary skill in the art. (*Id.*; Ex. 1005, 7:34-45 (“The controller 22 controls power transmission.”), 6:41-44.)

178. *Sogabe* further discloses that PTD10 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, 7:34-45; §IX.A.1.e.) That is, the microcontroller of the modified system (which controls power output) would have been configured to stop power transmission when a foreign object is detected between the PTD10 (“base system”) and the secondary coil L2 of the inductive charging receiver of PRD40. (Ex. 1005, 15:11-18, 7:34-35, 25:26-29, 26:34-43; §IX.A.1.e.)

179. Although *Sogabe* does not explicitly disclose “wherein the determination is made based on a difference between a measured input power to the inductive charger and a received output power at the inductive charging receiver of

the electronic device,” it is my opinion that a person of ordinary skill in the art would have had good reason to implement such features in view of *Azancot*.

180. *Azancot* discloses “detecting the presence of a foreign object between the inductive charger of the base system and the inductive charging receiver of the electronic device,” similar to *Sogabe* as discussed previously. In fact, *Azancot* discloses detecting when a “conductive sheet of metallic foil 5800” (“foreign object”) hazard “is introduced *between* [a] primary coil 5220” of a wireless power base system “and the secondary coil 5260” of an inductive charging receiver of an electronic device 5290. (Ex. 1006, 13:38-58, 14:58-15:3, 13:54-58, FIG. 6b; *see* my above analysis in §IX.A.1.e.)

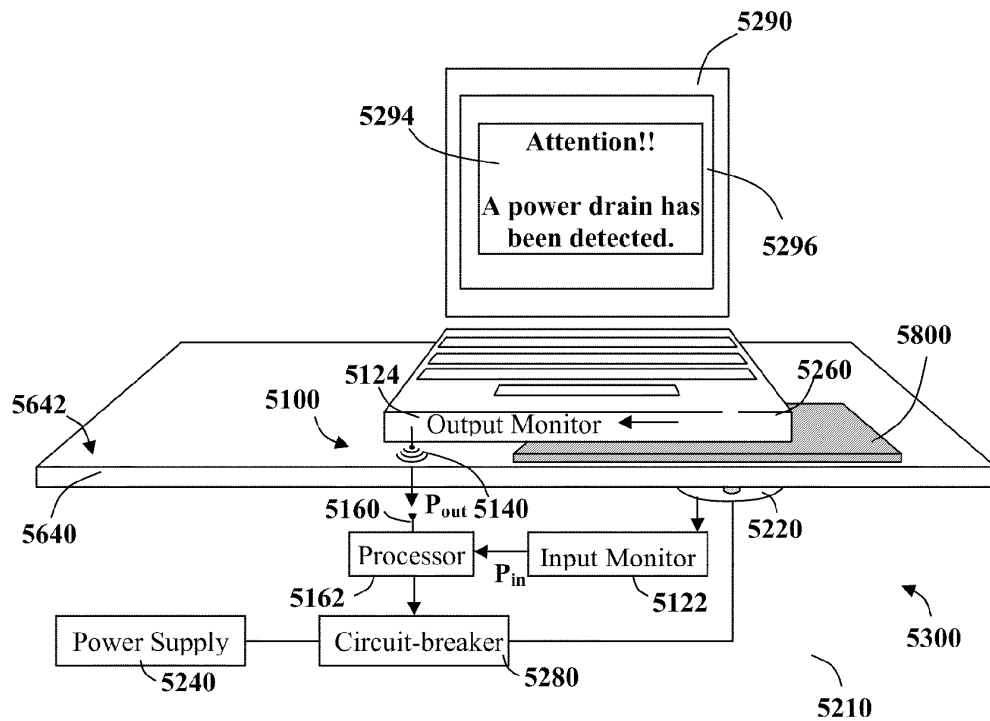
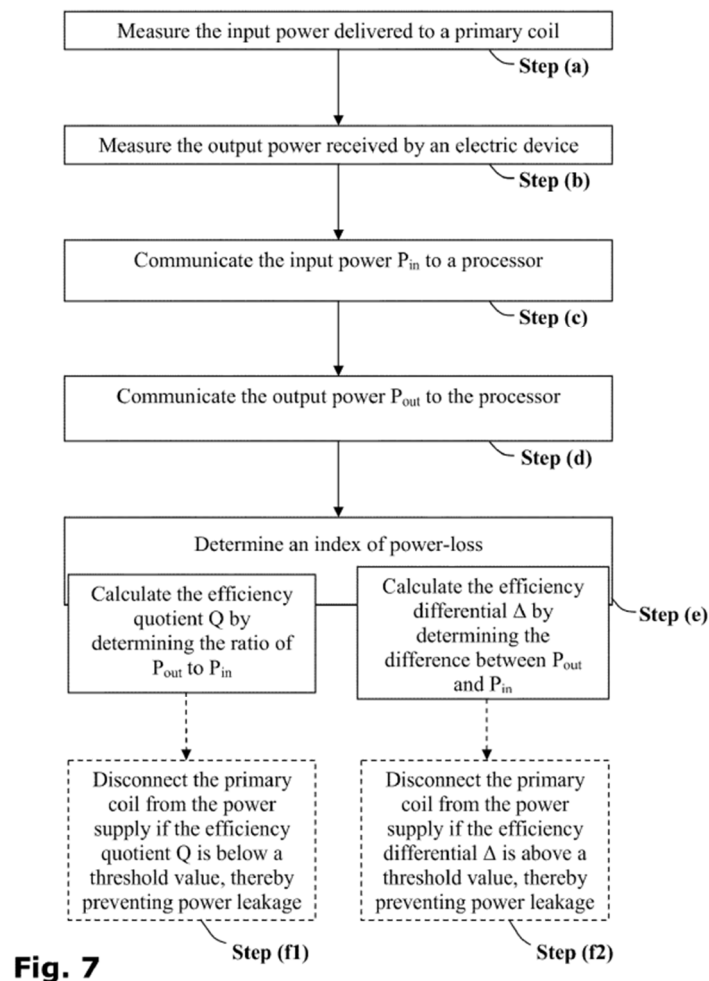


Fig. 6b

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

181. *Azancot* further discloses “wherein the determination is made based on a difference between a measured input power to the inductive charger and a received output power at the inductive charging receiver of the electronic device.” For instance, *Azancot* discloses the wireless power base system, operating with a processor, receives a P_{OUT} value from an output monitor 5124 of electronic device 5290 and a measured input power P_{IN} from input monitor 5122. (Ex. 1006, 13:65-14:3, 14:48-57, 15:6-11, 15:44-60, FIG. 6b; §IX.A.1.e.) When the efficiency differential Δ (which is “the difference between P_{OUT} and P_{IN} ”) is above a threshold,

the system detects that the conductive sheet 5800 hazard is between the wireless power base system and the electronic device 5290 and disconnects the primary coil from the power supply to prevent power leakage. (Ex. 1006, 13:27-29, 13:65-14:3, 14:48-57, 15:6-11, 15:44-60, FIGs. 6b, 7.) Figure 7 (below) includes an example of such a hazard detection process.



(*Id.*, FIG. 7.)

182. In light of such teachings/suggestions, and further to the reasons I explained for claim 1 (§IX.A.1), it is my opinion that a person of ordinary skill in the art would have been motivated to configure the “microcontroller” in the *Sogabe-Azancot* device/system to provide similar functionalities, such that *Sogabe*’s foreign object “determination” features were “based on a difference between a measured input power to the inductive charger and a received output power at the inductive charging receiver of the electronic device” similar to that disclosed by *Azancot*. For reasons that I explained above, the microcontroller of the modified *Sogabe* system would perform the detection and power control, as I discussed. (§IX.A.1.e; Ex. 1005, 7:34-45; Ex. 1006, 15:34-43 (disclosing that the power monitoring features are applicable to the FIG. 2 embodiment).)

183. A person of ordinary skill in the art would have recognized that there was a known problem with foreign objects interfering with wireless power systems, that *Azancot*’s teachings address such issues, and that combining the teachings of *Sogabe* and *Azancot* was within the skill/capability of an ordinary artisan.

184. Furthermore, it is my opinion that a person of ordinary skill in the art would have been motivated to modify the *Sogabe* system in view of *Azancot*’s teachings regarding power difference control to prevent power leakage in the system efficiently. (Ex. 1006, 2:53-58, 15:44-61.) Such a skilled person also would have appreciated that configuring the above modified *Sogabe* system with features similar

to those provided by *Azancot*'s hazard detection system would have improved the modified *Sogabe* system 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.) A person of ordinary skill in the art 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 *Sogabe* system by enabling the system to recognize that not all improper or low load conditions would necessitate turning off power flow. (Ex. 1006, 2:53-58, 15:44-61.) Such knowledge would have led a person of ordinary skill in the art to consider and implement the above modification.

185. 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* system (§IX.A.1). For instance, *Sogabe* describes detecting foreign objects between the base system and the electronic device (Ex. 1005, 15:11-18, 7:34-45), 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 led a person of ordinary skill

in the art to configure the microcontroller in the modified system for detecting the presence of a foreign object between the inductive charger of the base system and the inductive charging receiver of the electronic device.

7. Claim 10

- a) The base system of claim 1, wherein the base system operates in one of the first mode of operation and the second mode of operation depending on the power output level of the inductive charging receiver.**

186. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I discussed previously, *Sogabe* discloses an apparatus including PTD10, or PTD10 itself (“base system”) (*see* my above analysis in §IX.A.1.a; Ex. 1005, FIGs. 2, 9) that operates “in one of the first mode of operation and the second mode of operation” (*see* my above analysis in §IX.A.1.f, i (discussing *Sogabe*’s setup power transmission mode and normal power transmission mode as the first and second modes of operation)).

187. The base system described by *Sogabe* operates in at least one of the first and second modes of operation “depending on the power output level of the inductive charging receiver.” For instance, *Sogabe* discloses that the PRD40 or PRS42, PFCS48, and PRCD50 (“inductive charging receiver”) of the electronic device (*see* §IX.A.1.a) is “designed for contactless power transmission with 0.5 watts,” “15 watts,” etc. (“the power output level of the inductive charging receiver”)

depending on the type of device PRD40 is. (Ex. 1005, 10:38-11:16; *see also id.*, 17:50-60, 21:55-62.) During the setup mode, communication condition information is exchanged such that the output power of the transmitter for the normal mode is controlled depending on the specific power output level of the inductive charging receiver (*e.g.*, 15W, 0.5W, etc.). (Ex. 1005, 10:38-11:16, 9:25-31, 15:34-50.) Accordingly, the apparatus including PTD10, or PTD10 itself (“base system”) operates in the normal power transmission mode (in at least one of the first and second modes of operation) “depending on the power output level of the inductive charging receiver,” as claimed.

188. As another example, in my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests that the base system operates in at least one of the first and second modes of operation “depending on the power output level of the inductive charging receiver” for reasons similar to those I explained above for claim 9. (§IX.A.6 (*see* my discussions and analysis how a “ P_{OUT} ” value from a wireless power receiving electronic device controls whether wireless power is transmitted from a charger).) In such a configuration, the P_{OUT} value would similarly control power in the setup power transmission mode or the normal power transmission mode. (§§IX.A.1, 6.)

8. Claim 11

a) The base system of claim 1, wherein the operating

frequency for the first mode of operation is within a first frequency range and the operating frequency for the second mode of operation is within a second frequency range, and wherein the first frequency range and the second frequency range are different.

189. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation for the reasons I discussed in §§IX.A.1.o-p.

9. Claim 13

- a) The base system of claim 1, wherein the received first communication for the first mode of operation and the received second communication for the second mode of operation are different.**

190. In my opinion, *Sogabe* in view of *Azancot* discloses and/or suggests this limitation. As I discussed previously, the first communication is the communication that includes “communication condition information” or a “start frame” sent during the setup stage. (*See* my above analysis in §IX.A.1.g.) As I also discussed, the second communication may be a “full charge detection” command, an “interrupt request” sent from the power receiving device to the power transmission device, a “periodic authentication” performed by the power receiving device, or a communication during normal charging that informs the power transmission device as to the power requirements of the power receiving device. (*See* my above analysis in §§IX.A.1.j.) These distinct communications are different in signal structure, function, composition, binary value, encoding, name, etc. (Ex. 1005, 9:7-37, 15:34-56, 17:3-7, 19:55-59, 23:60-24:17.)

10. Claim 14

- a) **The base system of claim 1, wherein the frequency range of the power delivered to the battery for the first mode of operation is based on the first protocol and the frequency range of the power delivered to the battery for the second mode of operation is based on the second protocol.**

191. It is my opinion that the *Sogabe-Azancot* combination discloses or suggests claim 14.

192. As I explained previously, *Sogabe* discloses that PTD10 outputs power at one or more of the “f01” and “f02” frequencies in the setup mode and one or more of the “f1” and “f2” frequencies in the normal power transmission mode. (See my discussions in §IX.A.1.f and §IX.A.1.i.) As I also explained above, the setup mode is the first mode of operation and the first protocol, whereas the normal power transmission mode is included in the second mode of operation that includes use of the second protocol. (See my discussions in §§IX.A.1.f, I; §IX.A.1.c (“coil drive circuit provides [*the*] power”); Ex. 1005, 10:18-27, 14:41-67 (“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”), 15:34-50, 16:14-29, 17:41-47, 21:7-12, 23:60-24:3, FIG. 10A) *Sogabe* explains that the power output by PTD10 is received by PRD40 and delivered to the battery. (Ex. 1005, 8:13-36.)

Thus, the power delivered to PRD40 at one or more of the “f01” and “f02” frequencies (which a person of ordinary skill in the art would have understood to be a frequency range of power that is delivered) in the setup mode (first mode of operation and first protocol) (§IX.A.1.f)) and one or more of the “f1” and “f2” frequencies (which a person of ordinary skill in the art would have understood to be a frequency range of power that is delivered) in the normal power transmission mode (second mode of operation and second protocol), is delivered to the receiver’s coil that provides the power to the battery during such operation modes. Accordingly, it is my opinion that the *Sogabe-Azancot* combination discloses or suggests the features of claim 14.

B. Ground 2: *Sogabe* in view of *Azancot* and *Walley* discloses and/or suggests claim 6

1. Claim 6

- a) The base system of claim 1, wherein one of the first mode of operation and the second mode of operation is a proprietary mode of operation.**

193. While it is my opinion that the *Sogabe-Azancot* combination discloses and/or suggests claim 6 (*see* my above analysis in §IX.A.5), I have been asked to assume a scenario where the *Sogabe-Azancot* combination does not disclose or suggest claim 6. As to that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to implement such features in view of *Walley*. *Walley* is similar to *Sogabe* and *Azancot*, and discloses using a “microprocessor” or

“micro-controller” to control a wireless power transmitter (WP TX unit 10) that is capable of operating using different protocols, including “standardized protocols” or “proprietary protocols.” (§IX.A.1.6; Ex. 1007, 3:47-55, 4:15-55, FIG. 1.) *Walley* discloses the following:

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.). Such a conversion includes one or more of: scrambling, puncturing, encoding, interleaving, constellation mapping, modulation, frequency spreading, frequency hopping, beamforming, space-time-block encoding, space-frequency-block encoding, frequency to time domain conversion, and/or digital baseband to intermediate frequency conversion.

(Ex. 1007, 4:15-61.)

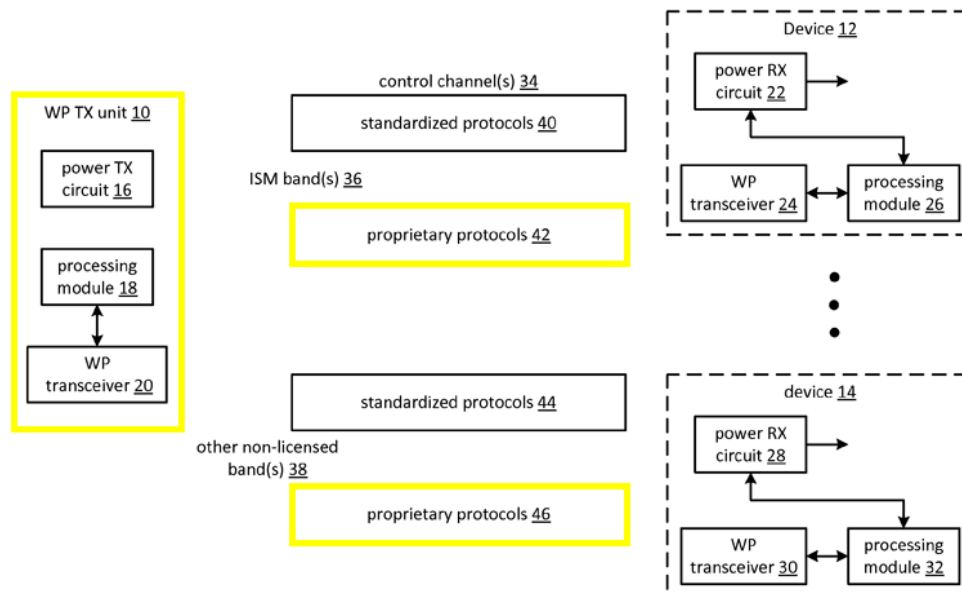


FIG. 1

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

194. In light of such teachings, a person of ordinary skill in the art would have been motivated to configure the *Sogabe-Azancot* device/system such that the second mode of operation (§IX.A.1.i) comprises one or more proprietary protocols, in order to increase the interoperability and universal features of the *Sogabe-Azancot* system to better work with other known wireless charging systems and receivers using understood proprietary protocols. (Ex. 1007, 1:56-2:15, 3:47-55, 4:15-25, FIG. 1.) As I explained in by background section, such universal features were contemplated and desired before the alleged time of invention. (§V.B.4.) Moreover, it is my opinion that such a modification would have been a predictable combination of known components according to known methods (*e.g.*, wireless power transmitters that are compatible with various proprietary protocols), which would have led a skilled person to configure the modified system to implement one of the first mode of operation and the second mode of operation as a proprietary mode of operation.

C. Ground 3: *Sogabe* in view of *Azancot* and *Baarman* discloses and/or suggests claim 7

1. Claim 7

- a) **The base system of claim 1, wherein the microcontroller is further configured for sending a ping to the electronic device through the inductive charging coil to determine which of the first mode of operation and second mode of operation to use, wherein the determination is made based on the**

received communication from the inductive charging receiver of the electronic device in response to the ping.

195. In my opinion, the *Sogabe-Azancot* combination in view of *Baarman* discloses and/or suggests this limitation. (*See also* §IX.A.1.) As I discussed above for limitations 1(f)-1(i), the *Sogabe-Azancot* combination discloses and/or suggests the PTD10 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.)

196. Although *Sogabe* does not explicitly disclose that the microcontroller sends a ping to PRD40 to determine which of setup or normal power transmission modes to use, a person of ordinary skill in the art would have had good reason to implement such a feature in view of *Baarman*.

197. Similar to *Sogabe* and *Azancot*, *Baarman* discloses a “wireless charging system.” (Ex. 1008, Title, Abstract, FIG. 1, ¶0030; *see* below and my discussions above in §VIII.D.) *Baarman* discloses that the charging system includes an inductive power supply 12, which includes a controller 32 (“microcontroller”) and a tank circuit 34, which includes the primary coil 16 (“inductive charging coil”) that transmits wireless power to remote control 14 (“electronic device”):

A remote control system 10 having an inductive charging system
in accordance with an embodiment of the present invention is

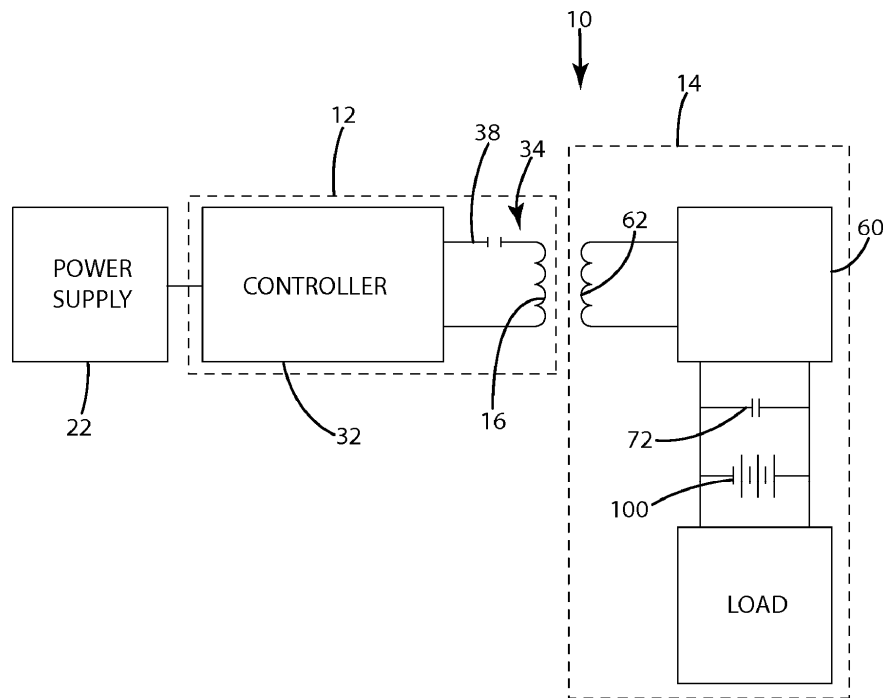
shown in FIG. 1. The system generally includes an inductive power supply 12 and a battery-operated remote control 14. The inductive power supply 12 generates an electromagnetic field capable of wirelessly transmitting power to the remote control 14. The remote control 14 includes a secondary power supply 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.

(*Id.*, ¶¶0030, 0032, FIGs. 1-2A.)



(*Id.*, FIG. 1.) The controller 32 may be a dsPIC30F2023 or similar microcontroller.

(*Id.*, FIG. 2A.) The dsPIC30F2023 was a known microcontroller before the alleged time of invention made by Microchip Technology.

198. *Baarman* discloses features consistent with a “microcontroller [] configured for sending a ping to [an] electronic device through [an] inductive charging coil.” 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 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.)

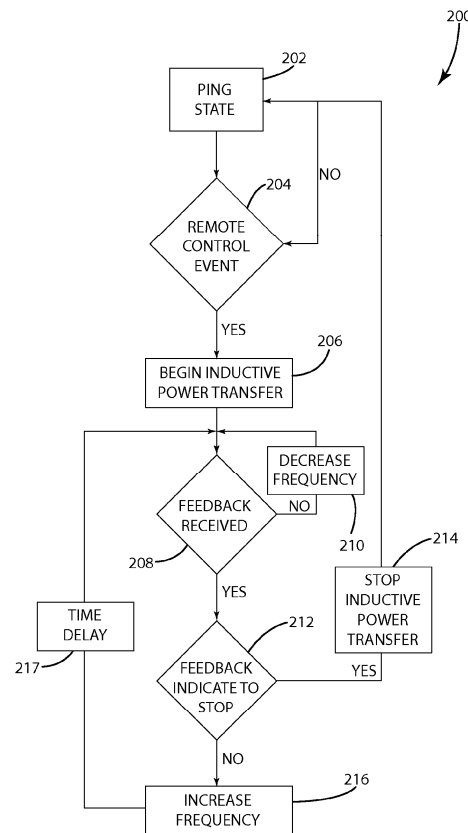


Fig.4

(Ex. 1008, FIG. 4.)

199. *Baarman* discloses that the ping is used “to determine” whether to use a normal power transmission mode “wherein the determination is made based on the received communication from the inductive charging receiver of the electronic device in response to the ping.” For instance, *Baarman* discloses that “[t]he 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...When a communication signal indicative of the presence of a compatible remote control 14 is received” (“received communication from the inductive charging receiver of the electronic device in response to the ping”), “the inductive power supply 12 begins inductive power transfer 206 at a specific start frequency.” (Ex. 1008, ¶0049, FIG. 4.) That is, the inductive power supply 12 begins a normal power transmission mode without complex setup negotiations when a ping response from an electronic device indicates that a compatible wireless power receiver is available:

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.*, ¶¶0048-49, FIGs. 1, 4.)

200. Given 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* uses a ping signal to determine whether to enter a normal power transmission mode, it is my opinion that a person of ordinary skill in the art would have been motivated to

have the microcontroller in the modified system I discussed above to send a ping to the electronic device through the inductive charging coil in order determine which of the above discussed first mode of operation and second mode of operation (*see* §IX.A.1) to use, such that the determination is made based on the received communication from the inductive charging receiver of the electronic device in response to the ping. For reasons above, and in light of the teachings and suggestions of *Baarman* in context of *Sogabe-Azancot*, a person of ordinary skill in the art to configure the microcontroller of the *Sogabe-Azancot* system (*see* my above analysis in §IX.A.1.e) to ping the electronic device to see if a compatible device was present and, if receiving a communication signal indicative of the presence of such a known compatible electronic device, begin the normal power transmission mode instead of the setup power transmission mode (as the setup power transmission mode would not be needed to negotiate operating power, etc.). (Ex. 1008, ¶¶0048-49, FIGs. 1, 4; Ex. 1005, FIGs. 2-5C, 9.)

201. A person of ordinary skill in the art would have had good reason to use ping and responsive signaling features similar to those disclosed by *Baarman* as explained. For example, such features would have been appreciated to 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 based on whether a compatible device can be determined quickly through pinging also would have decreased low power transmission time in favor of normal power transmission time and optimize charging. (Ex. 1008, ¶¶0048-49, FIGs. 1, 4; Ex. 1005, FIGs. 2-5C, 9.) Further, using the pinging to recognize compatible devices as I explained also would have reduced risks associated with powering an improper device. (Ex. 1008, ¶¶0048-49; Ex. 1005, FIGs. 3A-5C.) Moreover, *Baarman* discloses that such pinging can reduce the energy consumed by the system when a compatible receiver is not present (Ex. 1008, ¶0048) as other device detection means that transmit more complex signals to locate devices to be charged may require more energy to do so.

202. In my opinion, a person of ordinary skill in the art would have had a reasonable expectation of success in having the microcontroller use the ping and responsive signaling disclosed by *Baarman* as described. For instance, given the teachings of *Sogabe-Azancot-Barrman*, in context of a skilled person's state of art knowledge, a person of ordinary skill in the art would have appreciated that the modification would have been a foreseeable combination of known technologies and techniques (*e.g.*, pinging and responsive signaling to begin a normal wireless power transfer mode), and would have led such a skilled person to configure the microcontroller in the modified system for sending a ping to an electronic device

through the inductive charging coil to determine which of the first mode of operation and second mode of operation to use, such that the determination is made based on the received communication from the inductive charging receiver of the electronic device in response to the ping, consistent with the guidance and teachings of of *Sogabe-Azancot-Barrman*.

D. Ground 4: *Sogabe* in view of *Azancot* and *Muratov* discloses and/or suggests claim 8

1. Claim 8

- a) The base system of claim 1, wherein one of the first mode of operation and the second mode of operation is based on a Wireless Power Consortium standard.**

203. In my opinion, the *Sogabe-Azancot* combination in further view of *Muratov* discloses and/or suggests this limitation. (See §IX.A.1.) As I discussed in limitations 1(f)-1(i), the *Sogabe-Azancot* combination discloses and/or suggests the PTD10 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.)

204. Although the *Sogabe-Azancot* combination discloses and/or suggests that the first mode comprises uni-directional messaging (§IX.A.1.f.), the modified *Sogabe* system does not explicitly disclose that the first mode of operation is based on the Wireless Power Consortium standard. However, a person of ordinary skill in

the art would have had good reason to implement such a feature in view of *Muratov* and the state-of-the-art.

205. The Wireless Power Consortium (“WPC”) standard was also known as the Qi standard before the alleged time of invention. And before the alleged time of invention the standard was an understood and adopted wireless power control protocol. (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.), similar to the uni-directional messaging system of the first mode I discussed previously (§IX.A.1.f; §V.B.5). “The aim of the wireless power consortium [was] to enable a wide spread use of wireless power applications” and this was understood before the alleged time of invention. (Ex. 1011, 1.) To this effect, the consortium “defined a standard for providing up to 5W of power to low power mobile devices, like mobile phones, batteries and camera[s].” (*Id.*)

206. Before the alleged time of invention, *Muratov* discloses one such instance of using the understood and adopted Wireless Power Consortium/Qi standard. (Ex. 1009; *see* below and my discussions above in §VIII.E.) For instance, *Muratov* discloses “Qi establishes a common language for inductive chargers and devices to talk to one another. So any device with a Qi-enabled accessory or with Qi built directly into it can charge on any Qi inductive charging pad.” (*Id.*, 2:13-16.) Prior to the Qi standard, two wireless power devices “had to be designed specifically

for each other, but devices and chargers designed to support the standard established by the WPC [could] be freely interchanged.” (*Id.*, 2:20-26; *see also id.*, 7:6-9.) The Qi standard sought to overcome such problems before the alleged time of invention with a standard and accepted wireless charging protocol.

207. A person of ordinary skill in the art would have had good reason for having the setup mode of operation (§§IX.A.1.f, i) of the *Sogabe-Azancot* combination be “based on a Wireless Power Consortium standard” as disclosed by *Muratov* and understood in the art. In combination, the microcontroller of the *Sogabe-Azancot* system would operate in accordance with the WPC standard during the setup power transmission mode. (§§IX.A.1.e-f; Ex. 1005, 7:34-45.)

208. As I discussed previously, the WPC/Qi standard allowed wireless devices and systems to be freely interchanged with each other and was becoming popular and accepted before the alleged time of invention. For these and similar reasons, a person of ordinary skill in the art would have been motivated to base the setup operation mode off the WPC/Qi standard. (Ex. 1009, 2:13-26, 7:6-9; Ex. 1010, 1, 7-9; Ex. 1011, 1.) Moreover, such a skilled person would have appreciated that using the WPC/Qi standard for the first or second modes of operation (§§IX.A.1.f, i) would have increased marketability of the system by including a universally accepted wireless power standard/Qi branding. (Ex. 1009, 2:13-26, 7:6-9; Ex. 1010, 1, 7-9; Ex. 1011, 1.) Such a skilled person also would have been motivated to

implement the WPC/Qi standard for the setup mode (§§IX.A.1.f, i) to increase the interoperability of the system. (Ex. 1011, 1, 7.)

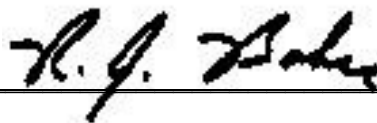
209. A person of ordinary skill in the art would have aware and appreciated that the WPC/Qi standard was adopted, and was well-understood before the alleged time of invention. To a person of ordinary skill in the art, the modification would have been a foreseeable combination of known components according to known methods (*e.g.*, implementing the readily available WPC/Qi standard), and which would have resulted in such a system with a first mode of operation being based on the then known and understood Qi standard. Furthermore, a person of ordinary skill would have appreciated that the WPC/Qi standard also comprised uni-directional messaging, like that claimed for the first mode of operation. (Ex. 1010, 1, 7-9, 51; Ex. 1011, 6-7; §IX.A.1.f.) Thus, it is my opinion that such a skilled person would have had a reasonable expectation of success in basing the first mode of operation on the WPC/Qi standard.

X. CONCLUSION

210. In summary, it is my opinion that all of the features recited in claims 1-3, 5-11, 13, 14, and 24 of the '777 patent are disclosed and/or suggested by the prior art.

211. 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.