

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. 7,948,208

**DECLARATION OF R. JACOB BAKER, PH.D., P.E.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 7,948,208**

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a)	A charger system for use with a mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, for charging and/or powering the device and/or battery inductively, comprising:	83
b)	a base unit having a surface, and comprising a plurality of primary coils arranged behind and parallel to the surface, wherein each of the primary coils is positioned within the base unit, and.....	97
c)	wherein each of the primary coils is associated with a switching circuit in the base unit, which switching circuit is capable of being selectively switched to activate its associated primary coil so that, when an electrical current is passed through that activated primary coil, a magnetic field is generated by that activated primary coil in a direction substantially perpendicular to the surface of the base unit, and	103
d)	wherein the base unit and/or switching circuit includes a capacitive or other component that decreases harmonics in that activated primary coil;....	112
e)	a power supply for passing a current through the primary coils when activated, to generate the magnetic field in a direction substantially perpendicular to the plane of the primary coils;.....	136
f)	a communications interface that the base unit, and the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, use to communicate with one another during powering or charging, to.....	143

- g) poll each of the primary coils, or receive a signal from a sensor associated therewith, to verify the presence of the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device placed upon or close to the surface of the base unit, ...154
- h) select, based on the polling or sensing, from within the plurality of primary coils, and selectively switch, using their associated switching circuits to activate, only those one or more primary coils which are determined to be most closely aligned with receiver coil at the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, and 163
- i) periodically thereafter exchange information to provide power transfer to the device and/or battery, including device and/or battery charging or power status or presence; and 172
- j) wherein the substantially perpendicular magnetic field is used to inductively generate a current in the receiver coil within or on the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device placed upon the activated primary coil of the base unit, to charge or power the device and/or battery, and 182
- k) wherein the base unit, and receiver coil or circuitry associated therewith, use current modulation performed by the receiver coil or its circuitry, to provide an indication that is then used by the base unit to 188

(1)	determine and regulate one or more of output voltage, current, or power provided by the base unit to the device and/or battery to be within the range of one or more of a value of a required voltage, current, or other power parameter for the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, ...	188
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I, R. Jacob Baker, Ph.D., P.E., declare as follows:

I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. (“Petitioner”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”) against Mojo Mobility Inc. (“Patent Owner”) regarding U.S. Patent No. 7,948,208 (“the ’208 patent”) (Ex. 1001).¹ I have been asked to consider whether the prior art discloses or suggests the features recited in claims 1 and 18 (“the challenged claims”) of the ’208 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 ’208 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. 7,948,208
Ex. 1004	Prosecution History of U.S. Patent No. 7,948,208
Ex. 1005	U.S. Patent Application Publication No. 2005/0068019 (“ <i>Nakamura</i> ”)
Ex. 1006	U.S. Patent No. 6,912,137 (“ <i>Berghegger</i> ”)
Ex. 1007	U.S. Patent Application Publication No. 2006/0202665 (“ <i>Hsu</i> ”)
Ex. 1008	U.S. Patent No. 6,960,968 (“ <i>Odendaal</i> ”)
Ex. 1009	U.S. Patent No. 6,489,745 (“ <i>Koreis</i> ”)
Ex. 1010	U.S. Patent No. 6,366,817 (“ <i>Kung</i> ”)
Ex. 1011	Physics, Henry Semat et al., Rinehart & Co., Inc., 1958, Chapters 29-32 (“ <i>Semat</i> ”)
Ex. 1012	U.S. Patent No. 5,702,431 (“ <i>Wang</i> ”)
Ex. 1013	International Patent Application Publication No. WO1996040367 (“ <i>WangII</i> ”)

Ex. 1014	Handbook of Radio and Wireless Technology, Stan Gibilisco, McGraw-Hill, 1999 (“ <i>Gibilisco</i> ”)
Ex. 1015	U.S. Patent No. 4,942,352 (“ <i>Sano</i> ”)
Ex. 1016	Fundamentals of Electric Circuits, 2d., Charles Alexander et al., McGraw-Hill, 2004 (“ <i>Alexander</i> ”)
Ex. 1017	International Patent Application Publication No. WO1994/18683 (“ <i>Koehler</i> ”)
Ex. 1020	U.S. Patent Application Publication No. 2007/0109708 (“ <i>Hussman</i> ”)
Ex. 1021	U.S. Patent Application Publication No. 2003/0210106 (“ <i>Cheng</i> ”)
Ex. 1023	U.S. Patent Application Publication No. 2004/0201988 (“ <i>Allen</i> ”)
Ex. 1024	U.S. Patent No. 7,378,817 (“ <i>Calhoon</i> ”)
Ex. 1025	International Patent Application Publication No. WO2003/096361 (“ <i>Cheng</i> ”)
Ex. 1026	International Patent Application Publication No. WO2004/038888 (“ <i>ChengIP</i> ”)
Ex. 1027	Spiral Inductor Design for Quality Factor, Sang-Gug Lee et al., Journal of Semiconductor Technology and Science, Vol. 2. No. 1, March 2002 (“ <i>Lee</i> ”)
Ex. 1028	U.S. Patent Application Publication No. 2001/0055207 (“ <i>Barbeau</i> ”)
Ex. 1029	AN710 Antenna Circuit Design for RFID Applications
Ex. 1030	U.S. Patent No. 6,606,247 (“ <i>Credelle</i> ”)
Ex. 1034	U.S. Patent Application Publication No. 2005/0127868 (“ <i>CalhoonIP</i> ”)

Ex. 1035	Watson, J., Mastering Electronics, Third Ed., McGraw-Hill, Inc. (1990) (" <i>Watson</i> ")
Ex. 1036	Sedra, A., <i>et al.</i> , Microelectronic Circuits, Fourth Ed., Oxford University Press (1998) (" <i>Sedra</i> ")
Ex. 1037	GB Patent Application Publication No. 2202414 (" <i>Logan</i> ")
Ex. 1038	U.S. Patent No. 7,226,442 (" <i>Sheppard</i> ")
Ex. 1040	U.S. Patent Application Publication No. 2006/0145660A1 (" <i>Black</i> ")
Ex. 1041	U.S. Patent No. 5,780,992 (" <i>Beard</i> ")
Ex. 1042	U.S. Patent Application Publication No. 2007/0145830A1 (" <i>Lee</i> ")
Ex. 1043	ATMEL e5530 Data Sheet (2002)
Ex. 1044	U.S. Patent No. 6,459,383 (" <i>Delatorre</i> ")
Ex. 1045	International Patent Application Publication No. WO1999050806A1 (" <i>Cunningham</i> ")
Ex. 1046	International Patent Application Publication No. WO2004026129A1 (" <i>Due-Hansen</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 '208 patent at the time of the alleged invention.

18. I understand that the '208 patent issued from an application filed June 1, 2007, and claims priority to three provisional applications: U.S. Provisional Application Nos. 60/810,262 (filed June 1, 2006), 60/810,298 (filed June 1, 2006), and 60/868,674 (filed December 5, 2006). (Ex. 1001, Cover.) For purposes of rendering my opinions, I have been asked to initially consider that the time of the alleged invention of the '208 patent is around September 2006 to December 5, 2006. My opinions reflect how one of ordinary skill in the art (which I described below) would have understood the '208 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.

19. 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 and 18 of the '208 patent, as I discuss in detail below.

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

20. 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 September 2006 to December 5, 2006. 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 '208 patent, a person of ordinary skill in the art as of the claimed priority date of the '208 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.

21. 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), which I discussed above as being around September 2006 to December 5, 2006. My opinions in this declaration are also applicable from the perspective of such a skilled person at other related time frames (e.g., early-to-mid 2006 to early-to-mid 2007 time frames), and thus to the extent the time of the alleged invention

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was determined to be in such time frames, my opinions in this declaration would not change. (*See* also my discussions below in Section V.)

V. TECHNICAL BACKGROUND

22. As I discuss further below in Sections VIII and IX, it is my opinion that the features recited in the '208 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 '208 patent.

23. 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 '208 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 '208 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 '208 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

24. 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. 1035, 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.

25. 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).)

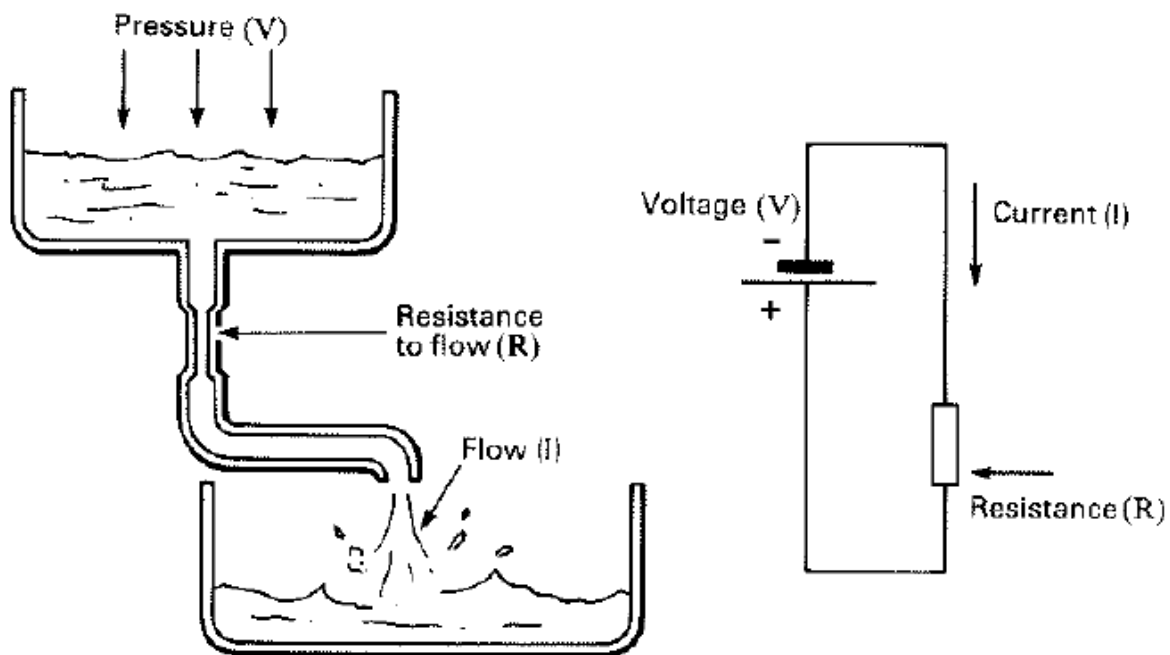
26. A person of ordinary skill would have known that “[i]n addition to measuring the current flow, we also need to measure another factor, the potential difference between two points,” which “is the energy difference between” the two points. (*Id.*, 10 (emphasis in original).) The potential difference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

27. 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.)

28. 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.*)

29. 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

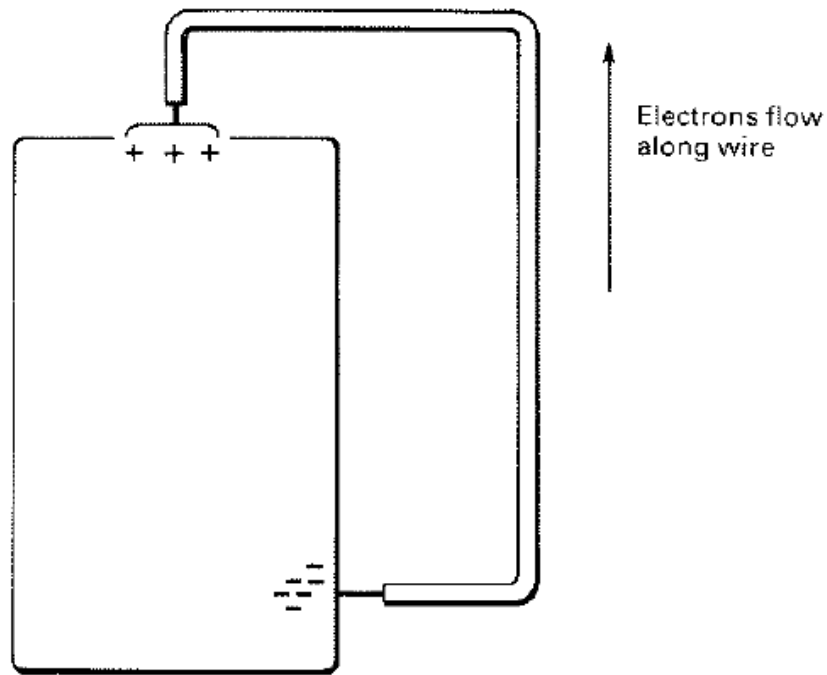


(*Id.*, FIG. 2.5.)

30. 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*



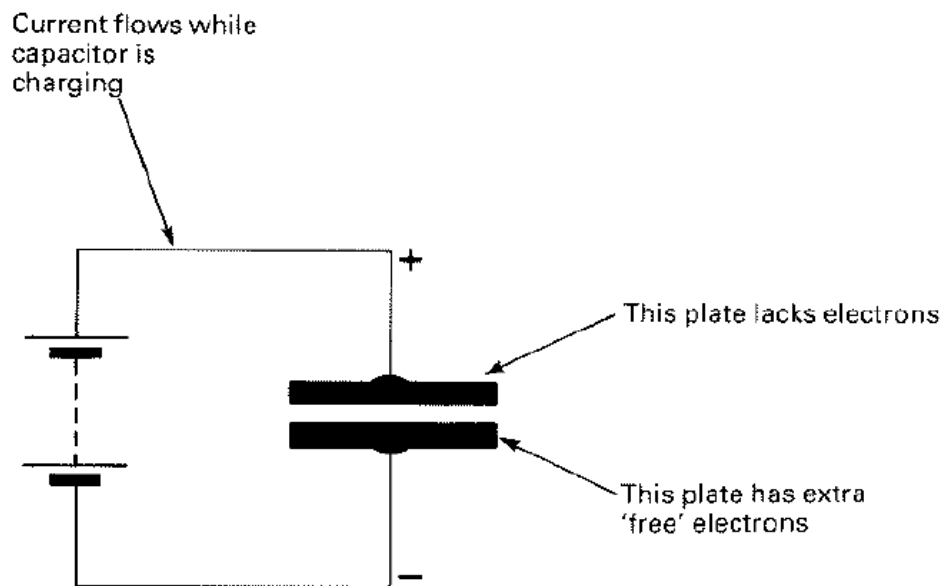
(*Id.*, FIG. 2.3.) A person of ordinary skill would have known that without such a closed path (e.g., as shown above in Figure 2.3), current cannot flow. (*Id.*, 8-11, FIGS. 2.3-2.5.)

31. 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.)

32. 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*

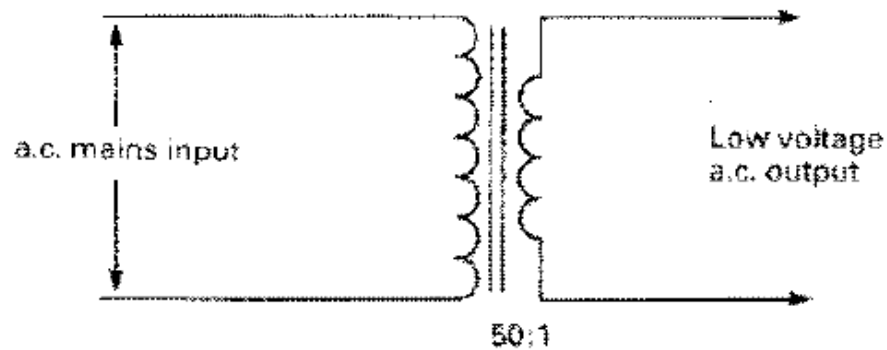


(*Id.*, FIG. 3.8.) A person of ordinary skill would have known that “[i]n this state the capacitor is said to be *charged*,” and [i]f the charged capacitor is connected in a circuit, it will, for a short time, act as a voltage source, just like a battery.” (*Id.*, 27 (emphasis in original).) It was known 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).)

33. 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”).)

34. A person of ordinary skill in the art would have known that in circuits, “L” signifies inductance and “C” signifies capacitance. (Ex. 1036, 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).)

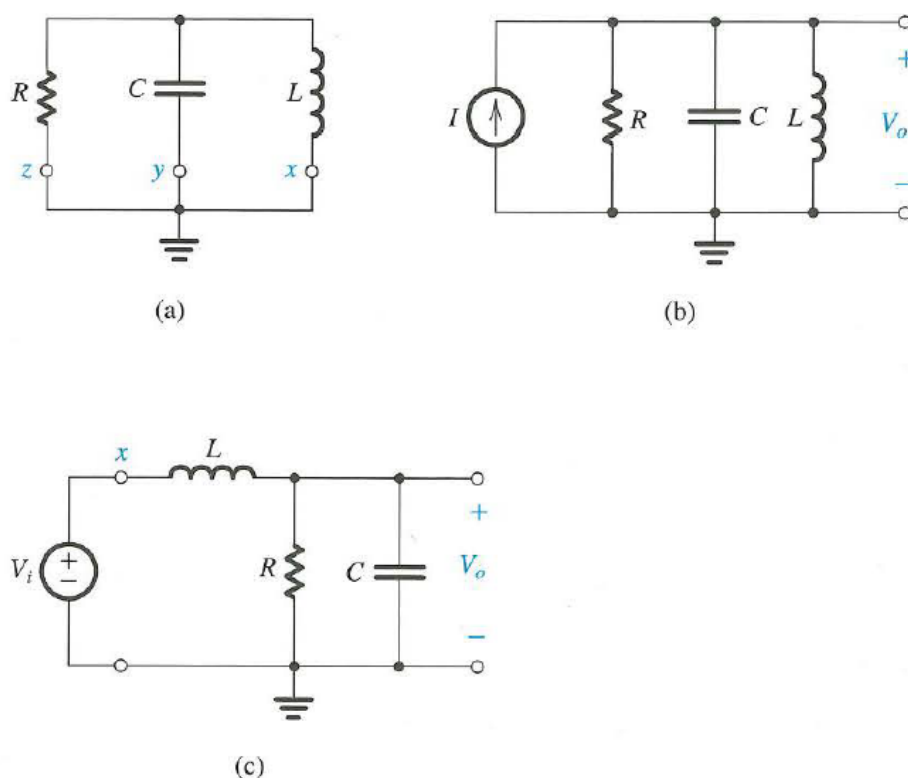


Fig. 11.17 (a) The second-order parallel LCR resonator. (b) and (c) Two ways for exciting the resonator of (a) without changing its *natural structure*. The resonator poles are the poles of V_o/I and V_o/V_i .

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

B. Contactless Power/Data Transfer

35. 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, including the use of planar inductive coils, and, the control/regulation of contactless power transfer.

1. Inductance and Inductive Coupling

36. It has long been known that a current carrying wire generates a magnetic field around it. (Ex. 1011, 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.)

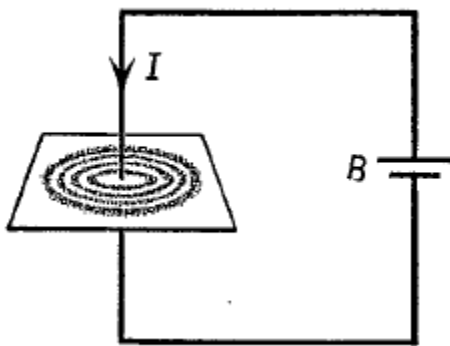
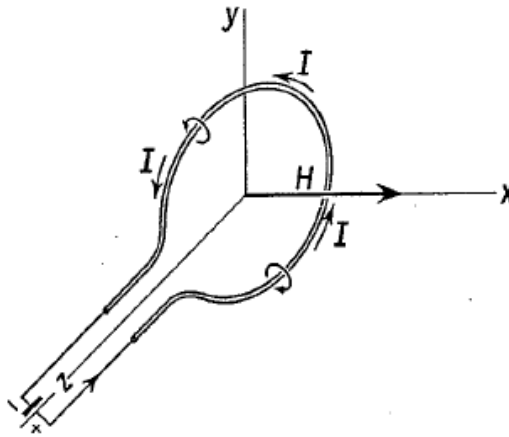


Fig. 30-2 Pattern formed by iron filings showing the circular magnetic field around a wire carrying current.

(*Id.* at 558.)

37. 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.)

38. 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.*)

39. 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.*)

40. 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.

41. 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.)

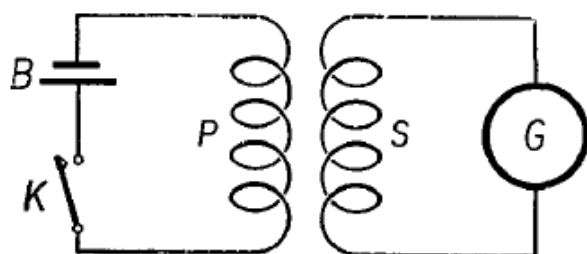


Fig. 32-3 Faraday's experiment on electromagnetic induction.

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

42. A secondary circuit includes a secondary coil S and a galvanometer G that is used to detect electrical current. (*Id.* at 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.*)

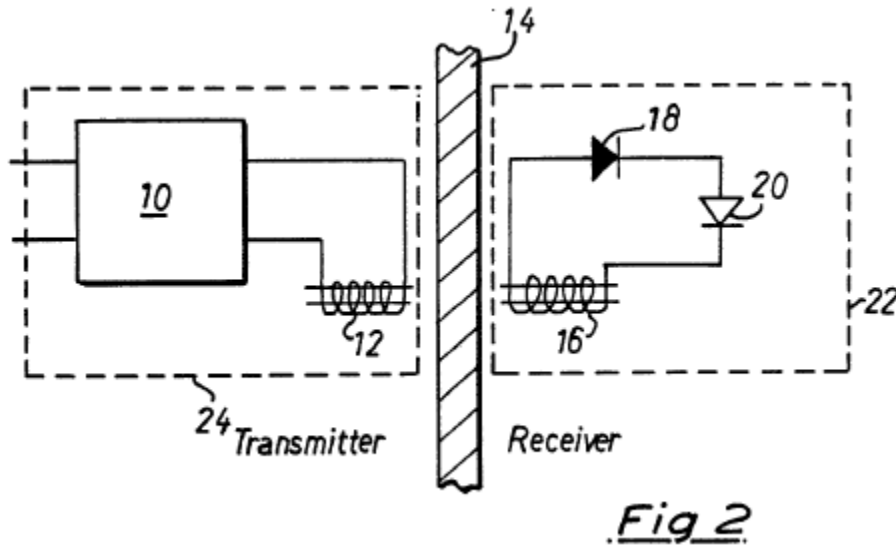
43. Therefore, in order to maintain current in the secondary circuit, the current in the first circuit can be continuously varied. By varying the current in the first circuit, the magnetic field (and therefore, magnetic flux) generated by the primary coil P is continuously varied, thereby inducing a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

44. 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.

45. For example, *Logan* notes that “[i]t is, of course, known in principle to transmit power and data using radio waves.” (Ex. 1037, 1:10-12.) It was well known to use inductor coils to facilitate wireless signal transmission. (Ex. 1038, 5:39-66 (describing “receiv[ing] power from an electromagnetic (EM) energy source” and “a coil for the receipt of electromagnetic energy”); Ex. 1037, 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. 1037, 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.)

46. 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. 1038, 5:39-66 (describing “receiv[ing] power from an electromagnetic (EM) energy source” and “a coil for the receipt of electromagnetic energy”); Ex. 1037, 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. 1009, 2:46-3:8; *see also id.*, FIG. 1.)

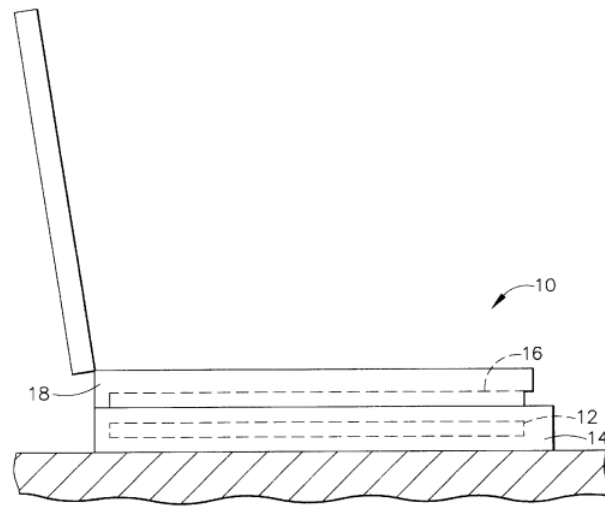


FIG. 1

(*Id.*, FIG. 1.)

47. *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. 1008, 1:13-27; *see also* Ex. 1013, Abstract (“[c]urrent is induced in a secondary coil”), 4:29-5:2; Ex. 1023, Abstract, ¶¶0039 (electromagnetic field induces a current), 0088; Ex. 1025, 1:10-15, 12:5-9, FIG. 1.)

48. 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. 1010, Abstract.)

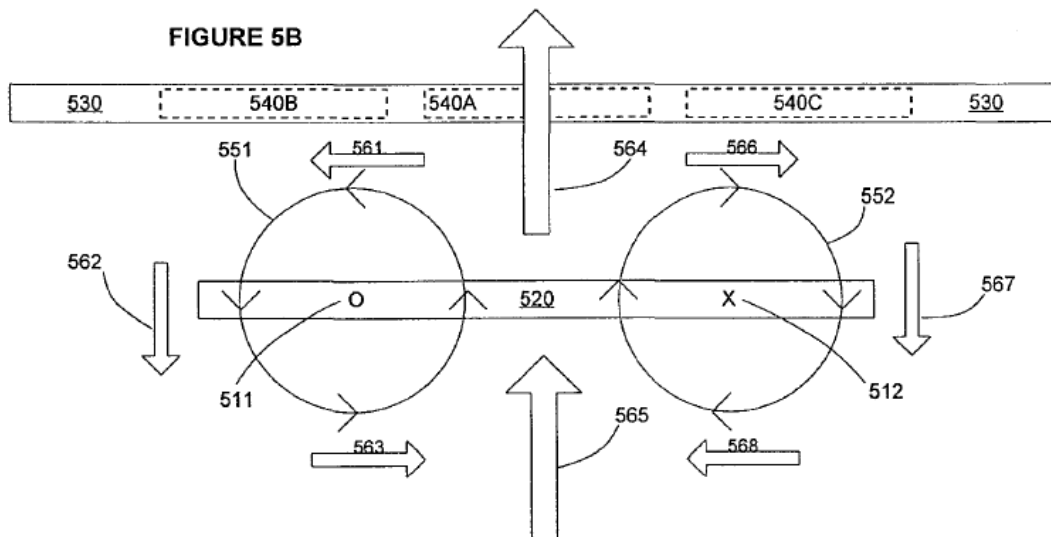
49. *Kung* also explains how the generated magnetic field traverses across the space. For example, *Kung* shows that a magnetic field represented by arrows 564 and 565 is perpendicular to plane 520 of charger and primary coil 510 and/or plane 540A of secondary coil 230.

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. 1010, FIG. 5B; *see also id.*, FIGS. 1-5A, FIGS. 6A-10, 7:21-8:54, 9:53-10:22, 11:27-14:67; Ex. 1011, 557-562, 593-594, 601; Ex. 1029, 3-4, 27-50.)

3. Use of Planar Coils

50. Because the inductive coils, such as those mentioned above, were often integrated into a portable device and/or a power transmitting device having a thin form factor (e.g., charging pad, etc.), a person of ordinary skill in the art would have considered the form factor of the coils to be installed in a portable device, such as cell phones, computers, PDAs, or in an inductive charger or a host object of such a charger, such as pads, desks, tabletops, and other supporting surfaces. A planar coil, given its relatively flat and thin structure, is known to be suitable for use in portable devices or in thin objects/surfaces. For example, *Odendaal* explains that the planar coils of the planar power resonator “may have a thin and/or relatively flat top coil surface” and the coils “are preferably **integrated into a planar (flat/thin) structure.**” (Ex. 1008, 2:44-64, 3:3-5.)

51. *Lee*, for example, also discusses the known use of a planar spiral coil inductor consistent with the knowledge of a person of ordinary skill in the art:

Since the arrival of the silicon-based RF IC era, much effort has been put into the **spiral inductor designs**. The main focus of the endeavor was to improve the quality factor. The major concern for the silicon-based spiral inductors has been the resistivities of the metal and the

silicon substrate. **Numerous techniques have been proposed** to reduce the resistivities of the interconnect lines and the silicon substrates [1,2]. Yet, **many planar spiral inductor structures have been designed and evaluated** without a clear understanding for the layout dependences of the quality factor. Simple and clear guidelines of inductor layout rules for optimum quality factor are presented for the required inductance and process information. . . . **Figure 1 shows the top view of a square spiral inductor layout.** Mohan [3] reported a simple and very accurate expression for the **planar spiral inductor inductances**. Modifying the Mohan's work, for the inductor dimensions shown in Fig. 1, the inductance can be expressed as . . .

(Ex. 1027, 1; *see also id.*, 1-3.)

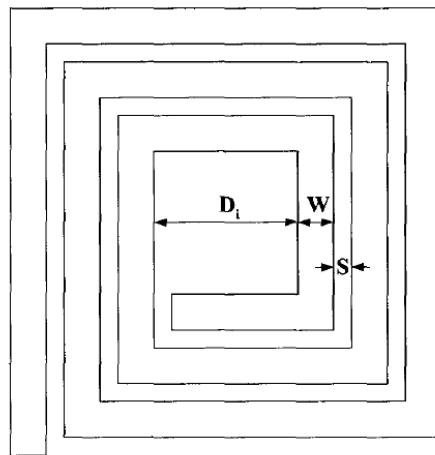


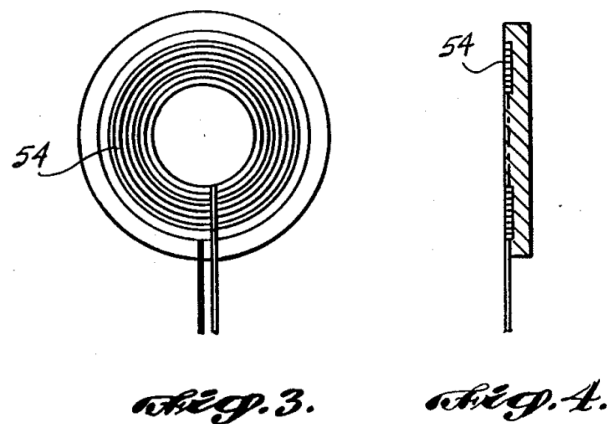
Fig. 1. A planar square spiral inductor structure.

(*Id.*, FIG. 1 (showing a “**planar square spiral inductor** structure”).)

52. Additionally, *Sano* (Ex. 1015) discusses the known use of a thin coil and a flat disk-like core.

Currently, the preferred form of the power receiving coil 54 is a **thin coil** which facilitates efficient interlinkage of the magnetic flux developed from the power supplying coil 18 with the power receiving coil 54. More particularly, the currently preferred power receiving coil 54 is a **flat disc-like core** on which is formed a single layer or several layers of wire-like electrical conductors. Such conductors can be formed, for example, by depositing conductive material on a side of the disc-like core that faces the power supplying apparatus 10. FIG. 3 is a front view of such a **sheet coil** and FIG. 4 is a vertical sectional view taken along its middle plane.

(Ex. 1015, 3:39-51; *see also id.*, FIGS. 1-2, 3-4, 7-12, Abstract, 1:5-2:29, 2:64-3:27, 5:5-47, 5:48-9:5.)



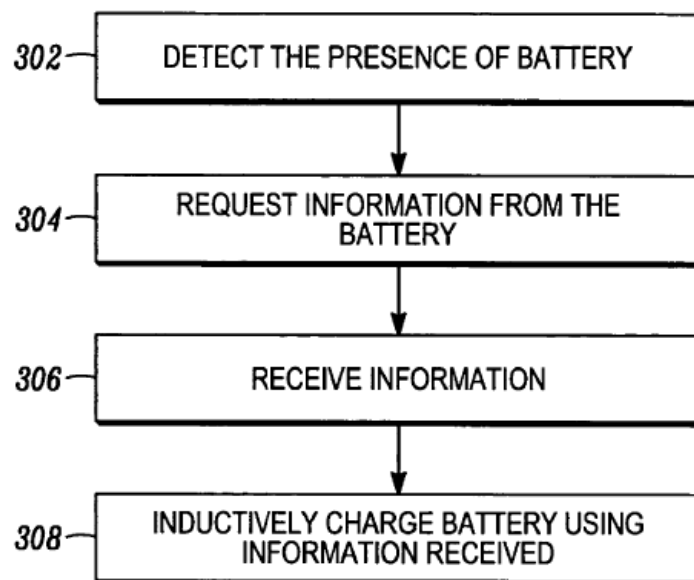
(*Id.*, FIGS. 3-4.)

53. There are other state of the art references that demonstrate and exemplify the knowledge of a person of ordinary skill in the art associated with using planar coils. (Ex. 1007, FIGS. 1-3, 6, 8A-9, ¶¶0002, 0006-0007, 0018-0025-0034; Ex. 1025, FIGS. 1, 3, 8-9, 13, 1:10-2:3, 2:5-12 (reasons to consider thin coil designs), 2:14-3:2, 4:19-32, 7:25-9:28, 12:27-32 (very thin printed coil), 14:4-17; Ex. 1026, FIGS. 1-2, 5 (conventional primary coil array arrangement), 9A-9C, Abstract, 1:3-4:4 (conventional designs), 4:6-9:4, 11:4-15 (concentric selectively active flat coils); Ex. 1009, Abstract, FIGS. 1-3, 1:4-51, 1:54-2:26, 2:47-3:8 (flat configurations), 3:9-39 (thin flat coil), 4:18-60; Ex. 1024, FIGS. 3, 8-9, 1:12-15, 1:39-2:29, 9:41-53, 10:45-57, 11:60-13:4; Ex. 1029, 1-4, 9-19 (planar, spiral coils); Ex. 1030, FIGS. 3-7B, 1:5-9, 1:59-61, 3:19-56, 4:62-567, 5:25-44.) A person of ordinary skill in the art would have understood complementing a primary/secondary-side planar coil with a second/primary-side planar coil would provide for efficient transmission of energy between the two planar coils in an inductive charging/power systems, especially where the coils were aligned to face each other to allow the perpendicular magnetic field generated from the transmitting planar coil to be received by the receiving planar coil. (See my discussions above in Section V.B.1.) Thus, in my opinion, where design applications in an inductive power transfer system called for planar transmitting or receiving coil designs (e.g., to provide for thin, compact, versatile devices), such a skilled person would have had reasons to likewise consider

design options where the receiving or transmitting coil likewise incorporated planar-type coil(s).

4. Controlling and Regulating Contactless Power/Data Transfer

54. 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. 1040, ¶0020.)



(Ex. 1040, 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. 1041, 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.

(Ex. 1041, 1:59-2:6.)

55. 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* (which I discuss further below in Sections VIII and IX), discusses such features consistent with that known by a person of ordinary skill in the art at the time. (See, e.g., Ex. 1005, ¶¶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).

(Ex. 1005, ¶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.

(Ex. 1005, ¶0079.)

56. 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* (which I also discuss below in Sections VIII and IX) 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. 1006, 5:65-6:37.)

C. Issues Relating to Harmonics in Contactless Power/Data Transfer

57. It was known to a person of ordinary skill in the art that alternating or pulsed signals, such as those provided to a primary coil in a contactless powering/charging system, included harmonic waves/signals that were multiple of the frequency of the reference wave/signal. Such harmonics were known to create unwanted radiation that generated heat, resulting in inefficiencies in signal transmission, such as power signals transferred in a contactless inductive power transfer system.

58. For example, *WangII* (also discussed below in Sections VIII and IX) describes features consistent with that known in the art at the time, such as:

The primary and secondary coils form a transformer so that electrical current in the primary induces current in the secondary coil. An approximation to a half-wave sinusoidal voltage is developed across the primary winding by the action of a field effect transistor (FET) switching a direct current (DC) voltage source across a tuning capacitor. Because, however, of the construction of the energy transmission device, **high frequency harmonic components are present in the waveform.** These high frequency components induce eddy currents in the implanted device which houses the electronics. The can temperature increases in response to the eddy currents. **A rise in temperature** of the outer surface of the can may be detrimental to operation of the medical device and surrounding body tissue. To prevent this temperature rise, the prior art charging devices must be operated at very low power levels.

(Ex. 1013, 3:29-4:5.)

It would be desirable, therefore, to provide a battery charging system that overcomes these and other problems associated with rechargeable implantable devices. In particular, it would be **desirable to construct a battery charging device which can efficiently charge a battery** in an implanted medical device at a relatively high power **without excessively heating the device....**

(Ex. 1013, 4:19-28.)

59. Likewise, *Lee* explains that

When a power MOSFET is switched while its source drain current is still nonzero, the flywheel actions of the choke and the main inductor will try to maintain the current during the switch transition, **thereby creating large voltage spikes with high harmonic content which lowers the overall power efficiency as well as distorting the output waveform.**

(Ex. 1042, ¶0084.)

60. Since unmanaged harmonics would reduce energy transmission efficiency, and lead to unwanted heating of surrounding/nearby electronic components, there were known ways to mitigate these issues, which I discuss below.

61. To mitigate the negative effects of harmonics, resonant circuits including a capacitor and/or other components were widely utilized and known to reduce harmonics in power and/or data transmission applications.

62. For example, the textbook, *Fundamentals of Electric Circuits*, 2d., Charles Alexander et al., McGraw-Hill, 2004 (“*Alexander*”) (Ex. 1016), explains that filters may be formed using a combination of components including a capacitive component to reduce harmonics.

[r]esonance is a condition in **an RLC circuit** in which the **capacitive** and inductive reactances are equal in magnitude, thereby resulting in a purely resistive impedance. **Resonant circuits (series or parallel) are useful for constructing filters.**

(Ex. 1016, 631.)

[a] bandpass **filter** is designed to pass all frequencies within a band of frequencies, $w_1 < w < w_2$ the bandpass filter in Fig. 14.35 is a series resonant circuit.

(*Id.*, 641.)

a bandpass filter . . . [i]f the filter is made highly selective . . . , the filter passes only the fundamental component ($n=1$) of the input and **blocks out all higher harmonics.**

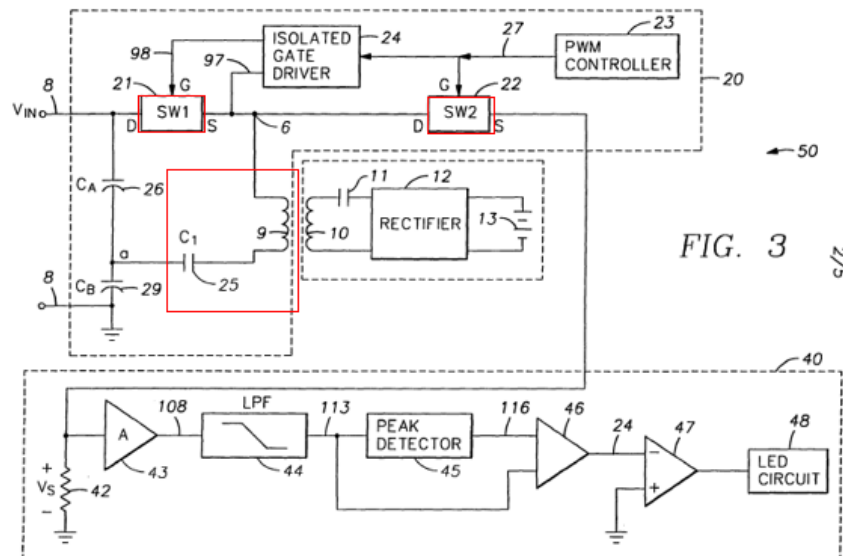
(*Id.*, 798.)

63. Likewise, *Lee* explains that:

The series LC resonator 101 and 115 provides a high “Q” environment to **filter out higher harmonics** and enhance the fundamental frequency to produce a substantially sinusoidal waveform at the output ports 102 and 103.

(Ex. 1042, ¶0083.)

64. *WangII* also discusses the use of capacitive components to reduce harmonics. For example, *WangII* discloses using capacitor-based resonant circuit with switches that provides full sinusoidal wave to “**reduce harmonics** and eddy current” to minimize heat and “without causing excessive energy loss.” (Ex. 1013, 4:29-5:7; *see also* Abstract, 3:29-4:5 (discussing prior art where primary/secondary coils arrangement using a switching DC voltage across a tuning capacitor where “high frequency harmonic components are present in the waveform,” which “induce eddy currents” that increase temperature that is detrimental to operation of the device), 4:19-28 (battery charging device to efficiently charge a battery in device without excessive heat), 7:24-8:14, 8:17-23 (tuning capacitor 25 designed so that a sinusoidal waveform “flows through the primary coil 9 with **little high order frequency content**”), 24-31, 9:26-12:27.)



(Ex. 1013, FIG. 3 (annotated); *see also id.*, FIG. 6.)

65. Other references provide similar disclosures consistent with a person of ordinary skill in the art at the time. (Ex. 1012, FIGS. 2, 5 (C1 25, inductor 9), 8 (same), 3:30-62, 8:47-9:51; Ex. 1014, 67-68 (“In a narrowband transmitter, a low-pass filter might be built in for ***reduction of harmonic output***”); *id.*, 62-68; Ex. 1015, FIGS. 1-2, 5-12, Abstract, 1:55-2:10, 3:28-51, 4:22-44 (providing a capacitor 20 in parallel with power supply coil “so that [there is] a resonance”), 5:45-6:4 (“the resonant frequency f_R ” is set to a level as low as approximately 1.5 times of the output frequency f_o of the frequency converter 16 . . . [and] oscillation at a frequency of $2 f_o$ was optimal from the standpoint of maximum circuit efficiency”); Ex. 1020, Abstract, (disclosing tuning capacitor 22 in a resonant circuit in an inductively coupled power transfer system that results in reduce harmonics); Ex. 1025, ¶¶00164-0165 (“[i]t was known in the art to drive coils using parallel or series resonant circuits” to allow “maximum current flow[] through the primary coil”); Ex. 1029, 19 (“antenna coils . . . can be formed by a metallic or conductive trace on PCB board or on flexible substrate”), 22-25; Ex. 1017, 1:9-8:22 (discussing known issues with harmonics and conventional and revised ways to reduce harmonics in AC-DC/DC-AC conversion power systems with application to “battery chargers”); Ex. 1023, FIGS. 1-4, 6A-6C, 14, Abstract, ¶¶0007-0024, 0027, 0032-34, 0074-0078

Declaration of R. Jacob Baker, Ph.D., P.E.
U.S. Patent No. 7,948,208

(describing mechanisms/techniques to reduce harmonics in AC and DC driven
lighting systems and benefits for doing so).)

VI. OVERVIEW OF THE '208 PATENT

66. The '208 patent discloses a power source, charging system, and inductive receiver for mobile devices, where a base unit comprising one or more primary coils creates a magnetic field that creates energy received by a receiver having a secondary coil. (Ex. 1001, Abstract, 3:20-49.) The Summary section of the '208 patent states that in an embodiment, a “pad or similar base unit comprises a primary[], which creates a magnetic field by applying an alternating current to a winding, coil, or any type of current carrying wire” and “[a] receiver comprises a means for receiving the energy from the alternating magnetic field and transferring it to a mobile of other device.” (*Id.*, 3:20-27.) “The receiver can also comprise electronic components or logic to set the voltage or current to the appropriate levels required by the mobile device, or to communicate information or data to and from the pad.” (*Id.*, 3:27-30.) (*See also id.*, 4:39-6:25.) These features, in my opinion, were conventional at the time. Likewise, these and other features recited in claims 1 and 18, were known and consistent with contactless power transfer technologies and techniques, and related circuit designs at the time of the alleged invention, as I discussed above and further below. (*See my discussions above in Section V and below in Sections VIII-IX.*)

VII. CLAIM CONSTRUCTION

67. 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, namely claims 1 and 18, 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., September 2005 to December 5, 2005). 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 petition where appropriate.

VIII. OVERVIEW OF THE PRIOR ART

68. 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 '208 patent below in Section IX. Accordingly, the following discussions are incorporated into my analysis below in Section IX.

A. *Nakamura* (Ex. 1005)

69. I understand that *Nakamura* is a published United States patent application. (Ex. 1005, Cover.) My understanding is that *Nakamura* was filed September 23, 2004 and published March 31, 2005. (*Id.*) I rely on the disclosures and analysis thereof of *Nakamura* discussed in this section VIII for my opinions regarding *Nakamura*'s teachings and suggestions as applied to the challenged claims of the '208 patent below in Section IX.

70. *Nakamura* discloses “a power supply system that supplies power to electronic equipment and, more particularly, [] a power supply system that supplies power to mobile electronic equipment such as portable telephones, notebook personal computers, a digital cameras, and an electronic toys.” (Ex. 1005, ¶0003; *see also id.*, ¶¶0016.) *Nakamura* discloses that such a power supply system supplies power in “a *non-contact manner*, to power reception equipment from a power transmission apparatus” that provides selective power levels “to be transmitted according to power required by the power reception equipment” (e.g., indicated by “information on consumed power”). (*Id.*, ¶0017; *see also id.*, ¶¶0062-0063, 0065, 0077-0078, 0083-0085, 0090-0091, FIGS. 3-5.)

71. *Nakamura*'s figures (e.g., FIGS. 1A, 1B, and 2A and other figures such as FIGS. 3, 5, 6, 13A-13E, 14-25, etc.) show examples of such a power supply system with a power reception equipment (e.g., mobile device 2 or 3) and a power transmission apparatus (e.g., apparatus 1). For example, *Nakamura* explains, “FIGS.

1A and 1B are views showing outer appearances of power supply systems embodying the present invention. In FIGS. 1A and 1B, a numerical symbol 1 indicates a power transmission apparatus for supplying power. FIG. 1A shows a case where power reception equipment is a portable telephone 2, and FIG. 1B shows a case where the power reception equipment is a notebook PC 3.” (Ex. 1005, ¶0062.)

FIG. 1A

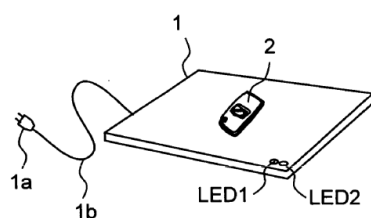
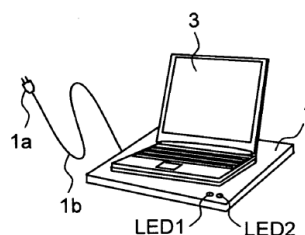


FIG. 1B



(*Id.*, FIGS. 1A-1B.) *Nakamura* also explains, “Description will be given of a principle of a non-contact transmission system with reference to FIGS. 2A and 2B. FIGS. 2A and 2B are schematic diagrams for describing schematic constructions of the interiors of the power transmission apparatus 1 and the portable telephone 2 shown in FIG. 1A.” (*Id.*, ¶0064.)

FIG. 2A

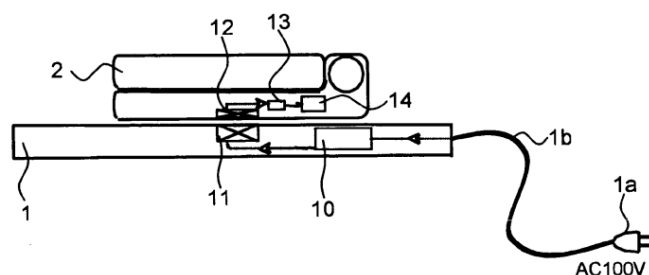
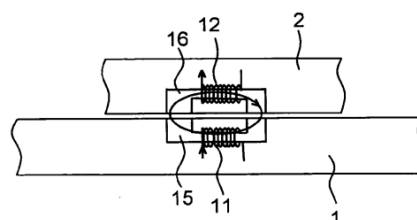


FIG. 2B



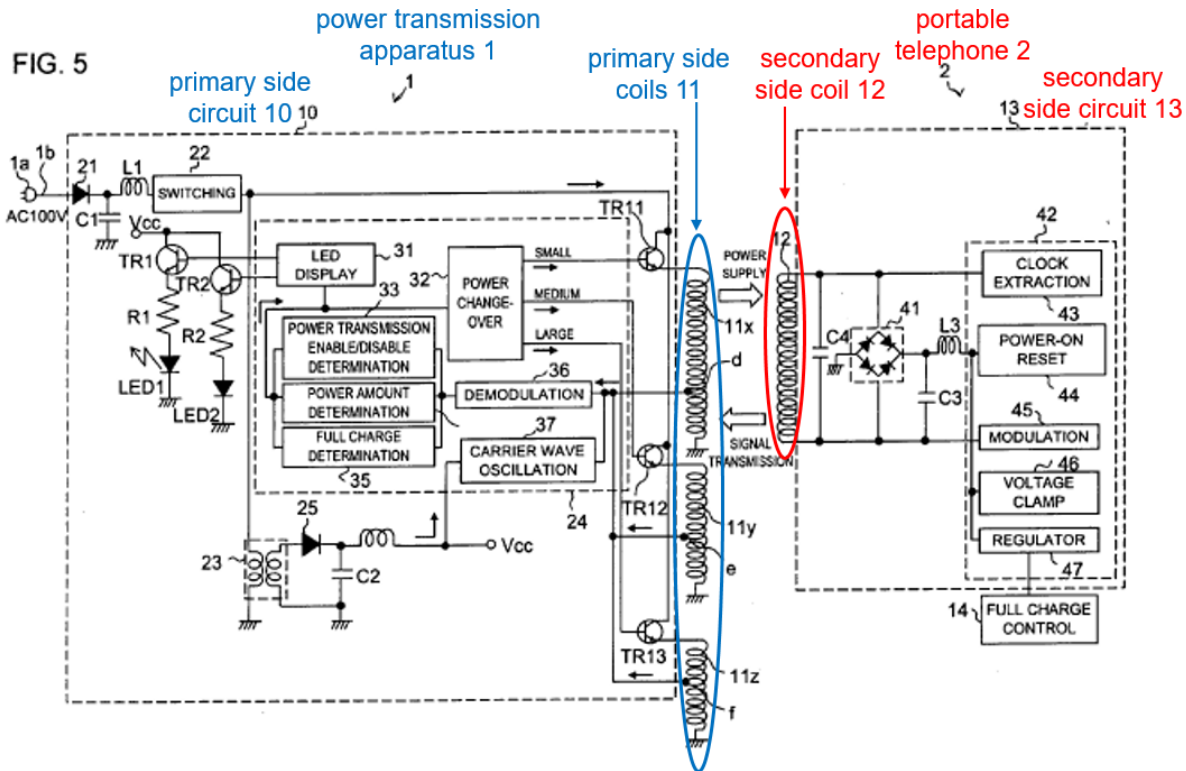
(*Id.*, FIGS. 2A-2B.)

72. *Nakamura* discloses that the power transmission apparatus (e.g., apparatus 1) has a “primary side circuit” (labeled 10 in FIGS. 2A, 3 and 5, for example) that provides a pulsed voltage to a “primary side coil” (labeled 11, for example) that resulted from rectifying and smoothing a commercial power supply (*id.*, ¶¶0018), and that the power reception equipment (e.g., device 2 or 3) includes a “secondary side coil” (labeled 12, for example) that is “magnetically coupled to the primary side coil,” where power (including voltage and current) is “induced across [from the primary side coil to] the secondary side coil 12 by [the] magnetic coupling” and used to power/charge the power reception equipment and/or its battery. (*Id.*; see also *id.*, ¶¶0062, 0065, FIGS. 3-5.) *Nakamura* explains:

The primary side circuit 10 full-wave rectifies and smoothes AC 100 V supplied through the AC plug 1a and the cord 1b to convert the AC 100 V once to a DC voltage, and thereafter the DC voltage is subjected to switching to obtain **a pulse voltage which is then supplied to the primary side coil 11. The primary side coil 11 and the secondary side coil 12 constitute a transformer through magnetic coupling between a primary side core (ferrite) 15 and a secondary side core (ferrite) 16, wherein when the pulse voltage obtained by switching is applied across the primary side coil 11, a voltage is**

induced across the secondary side coil 12 by magnetic coupling depending on a turns ratio between the primary side coil 11 and the secondary side coil 12. **The induced voltage is rectified to a DC voltage and smoothed in the secondary side circuit 13; the resultant DC voltage is supplied to a charge control circuit 14; and the charge control circuit 14 charges a battery with the supplied DC voltage. In this way, a non-contact power supply is performed from the power transmission apparatus 1 to the portable telephone 2.**

(Id., ¶0065; see also id., ¶0062, FIGS. 3-5.)

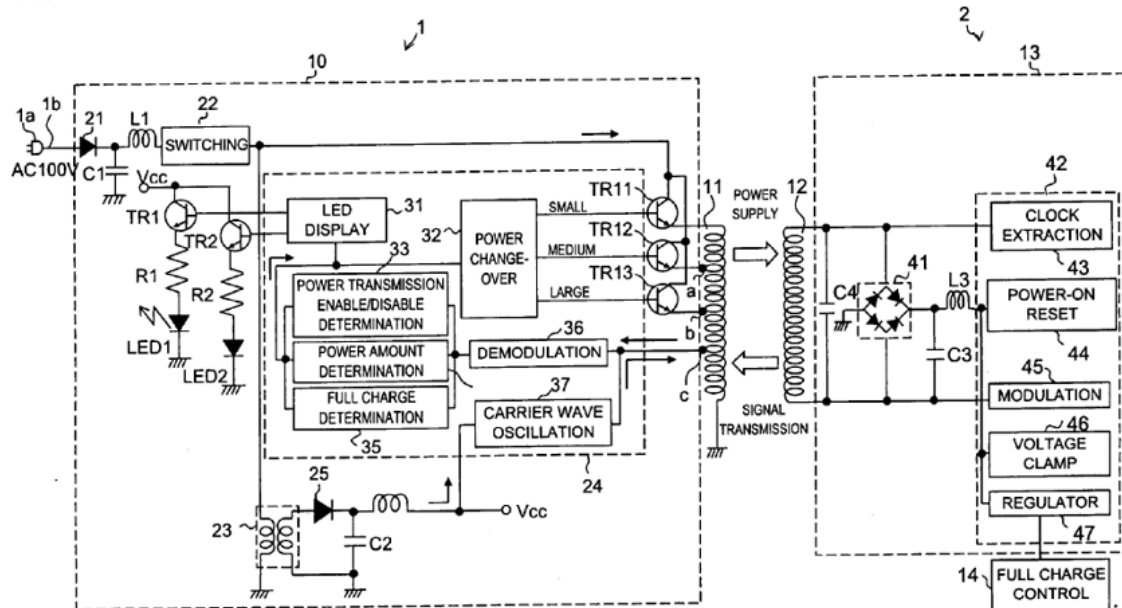


(Id., FIG. 5 (annotated); ¶¶0090-0091.)

73. *Nakamura* describes various configurations that while arranged slightly different, operate and perform similar features to transfer power and data inductively between the power transmission apparatus (e.g., apparatus 1) and power reception equipment (e.g., device 2 or 3) and are applicable to many different applications *Nakamura* contemplates in the disclosure. For example, in certain configurations, “the primary side coil comprise either a coil with a plurality of taps each arranged on the coil at different turns” (e.g., FIG. 3 (see below)), or it can “comprise a plurality of coils each having a different number of turns” (e.g., FIG. 5 (see above)), which allow a power change-over section to select, according to the power required by the

power reception equipment, one or more taps from among the plurality of taps (for multi-tap primary coil) or one coil from the plurality of coils (for multi-coil configuration) to allow the system to transmit different levels of power from the power transmission apparatus depending on the power required by the power reception equipment. (*Id.*, ¶¶0019, 0084; *see also id.*, FIGS. 3, 5.)

FIG. 3



(*Id.*, FIG. 3.) *Nakamura* explains that “[i]n FIG. 5, the same constituents as in FIG. 3 are attached with the same symbols and descriptions thereof will not be given herein” (*id.*, ¶0090) and that “the power transmission apparatus 1 has the configuration in which three coils for power transmission and respective transistors are provided. It is also possible to transmit power in the same manner as in the

case of the power transmission apparatus 1 shown in FIG. 3 where one primary side coil 11 is used” (*id.*, ¶0091).

74. *Nakamura* discloses various configurations/setups/applications where “the power transmission apparatus is embedded in [various objects such as] the top plate of a desk, the shelves of a rack, the bottom plates of a lockable locker, the holder for holding a power reception equipment, the dashboard and/or the console box of an automobile, the top mat, the wall, the side surface of a utensil, the floor, and the floor covering fabric.” (See, e.g., *id.*, ¶0159; see also *id.*, ¶0124, FIGS. 13A-20, ¶¶0107-0123, 0147-0153.)

FIG. 13A

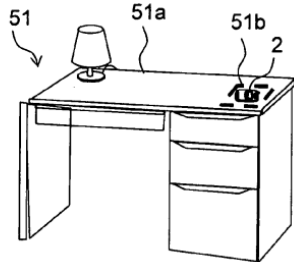


FIG. 13B

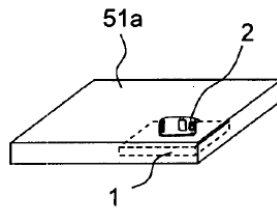


FIG. 13E

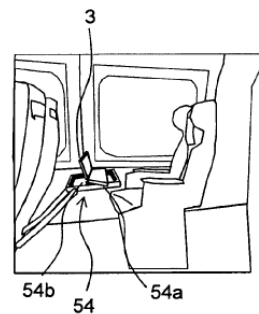


FIG. 14

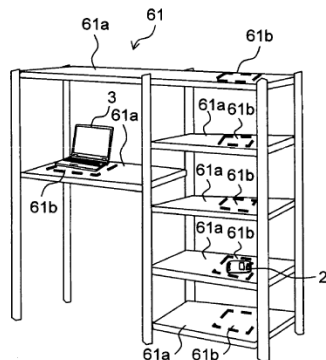


FIG. 15B

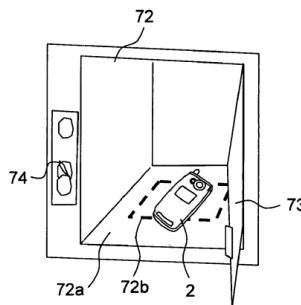
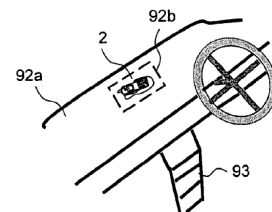


FIG. 18



(*Id.*, FIGS. 13A, 13B, 13E, 14, 15B, 18.)

75. *Nakamura* also describes configurations/setups/applications where multiple power transmission apparatuses 1 are embedded in objects such as a conference desk/table (e.g., FIG. 13C), floor (e.g., FIG. 20), “floor covering fabric[,]” etc. so that multiple (and different types of) mobile devices (e.g., portable phone, laptop computer, cleaning robot, etc.) can be powered/charged (e.g., at different locations on the surfaces of such objects), in accordance and consistent with features/configurations discussed for other figures in *Nakamura* such as (including but not limited to) “FIGS. 1A, 1B, 2A, 2B, 3, 5 to 9, 10A, and 10B” as well as FIGS. 13A and 13B (some of which are shown above). (*See, e.g.*, Ex. 1005, ¶¶0107-0109, 0123-0124, FIGS. 13C, 20.)

FIG. 13C

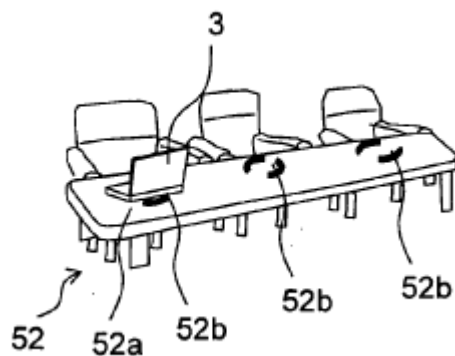
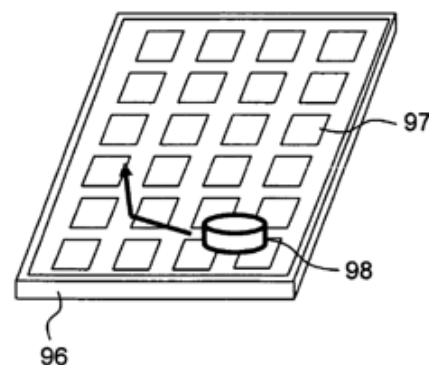


FIG. 20



(*Id.*, FIGS. 13C, 20.)

76. *Nakamura* explains that the power supply system is also configured to exchange information between the power transmission apparatus (e.g., apparatus 1) and power reception equipment (e.g., device 2 or 3) via the above-discussed

magnetic coupling between the primary side coils (e.g., of power transmission apparatus 1) and secondary side coil (e.g., of device 2 or 3). (*Id.*, FIGS. 3-5, Abstract, ¶¶0066 (“A signal including such as information on power supply or the like is transmitted between the primary side circuit 10 and the secondary side circuit 13 by the noncontact transmission method”), 0070, 0075 (power receiving control IC 42 includes components for performing “signal processing for a signal transmitted through the primary side coil 11 and secondary side coil 12”), 0076-0077 (oscillation circuit 37 outputs a **carrier wave supplied to primary coil 11 and subsequently “transmitted to the secondary side coil 12 which is magnetically coupled with the primary side coil 11”**).)

77. The carrier wave signal transmitted from primary side coils 11 is processed so that information regarding the power reception equipment (e.g., device 2 or 3) (e.g., “code indicating being power reception equipment,” “information on consumed power,” and “information on full charge”) is modulated and transmitted back (as a modulated wave containing such information) to the power transmission apparatus (e.g., apparatus 1). (*Id.*, FIGS. 4-5, ¶¶0077-0078.) The transmitted information signal is used to control powering/charging operations. For example, *Nakamura* explains:

The carrier wave outputted from the carrier wave oscillation circuit 37 is supplied to the tap c of the

primary side coil 11, and in a case where the portable telephone 2 is placed on the power transmission apparatus 1, the carrier wave is transmitted to the secondary side coil 12 which is magnetically coupled with the primary side coil 11. The carrier wave transmitted onto the secondary side coil 12 is rectified and smoothed by the rectification circuit 41, the coil 3, and the capacitor C3, and thereby converted to a DC voltage. The power-on reset circuit 44 detects the DC voltage obtained by converting the carrier wave and thereby recognizes that the carrier wave has been transmitted. The clock extraction circuit 43 connected to the secondary side coil 12 extracts a clock signal required for modulation from the carrier wave, and the modulation circuit 45 modulates the carrier wave based on information regarding the portable telephone 2, namely, “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge” and supplies the modulated wave to the secondary side coil 12. . . .

The modulated wave supplied to the secondary side coil 12 from the modulation circuit 45 is transmitted to the primary side coil 11 magnetically coupled thereto. The demodulation circuit 36 connected to the tap c of the primary side coil 11 receives and demodulates the transmitted modulated wave and supplies the “code

indicating being power reception equipment”, “information on consumed power”, and “information on full charge”, which are included in the demodulated information signal, to the power transmission enable/disable determination circuit 33, the power amount determination circuit 34, and the full-charge determination circuit 35. . . .

(Ex. 1005, ¶¶0077-0078; *see also id.*, FIGS. 4-5, ¶¶0079-0089; *id.*, 0090, 0091.)

78. The communicated **“code indicating being power reception equipment”** is used to detect/determine/verify presence and correct/proper placement/alignment of the power reception equipment (e.g., device 2 or 3) and its secondary side coil on or near the power transmission apparatus (e.g., apparatus 1) and its primary side coil(s) (e.g., the primary side and the secondary side coils are **“arranged at positions where a high coupling degree in magnetic coupling is established”** and **“at positions where a high power transmission efficiency in a non-contact power supply system is obtained”**). *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).

(Ex. 1005, ¶0078.) *Nakamura* also explains:

[A]s 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; *see also id.*, ¶¶0080-0083, 0086-0087, 0096, 0109, FIGS. 3-5, 11A-11B.)

79. *Nakamura* explains that the above-discussed communicated “**information on consumed power**” is used by the power transmission apparatus (e.g., apparatus 1) to determine the appropriate level of power (e.g., small, medium, or large) to be transmitted to the power reception equipment (e.g., device 2 or 3) in order to inductively power/charge the device and/or its battery. The power transmission apparatus (e.g., apparatus 1) turns on relevant circuitry (e.g., switching circuits such as transistors TR11/TR12/TR13) using a power change-over section (e.g., power change-over circuit 32)) in order to select and activate, based on the power level required by the power reception equipment whose presence has been detected, one primary side coil among a plurality of primary side coils (for a multi-coil configuration (e.g., FIG. 5))² that is detected and closely positioned/aligned with the secondary side coil (e.g., the primary side and the secondary side coils are

² In case of a multi-tap, single primary coil configuration (e.g., FIG. 3), one or more taps among a plurality of taps of a primary side coil that is present and closely aligned with the secondary side coil is turned on. (Ex. 1005, ¶¶0083-0084; *see also id.*, ¶¶0078-0082, 0086-0087, FIGS. 3, 11A-11B.)

“arranged at positions where a high coupling degree in magnetic coupling is established” and “at positions where a high power transmission efficiency in a non-contact power supply system is obtained”) as determined and verified by the above-discussed process that involves the use of the communicated **“code indicating being power reception equipment,”** in order to transmit power (including voltage and current) from the power transmission apparatus to the power reception equipment, according to the power level required by the power reception equipment and/or its battery. (*Id.*, ¶¶0083-0084, 0090, 0091; *see also id.*, ¶¶0079-0082, 0086-0087, 0096, 0109, FIGS. 3-5, 11A-11B.)

80. For example, *Nakamura* explains:

[I]f the positional deviation of the portable telephone 2 from the power transmission apparatus 1 does not exceed the predetermined value, the process moves to **a process for determining a level of power to be transmitted (step S6)**. The determination process is performed in the power amount determination circuit 34 based on the **“information on consumed power”** included in the information signal demodulated in the demodulation circuit 36. The power of the portable telephone 2 is recognized based on the **“information on consumed power”**. A power transmission output is adjusted at one of three levels of large, medium, and small depending on the recognized power. A result of the

determination from the power amount determination circuit 34 is transmitted to the LED display circuit 31 and the **power change-over circuit 32** so as to perform the **process described below in response to one of the large, medium, and small levels as the result of the determination.**

If the determination result shows the small level, . . . the power change-over circuit 32 turns on the transistor TR11. When the transistor TR11 is turned on, a pulse voltage from the switching circuit 22 is applied across the total length of the primary side coil 11 to start power transmission (step S8). Then, when the determination result shows the medium level, . . . the power change-over circuit 32 turns on the transistor TR12. When the transistor TR12 is turned on, a pulse voltage from the switching circuit 22 is applied to the tap a of the primary side coil 11 to start power transmission (step S10). When the determination result shows the large level, . . . the power change-over circuit 32 turns on the transistor TR13. When the transistor TR13 is turned on, a pulse voltage from the switching circuit 22 is applied to the tap b of the primary side coil 11 to start power transmission (step S12).

(Ex. 1005, ¶¶0083-0084; *see also id.*, FIGS. 3-5, ¶¶0090, 0091 (“In this embodiment [relating to FIG. 5], to be specific, **one of the transistors is selected by the power change-over circuit 32 according to the level of power to be transmitted determined from the signal containing the ‘information on consumed power’ received from the portable telephone 2. Accordingly, a coil for transmitting power can be selected, and power required for the power reception equipment can be transmitted.** For example, in a case where the power of the power reception equipment is small, a coil with a large number of turns is used. In a case where the power of the power reception equipment is large, a coil with a small number of turns is used.”).)

81. *Nakamura* explains that the above-discussed communicated **“information on full charge”** is used to “determine[] whether or not the portable telephone 2 [power reception equipment] is in a state of full charge.” (*Id.*, ¶0088.) Moreover, *Nakamura* explains that the above-discussed communications (e.g., of information) between the power transmission apparatus and the power reception equipment and the processes that use the communicated information such as detecting/determining/verifying presence and correct placement/alignment of the power reception equipment (e.g., device 2 or 3) and its secondary side coil on or near the power transmission apparatus (e.g., apparatus 1) and its primary side coil(s) continue “regularly,” “[e]ven after the power transmission is started,” until, for

example, the power reception equipment has been fully charged (or until the power reception equipment or its secondary side coil ceases to be present on or near the power reception equipment or its primary side coils, etc.). (Ex. 1005, ¶¶0086-0088; *see also id.*, FIG. 4, ¶0020.) For example, *Nakamura* explains:

Even after the power transmission is started, the carrier wave is *regularly* transmitted (step S13), and it is checked whether or not the portable telephone 2 which is power reception equipment, has been removed from on the power transmission apparatus 1 according to the information included in the modulated wave transmitted back against the carrier wave (step S14). In the confirmation, the power transmission enable/disable determination circuit 33 determines, in a similar manner to that in step S3, **whether or not the power reception equipment is placed on the power transmission apparatus 1, based on the “code indicating being power reception equipment”.** If a predetermined “code indicating being power reception equipment” has not been received, it is determined that the power reception equipment has been removed from on the power transmission apparatus 1, and the power change-over circuit 32 turns off all of the transistor TR11, TR12, and TR13 to cease power transmission (step S15).

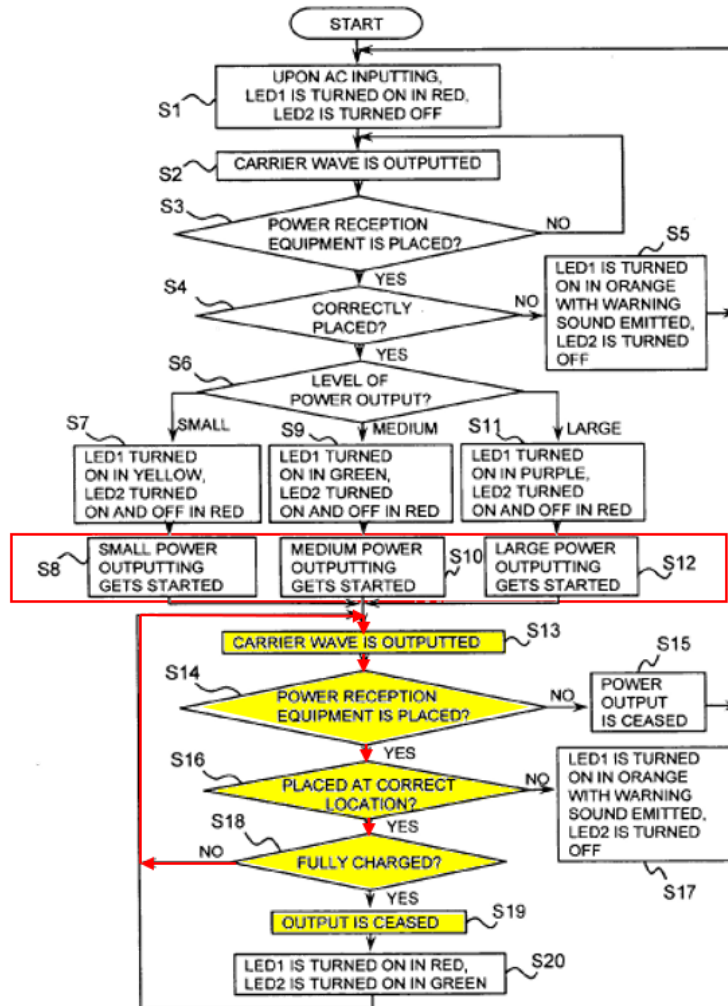
On the other hand, if the predetermined “code indicating being power reception equipment” has been received, it is recognized that the power reception equipment has been placed on the power transmission apparatus 1, and then, it is determined whether or not the power reception equipment has been placed correctly on the power transmission apparatus 1 (step S16). The determination is performed in a similar manner to that in step S4 by determining whether or not a deviation of the portable telephone 2 from the power transmission apparatus 1 exceeds a predetermined value. If the positional deviation exceeds the predetermined value, no power transmission is performed from the power transmission apparatus 1. Then, in a similar manner to that in step 5, the LED1 is turned on in orange and the LED2 is turned off as a warning indication (step S17). In this situation, a warning sound may be emitted instead.

On the other hand, if the positional deviation of the portable telephone 2 from the power transmission apparatus 1 does not exceed the predetermined value, then the process moves to a process in which it is determined whether or not the portable telephone 2 has been fully charged (step S18). The determination process is performed in a way such that the full-charge determination circuit 35 determines whether or not the

portable telephone 2 is in a state of full charge, **based on the “information on full charge” included in the information signal demodulated in the demodulation circuit 36. If the information shows a state of full charge, the power change-over circuit 32 turns off all of the transistors TR11, TR12, and TR13 to cease power output (step S19), and the LED1 is turned on in red and the LED2 is turned on in green (step S20) so as to indicate that the power transmission ceases, because the power reception equipment is in a full charge state. Thereafter, the carrier wave is outputted to thereby *continue confirmation* of a state of the power reception equipment (step S13). On the other hand, if the information does not show a state of full charge, the confirmation of a state of the power reception equipment *continues* while performing power transmission (step S13).** In this way as described above, **a non-contact power supply is performed from the power transmission 1 to the portable telephone 2.**

(Ex. 1005, ¶¶0086-0088; *see also id.*, FIG. 4, ¶0020.)

FIG. 4



(Ex. 1005, FIG. 4 (annotated).)

82. *Nakamura* explains that the power transmission apparatus (e.g., apparatus 1) “is equipped with light emitting diodes (display section) LED1 and LED2 . . . indicating an input state of AC 100 V, a state of power supply to power reception equipment, and other information.” (*Id.*, ¶0063; *see also id.*, ¶¶0082, 0084 (LEDs are used “to indicate that power transmission is performed at the [small/medium/large] level”), 0089, FIGS. 4, 12.)

B. *Berghegger* (Ex. 1006)

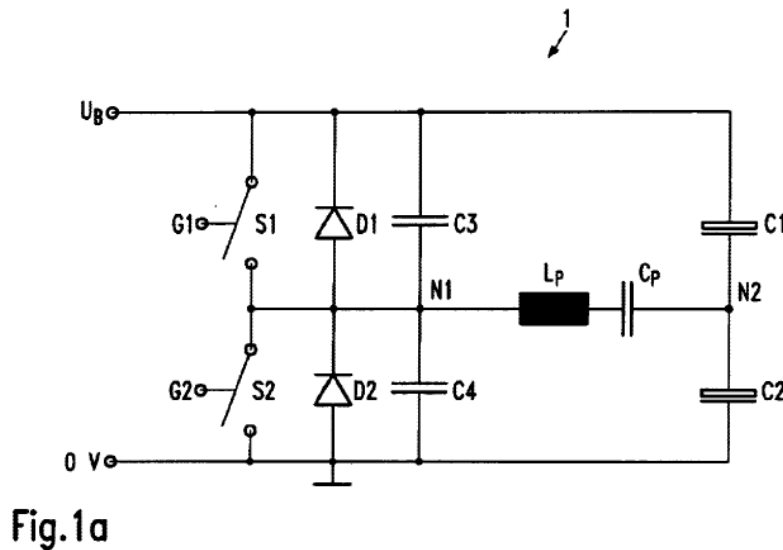
83. I understand that *Berghegger* is an issued United States patent. (Ex. 1006, Cover.) My understanding is that *Berghegger* was filed November 28, 2002 and issued June 28, 2005. (*Id.*)

84. *Berghegger* discloses an inductive contactless power system using primary and secondary coils for powering/charging a device and/or its battery. For example, *Berghegger* explains:

The present invention relates to **an inductive contactless power transmitter having a primary side including a first inductor (L_P) on the primary side** and an oscillator for producing an alternating signal which is supplied to the inductor (L_P) on the primary side, and having **a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (L_P) on the primary side**, a load (R_L) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).

(Ex. 1006, Abstract; *see also id.*, FIGS. 1a-1b, 4-6, 1:65-2:17, 2:18-3:30, 5:27-30, 6:12-19 (load can include batteries), 6:37-45 (charging tray for mobile phone).)

85. *Berghegger* discloses the use of resonant capacitor (e.g., resonant capacitor C_p) or other capacitors or components (e.g., capacitors C_3 and C_4) that would decrease harmonics in an activated coil, such as the activated primary coil of its contactless inductive-based power system. For example, with reference to FIG. 1a, *Berghegger* discloses a “basic circuit for driving an inductive resonant transmitter.” (*Id.*, 3:51-61, FIG. 1a.) *Berghegger* explains that this circuit includes capacitors (e.g., large capacitors C_1 and C_2 and small capacitors C_3 and C_4), a resonant capacitor C_p , and an inductor L_p on the “primary side.” (*Id.*, 3:52-56.)



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

frequency, whereby the transmitted power increases”); *see also* discussions in Section IX.A.1(d); Section V.[TBD].)

88. In addition, *Berghegger* explains that “[w]henever following the switching off of one of the switches the inductor L_P on the primary side produces— at node N1—a voltage” (*id.*, 3:61-66) and that “[t]he **small capacitors C3 and C4 serve interference suppression because they short-circuit high-frequency signals** that are created during opening and closing of the switches or MOSFETs” (*id.*, 4:1-5; *see also id.*, FIG. 1a).

C. Hsu (Ex. 1007)

89. I understand that *Hsu* is a published United States patent application. (Ex. 1007, Cover.) My understanding is that *Hsu* was filed May 13, 2005 and published September 14, 2006. (*Id.*)

90. *Hsu* discloses a contactless inductive power/charging system that uses inductive coupling to provide power to a mobile device (e.g., laptop, PDA, etc.) having a secondary coil placed on or near one or more primary coils in the surface of a powering device. (Ex. 1007, ¶0006; *see also id.*, Title, Abstract, ¶¶0002, 0007, 0018-0025, 0029-0034.) For example, *Hsu* describes an inductive coupling power system that provides a plurality of primary coils 26 (e.g., “arranged into a matrix with rows and columns”) in a powering device 20 such as a desk/table, pad, etc. (*see, e.g., id.*, ¶¶0007, 0018, 0029-0030) that form a transformer with a secondary coil 25

in a portable device when placed on or near surface 21 of powering device 20, where magnetic flux generated by the primary coil(s) is picked up by the secondary coil 25 and induces an alternating voltage (and current) in the coil that is converted to power for the portable device (*id.*, ¶¶0018-0021).

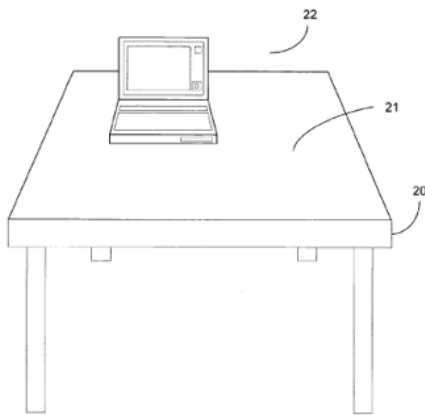


FIG. 1

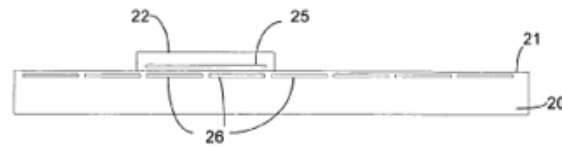


FIG. 2

(*Id.*, FIGS. 1-2.)

91. *Hsu* explains that powering device 20 can determine/verify the presence and location of the portable device using information sent from the portable device. (*Id.*, FIG. 5, ¶¶0021-0025, 0029-0030.) *Hsu* also explains that “primary coils are sized such that multiple primary coils overlap with the secondary coil when the portable device is placed on the inductive powering surface.” (*Id.*, ¶0034.) *Hsu* performs a sensing mode, where primary coil 26 is driven to send signals that portable device is tuned to receive, and upon determining the presence/location of the portable device on the powering device, a power transfer mode to provide power

using inductive coupling. (*Id.*, FIG. 5, ¶¶0025-0029.) *Hsu* also explains that “the controller scans the primary coils” for detecting/sensing the presence/location of the portable device using a “scan pattern,” such as one that “loops through the rows or columns of the primary coils, or [] any other desired pattern.” (*Id.*, ¶0029.) For example, *Hsu* explains:

As mentioned above, **the inductive powering surface has a plurality of primary coils 26, and only those that are covered by or overlapping with the secondary coil 25 are to be energized for transferring power to the portable device. To that end, the controller 36 of the powering device first determines whether any portable device is present on the powering surface and, if so, the location of the secondary coil of that device.**

Referring to FIG. 5, **to detect the presence and location of the secondary coil, the controller scans the primary coils. The *scan pattern* may be a linearly progressive pattern in which the controller loops through the rows or columns of the primary coils, or may be any other desired pattern.** For each primary coil 26, the controller operates an appropriate driver circuit to energize the coil at a ***sensing frequency***, such as 13.56 MHz, and at a lower power level (step 50). **If a secondary coil is present and overlaps with that primary coil, the RFID circuit in the portable device will pick up the waves sent by the**

primary coil (step 51), power up the RFID chip, and return RF waves containing information about the portable device.

As mentioned above, the information may include power requirements of the portable device that may be used by the controller to facilitate the power transfer operation. *The RF waves returned by the RFID device are picked up by the primary coil (step 52).* The detection of the returned waves indicates that a secondary coil is present and overlaps with the primary coil. The location of that primary coil is recorded by the controller. (step 53) In this way, the controller goes through the primary coils according to the *scan pattern*, and identifies those primary coils that have *picked up responses from the RFID device*. Those primary coils are then energized at a power delivery frequency, such as 100 KHz (step 54), to transfer power to the portable device via inductive interaction with the secondary coil.

(Ex. 1007, ¶0029.)

92. Hsu explains that multiple primary coils can be arranged such that each is associated with one or more switching circuits that selectively switch/activate one or more primary coils 26 based on the position/location of the secondary coil 25

detected according to the above-discussed scanning features. (*Id.*, FIG. 6, ¶0030; *id.*, ¶¶0007, 0029, 0031-0032.)

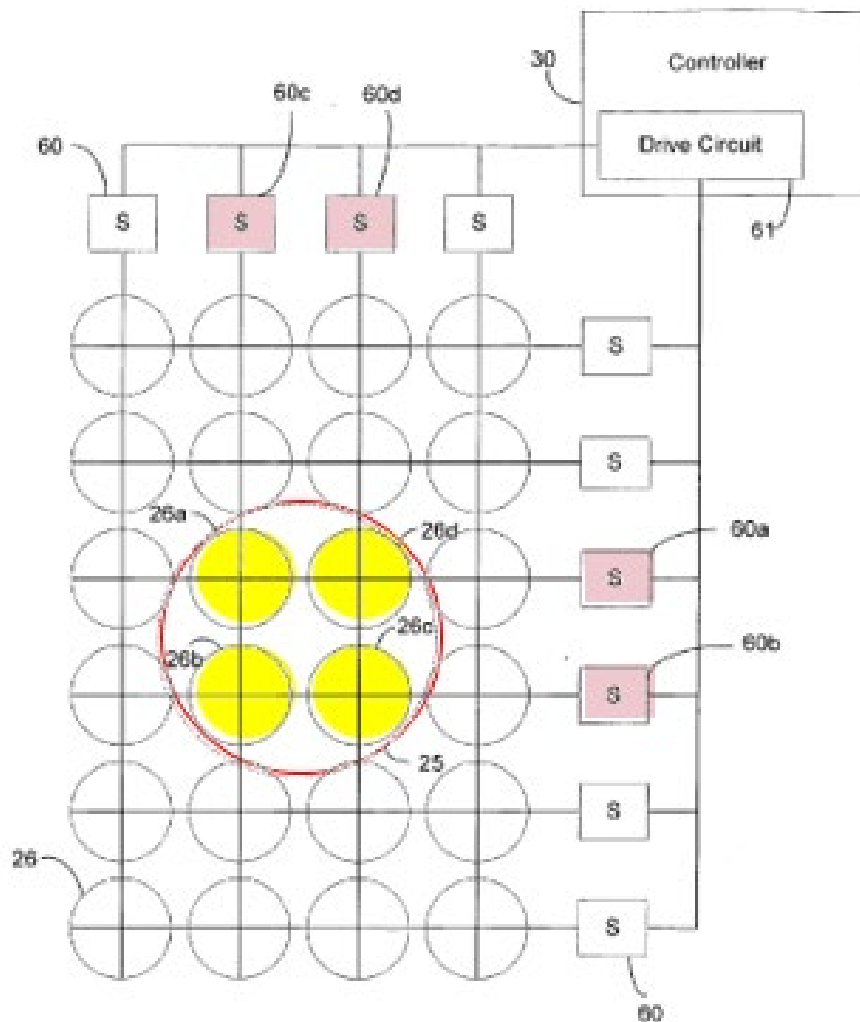


FIG. 6

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

93. For example, *Hsu* explains (with respect to FIG. 6 above) that four primary coils 26a-26d overlap with secondary coil 25 (of a portable device), such

that during the “scan phase” (e.g., using the above-discussed scanning/sensing techniques/features) the four coils 26a-26d are identified using RFID transmissions (see Ex. 1007, ¶¶0021-0025, 0029 (a portable device picks up waves sent by primary coil(s) 26 that are overlapping with the portable device’s secondary coil 25, and returns “RF waves [that] are picked up by the primary coil” to detect/sense the presence/location of the portable device and its secondary coil 25), and switches 60a-60d are actuated to connect those primary coils 26a-26d to a drive circuit, thus energizing the four coils 26a-26d (and only those coils) to facilitate power transfer to the overlapping secondary coil 25. (*Id.*, ¶0030; see also *id.*, ¶¶0007, 0020, 0029, 0034.) For example, *Hsu* explains:

As shown in FIG. 6, **the primary coils 26 are arranged generally in a two-dimensional matrix with multiple rows and columns, each row or column can be switchably connected to a drive circuit 61 by means of respective switches 60.** The drive circuit may comprise, for example, semiconductor or relay switches, and the drive circuit for each primary coil may be a single switch or multiple switches depending on the circuit configurations. . . . A primary coil 26 can be **turned on, i.e., energized or excited**, when both its row and column are connected to the drive circuit. By way of example, in the example shown in **FIG. 6, four primary coils 26a, 26b, 26c, 26d overlap with the secondary coil 25.**

During the scan phase as described above, the controller 26 identifies these four primary coil by means of the RFID transmission. Thereafter, the controller 26 actuates the switches 60a, 60b, 60c, 60d to connect the four primary coils 26a, 26b, 26c, 26 d to the drive circuit, thereby energizing these coils, while the other coils are not energized.

(Ex. 1007, ¶0030.)

D. *Odendaal* (Ex. 1008)

94. I understand that *Odendaal* is an issued United States patent. (Ex. 1008, Cover.) My understanding is that *Odendaal* was filed June 26, 2002 and issued November 1, 2005. (*Id.*)

95. *Odendaal* discloses a contactless inductive power/charging system (e.g., “contactless power transfer system[.]”) that uses inductive coupling (e.g., “coupling between battery charging circuit and the battery [that] may comprise capacitive coupling and/or **magnetic coupling, and wherein power is transferred by the coupling of** an electric field and/or **magnetic flux** across the IOET [interface-of-energy-transfer]”) between primary and secondary coils (e.g., thin, planar-type coils) to provide power to a mobile device (e.g., cellphone, computer, etc.) through its secondary coil placed on or near primary coils in the surface of a powering device (e.g., charger for cellphones, powering pad, or charger embedded in a thin surface,

including fabrics, etc.). (Ex. 1008, 1:5-3:57; *see also id.*, Title, Abstract, FIGS. 1A-4, 11-12, 4:50-5:8, 5:24-28, 6:59-64.)

96. *Odendaal* discloses the known use of thin, planar-type inductor coils for use in a contactless power/data transfer system that transfers power/data via magnetic coupling for, e.g., charging a battery of a cellphone, computer, wearable items, etc. (*Id.*, FIGS. 1A-1B, 2A, 2C, 8E, 1:58-2:43.) For example, *Odendaal* explains:

The spiral-shaped conductor may comprise pcb spiral-wound conductors. In addition, a battery charging circuit can be coupled to one of the first and second spiral-shaped conductors, and a load can be coupled to the other of the first and second **spiral-shaped conductors**. The coupling between battery charging circuit and the battery may comprise capacitive coupling and/or **magnetic coupling, and wherein power is transferred by the coupling of an electric field and/or magnetic flux across the IOET** [interface-of-energy-transfer].

According to an aspect of the present invention, a signal applied to the first spiral-shaped conductor can be transferred to the second spiral-shaped conductor by coupling of magnetic flux of the first and second spiral-shaped conductors across the IOET.

The first and second spiral-shaped conductors and the IOET are preferably integrated into a planar (flat/thin) structure.

(*Id.*, 2:55-3:5.) *Odendaal* also explains:

According to another aspect of the invention, an isolating coupling interface and a resonant tank are functionally integrated into a planar configuration for transferring power with isolation properties. **The device may comprise two separable structures on either side of the IOET, such as, for example, a cellphone and its charger. . . .**

An advantage of the present invention is that it facilitates the use of **wearable electronics**. For example, **flex circuits may be used so as to cause the surface of the coils to be flexible**. In addition to the flexibility, the coils may be formed in any arbitrary shape to facilitate woven wire arranged in **a fabric, or pads with embedded conductors that can be attached to clothes**. In this way, for example, **one could charge a radio, cellphone, and/or computer (just to name a few of the many wearable items) by bringing the device in close proximity to the fabric**. Thus, implementation of the invention with wearable electronics could provide an **interface between the wearable device(s) and external power sources**. Digital or analog signals may also be

transmitted across such interfaces to, for instance, up- or
download digital information.

(*Id.*, 2:16-43; *see also id.*, 2:44-54 (explaining that the “interface-of-energy-transfer” (IOET) of the planar power resonator “may have a **thin and/or relatively flat top coil surface**” and may have coils arranged in upper and lower configurations with an air gap”); *see also id.*, 2:1-15 (transferring power across IOET “in **either** an electric **or magnetic form**, or both” and “**transformer action** with or **without** capacitive energy transfer”), 4:44-5:8, 6:1-18 (air coil transformer).)

E. *WangII* (Ex. 1013)

97. I understand that *WangII* (WO1996040367) is International Application Published under the Patent Cooperation Treaty. (Ex. 1013, Cover.) My understanding is that *WangII* was published December 19, 1996. (*Id.*)

98. *WangII* discloses a contactless inductive power transfer system for powering a remote device (e.g., an implanted medical device and its batteries) via magnetic coupling. (*See, e.g.*, Ex. 1013, Abstract; *see also id.*, 4:34-5:2 (“The inductor forms a primary coil of a transformer in which current is induced in a secondary coil attached to an implanted medical device. The medical device receives the induced current for charging rechargeable batteries.”), FIGS. 1-3, 6, 4:29-5:13.)

99. *WangII* also describes configurations that use switch(es) loaded by a capacitor (e.g., capacitor (25)) coupled to a primary coil (e.g., primary coil (9)) (e.g.,

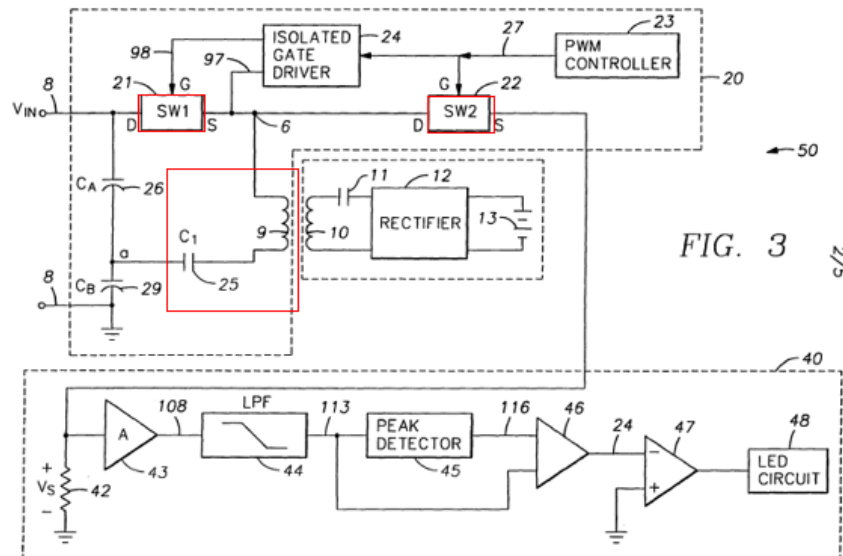
“a resonant circuit comprising a primary coil (9) and a capacitor (25)” (*id.*, Abstract, FIG. 3)) providing wireless power to secondary coil that reduces harmonics in the signals generated by the primary coil. For one example, *WangII* explains:

The present invention solves the shortcomings and deficiencies of the prior art by constructing a transcutaneous energy transmission device with **two solid state switches facilitating the production of a substantially sinusoidal power waveform. The generation of the full sinusoidal wave reduces harmonics and eddy currents which otherwise are generated in the housing (or can) of the implanted device. As a result, heating of the can is minimized. The solid state switches connect a regulated DC voltage across an inductor and capacitor resonant circuit.** The inductor forms a primary coil of a transformer in which current is induced in a secondary coil attached to an implanted medical device. The medical device receives the induced current for charging rechargeable batteries.

The present invention can be implemented in a circuit in which a 5 KHz gate signal turns a first MOSFET switch on and off. The gate signal also turns on and off a second MOSFET switch at opposite times than the first MOSFET switch. **In addition to minimizing harmonics, the use of the optimum switching frequency reduces the eddy**

**current in the housing (or can) of the implanted device,
without causing excessive energy loss.**

(Ex. 1013, 4:29-5:7; *see also id.*, Abstract (“ . . . A current with a sinusoidal waveform is applied to **a resonant circuit comprising a primary coil (9) and a capacitor (25)**. Current is induced in a secondary coil (10) attached to the implanted medical device. . . .”), FIGS. 1-3, 6, 3:29-4:5, 7:24-8:14, 8:17-23 (“little high order frequency content”), 8:24-31, 9:26-12:27.)



(Ex. 1013, FIG. 3 (annotated).)

IX. THE PRIOR ART DISCLOSES OR SUGGESTS ALL RECITED FEATURES OF CLAIMS 1 AND 18 OF THE '208 PATENT³

A. Ground 1: *Nakamura* in view of *Berghegger* Discloses and/or Suggests the Features of Claims 1 and 18

100. In my opinion, *Nakamura* in view of *Berghegger* discloses and/or suggests all of the features of claims 1 and 18 of the '208 patent.

1. Claim 1

a) A charger system for use with a mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, for charging and/or powering the device and/or battery inductively, comprising:

101. I understand that this phrase is the preamble of claim 1, and I have been asked to assume that the preamble limits the claim. Under that assumption, it is my opinion that *Nakamura* discloses the limitation(s) in the preamble. (See my

³ 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.)

discussions in §VIII.A; my discussions below for this section; *see also* discussions below for Sections IX.A.1(b)-(k), IX⁴.)

102. For example, *Nakamura* discloses “a power supply system that supplies power to electronic equipment and, more particularly, [] a power supply system [e.g., “**charger system**”] that supplies power to mobile electronic equipment such as portable telephones, notebook personal computers, a digital cameras, and an electronic toys.” (Ex. 1005, ¶0003; *see also id.*, ¶0016 (explaining the object of the invention is to provide such a system that is capable of “supplying power to different types of electronic equipment”).) *Nakamura* discloses that such a power supply system (e.g., “**charger system**”) supplies power in “a *non-contact manner*, to power reception equipment [e.g., “**mobile, electronic, or other device and/or battery, battery door, or skin for use with the device**” (hereinafter “**device**” or “**battery**”)] from a power transmission apparatus” (e.g., “**base unit**”—*see also* discussions for limitation 1(b)) that collectively form an example of a “**charger system**,” that

⁴ My discussions of *Nakamura* and supporting citations to *Nakamura* in this section are applicable to the discussions/analysis for all limitations of claims 1 and 18, and are incorporated by reference fully below in each of those sections even where not expressly cited or referenced.

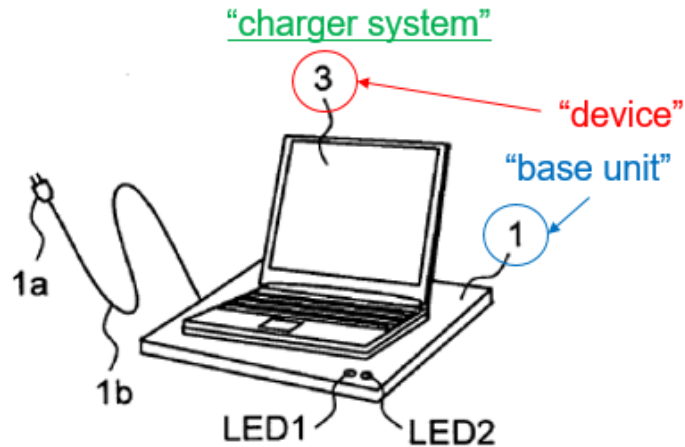
provides selective power levels “to be transmitted according to power required by the power reception equipment.” (*Id.*, ¶0017.)

103. *Nakamura*’s figures (e.g., FIGS. 1B and 2A and other figures such as FIGS. 13A-13E, 14-25, etc.) show examples of such a power supply system (e.g., “**charger system**”) with a power reception equipment (e.g., “**device**”) and a power transmission apparatus (e.g., “**base unit**”). For example, *Nakamura* explains,

FIGS. 1A and 1B are views showing outer appearances of power supply systems embodying the present invention. In FIGS. 1A and 1B, a numerical symbol 1 indicates a power transmission apparatus for supplying power. FIG. 1A shows a case where power reception equipment is a portable telephone 2, and FIG. 1B shows a case where the power reception equipment is a notebook PC 3.

(Ex. 1005, ¶0062.) The charger system and base unit are exemplified in the annotated FIGS. 1B and 2A below.

FIG. 1B

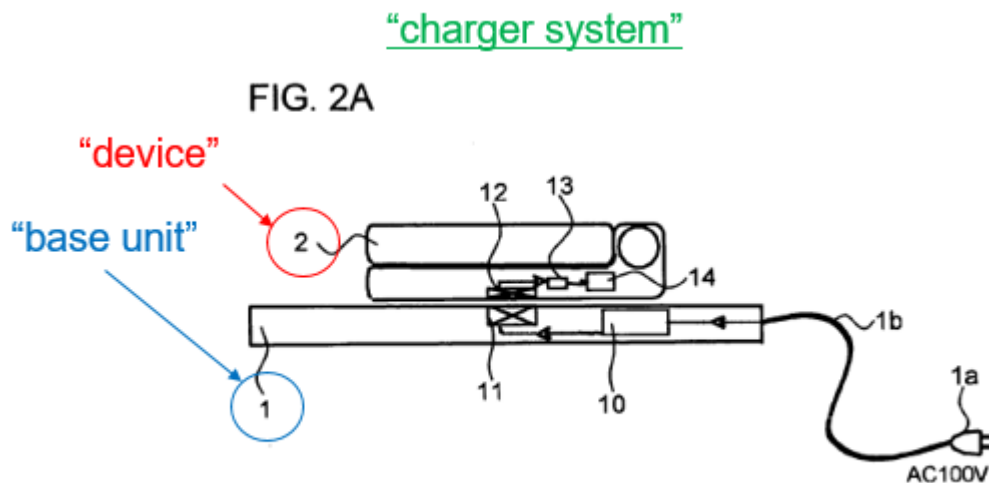


(Ex. 1005, FIG. 1B (annotated).)

Nakamura explains,

Description will be given of a principle of a non-contact transmission system with reference to FIGS. 2A and 2B. FIGS. 2A and 2B are schematic diagrams for describing schematic constructions of the interiors of the power transmission apparatus 1 and the portable telephone 2 shown in FIG. 1A.

(*Id.*, ¶0064.)



(*Id.*, FIG. 2A (annotated), *see also* FIG. 2B.)

104. A person of ordinary skill in the art would have understood that the configurations disclosed by *Nakamura* include the power transmission apparatus (“**base unit**”) having a “primary side circuit” (labeled 10 in FIGS. 3 and 5, for example) that provides a pulsed voltage to a “primary side coil” that resulted from rectifying and smoothing a commercial power supply. (*Id.*, ¶0018.) Such a skilled person would have also understood that the power reception equipment (“**device**”) includes a secondary side coil “magnetically coupled to the primary side coil.” (*Id.*) *Nakamura* explains that,

*[w]ith this configuration, a single power transmission apparatus [“**base unit**”] can supply power to different types of power reception equipment” (“**for charging***

and/or powering the device and/or battery inductively”).

(*Id.*) *Nakamura* also explains:

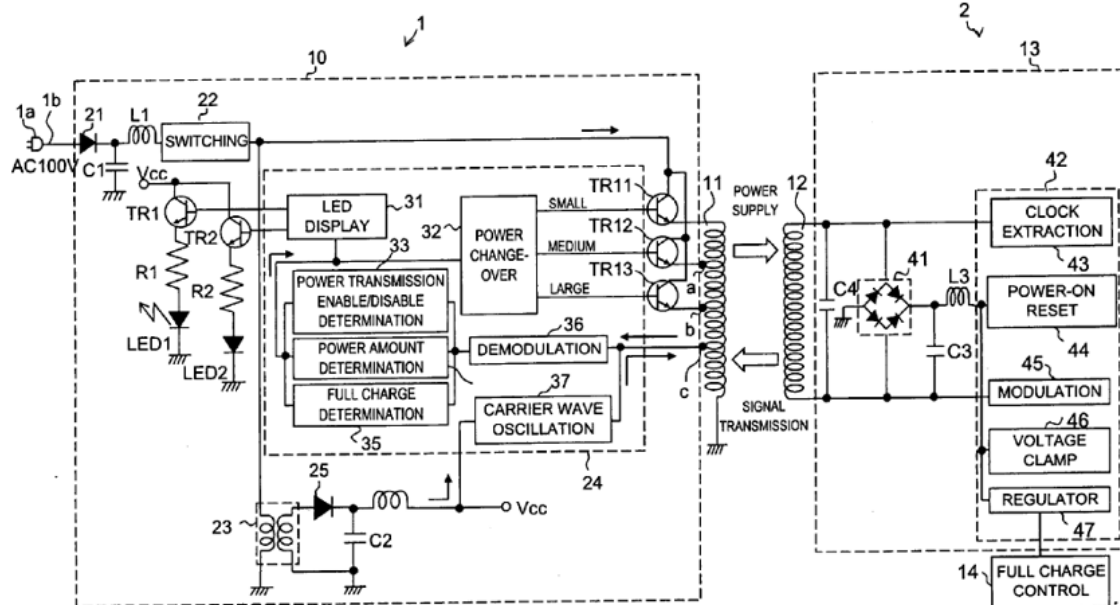
The primary side circuit 10 full-wave rectifies and smoothes AC 100 V supplied through the AC plug 1a and the cord 1b to convert the AC 100 V once to a DC voltage, and thereafter the DC voltage is subjected to switching to obtain a pulse voltage which is then supplied to the primary side coil 11. **The primary side coil 11 and the secondary side coil 12 constitute a transformer through magnetic coupling between a primary side core (ferrite) 15 and a secondary side core (ferrite) 16, wherein when the pulse voltage obtained by switching is applied across the primary side coil 11, a voltage is induced across the secondary side coil 12 by magnetic coupling** depending on a turns ratio between the primary side coil 11 and the secondary side coil 12. **The induced voltage is rectified to a DC voltage and smoothed in the secondary side circuit 13; the resultant DC voltage is supplied to a charge control circuit 14; and the charge control circuit 14 charges a battery with the supplied DC voltage. In this way, a non-contact power supply is performed from the power transmission apparatus 1 to the portable telephone 2.**

(*Id.*, ¶0065; *see also id.*, FIGS. 3-5.)

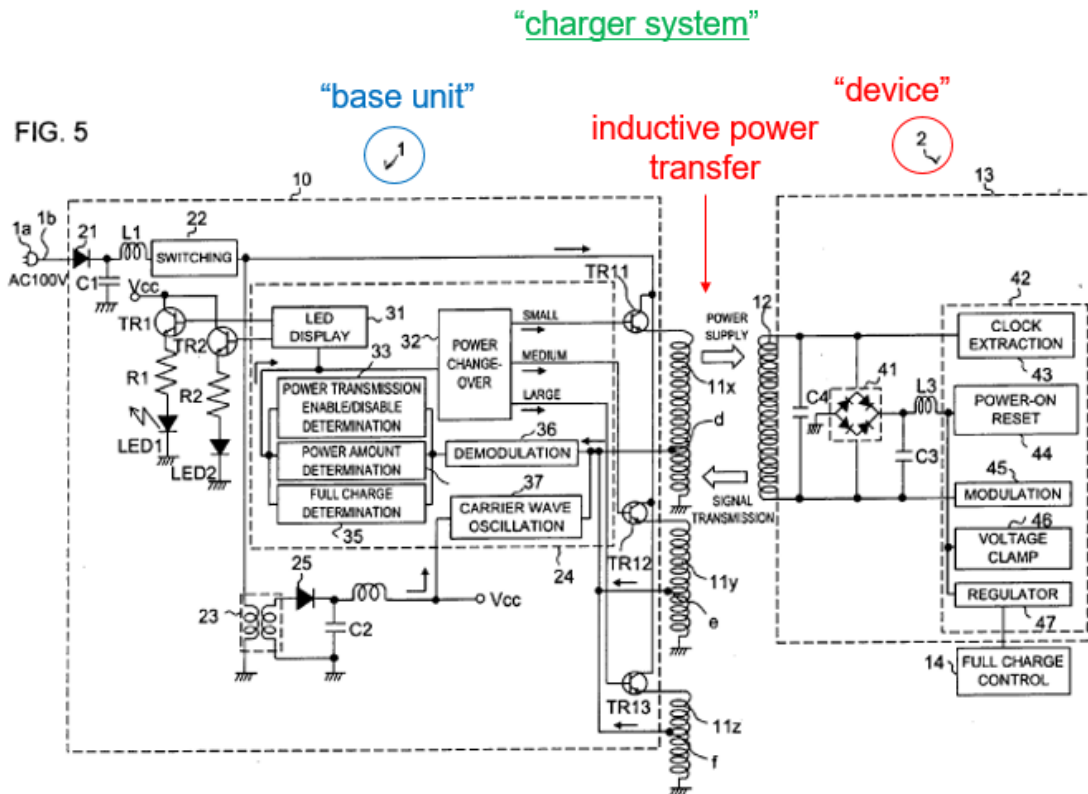
105. As I explained above in Section VIII.A, a person of ordinary skill in the art would have understood that *Nakamura* describes various configurations that while arranged slightly different, operate and perform similar features to transfer power and data between the apparatus and the device (which can be a mobile device 2/3) and were applicable to the many different applications *Nakamura* contemplates in the disclosure. For example, in certain configurations, the primary side coil comprises a single coil with multiple taps at different turns, or it can comprise a “plurality of coils each having a different number of turns,” which allow a power change-over section to select, according to the power required by the power reception equipment (“**device**”) one or more taps among the plurality of taps (for multi-tap primary coil) or one coil from the plurality of coils (multi-coil configuration) to allow the system to transmit different levels of power from the power transmission apparatus (“**base unit**”) depending on the power required by the power reception equipment (“**device**”) (“**for charging and/or powering the device and/or battery inductively**”). (*Id.*, ¶0019, ¶0084.)

106. One example of a multi-tap single primary coil configuration is shown in FIG. 3 and an example of multi-primary coil configuration (“**charger system**”) is shown in FIG. 5, both shown below.

FIG. 3



(*Id.*, FIG. 3.)



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

107. Nakamura explains, “In FIG. 5, *the same constituents as in FIG. 3* are attached with the same symbols and *descriptions thereof will not be given herein.*”

(Id., ¶0090.) Nakamura also makes clear that “[t]he power supply system shown in FIG. 5 is different from the power supply system shown in FIG. 3 in that primary side coils 11x, 11y, and 11z are provided instead of the primary side coil 11 of the power transmission apparatus 1.” (Id.; see also id., ¶¶0091 (“[T]he power transmission apparatus 1 has the configuration in which three coils for power transmission and respective transistors are provided. It is also possible to transmit

power in the same manner as in the case of the power transmission apparatus 1 shown in FIG. 3 where one primary side coil 11 is used.”), 0092, 0096-0101, FIG.

3.) *Nakamura* also explains how the features of the FIG. 3 configuration relate to those discussed for other figures, such as FIGS. 1A and 2A-2B. (*Id.*, ¶0067 (“In FIG. 3, the same constituents as in FIGS. 1A, 2A, and 2B are attached with the same symbols and descriptions thereof will not be given herein.”), *see also id.*, ¶¶0068-0075.)

108. Thus, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura*’s discussions of similar components and features described in connection with the various figures are applicable to other configurations and figures of *Nakamura*, such as those shared with FIGS. 1A-3, 5, and others—e.g., FIGS. 4, 6, 13A-20, and others, where applicable. (*See id.*; *see also id.*, ¶¶0029 (“FIG. 4 is a flowchart showing power supply operations in a power transmission apparatus shown in FIG. 3”), 0076 (“[D]escription will be given of power supply operations in the power transmission apparatus 1 and the portable telephone 2 having such a configuration with reference to FIG. 4. FIG. 4 is a flowchart showing power supply operations in the power transmission apparatus 1.”), 0093 (“FIG. 6 is a block diagram showing an electric configuration of a power supply system of a third embodiment of the present invention. In FIG. 6, the same

constituents as in FIG. 3 are attached with the same symbols and descriptions thereof will not be given herein.”.)

109. In fact, a person of ordinary skill in the art would have recognized and appreciated how *Nakamura* describes features and functionalities with respect to FIGS. 1A-1B, 2A-2B, and 3 that are applicable to the FIG. 5 configuration and to the features claimed in claim 1 of the '208 patent. (*See, e.g., id.*, ¶¶0067, 0090.) For instance, *Nakamura* explains how apparatus 1 (“**base unit**”) includes primary side coil 11 and has functionalities to recognize when equipment 2 (“**device**”) (and its coil) is placed on and properly positioned with apparatus 1 (“**base unit**”) (and its coil(s)) “so as to transmit power necessary for the power reception equipment thereto depending on the type” (Ex. 1005, ¶0063; *see also id.*, ¶¶0077-0085, 0090-0091), and how the power transmission apparatus 1 (“**base unit**”) can “charge even batteries [“**battery**”] of electronic equipment different in power required for charging, such as the portable telephone 2 and the notebook PC 3” (“**device**”) (*id.* ¶0063). *Nakamura* also explains, “Though not shown, any type of electronic equipment [“**device**”] equipped with a battery [“**battery**”], such as a digital camera, a camcorder, a PDA, or the like, can be charged similarly.” (*Id.*) FIGS. 2A-2B show schematic diagrams of a “**charger system**” with apparatus 1 (“**base unit**”) and a portable telephone 2 (“**device**”) and their respective coils.

FIG. 2A

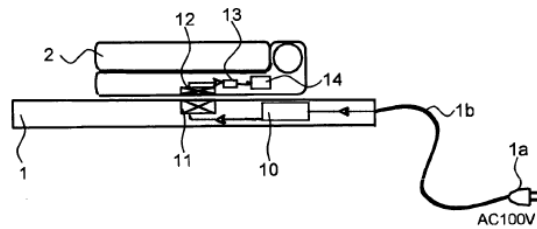
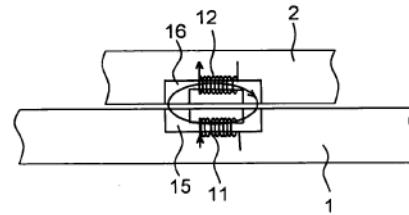


FIG. 2B



(*Id.*, FIGS. 2A-2B.) (*See also id.*, ¶0065 (describing primary side circuit 10 of apparatus 1 as full wave rectifying and smoothing AC 100V through plug 1a, to provide a DC voltage that is subjected to switching to provide a pulse voltage to the primary side coil 11, and how primary side coil 11 and secondary side coil 12 (in the “device” 2) “constitute a transformer through magnetic coupling between a primary side core (ferrite) 15 and a secondary side core (ferrite) 16, wherein when the pulse voltage obtained by switching is applied across the primary side coil 11, **a voltage is induced across the secondary side coil 12 by magnetic coupling,**” where “[t]he induced voltage is rectified to a DC voltage and smoothed in the secondary side circuit 13; the resultant DC voltage is supplied to a charge control circuit 14; and the charge control circuit 14 **charges a battery** [of “device” 2] **with the supplied DC voltage,**” thereby performing “a **non-contact power supply** . . . from the power transmission apparatus 1 to the portable telephone 2”); *see also id.*, ¶0062 (“The DC voltage can be also used as a power supply for **directly driving the portable**

telephone 2 and the notebook PC 3.”) (“for charging and/or powering the device and/or battery inductively”).)

110. With respect to FIG. 3, *Nakamura* describes components and associated features in apparatus 1 that are similar to those described for apparatus 1 in the systems of FIGS. 1A, 2A, 2B, and FIG. 5 (Ex. 1005, ¶¶0067, 0090), including use of smoothing circuits (LC circuits), switching circuit 22, power change over section 32, transistors TR11, TR12, TR13, power determination circuit 33, power amount determination circuit 34, full-charge determination circuit 35, and demodulation circuit 36 and carrier wave oscillation circuit 37 for information transfer, among others. (*Id.*, FIG. 3, ¶¶0068-0073.) Similarly, *Nakamura* describes components and features associated with the receiving device side (e.g., rectifier 41, smoothing circuit, power-on reset circuit 44, voltage clamp 46, regulator 47, charge control circuit 14, among other things), attributed to both the FIGS. 3 and 5 configurations. (*Id.*, ¶¶0074-0075, 0090-0091 FIGS. 3, 5.)

111. *Nakamura* also discusses power supply operations involving the apparatus 1 and device 2/3 (e.g., portable telephone 2, notebook PC 3) with respect to FIG. 4, which are also applicable to the various configurations of the “**charger system**,” including those of FIG. 3 and FIG. 5. (Ex. 1005, FIG. 4, ¶¶0076-0089.) Likewise, in my opinion, the alternate configuration of a separate coil for information transfer as described in FIG. 6 is applicable to the FIG. 3 and FIG. 5

configurations. (*Id.*, FIG. 6, ¶¶0092-0094.) Likewise, in my opinion, a person of ordinary skill in the art would have also understood the teachings of FIGS. 11A-11B and FIG. 12 are applicable to the various power supply system configurations (“**charger system**”) described in *Nakamura*, including those of FIGS. 3 and 5. (*Id.*, FIGS. 11A-11B, FIG. 12, ¶¶0080-0081, 0089.)

112. Likewise, in my opinion, a person of ordinary skill in the art would have understood the exemplary applications and configurations associated with respect to e.g., FIGS. 8-9, 11A-11B, 12, 13A-13E, 14, 15A-15B, 16-20, 21-25 are applicable to the various power supply system configurations (“**charger system**”) described in *Nakamura*, including those of FIGS. 3 and 5. (*See, e.g.*, Ex. 1005, ¶0107 (“FIGS. 13A to 13E are views showing outer appearances of power supply systems of an eighth embodiment of the present invention. The power supply systems shown in FIGS. 13A to 13E are characterized by the power transmission apparatus 1 shown in one of FIGS. 1A, 1B, 2A, 2B, 3, 5 to 9, 10A, and 10B is embedded in a top plate of a desk (utensil), of which some examples are shown.”); *see also id.*, ¶¶0102-0103, 0107-0120, ¶0121 (FIG. 19 “is characterized by that the power transmission apparatus 1 shown in one of FIGS. 1A, 2A, 2B, 3, 5 to 9, 10A, and 10B is embedded in a top mat (utensil).”), ¶0122 (FIG. 19 shows “the portable telephone shown in one of FIGS. 1A, 2A, 2B, 3, 5 to 9, and 10B”), ¶0123 (FIG. 20 is “characterized that the power transmission apparatus 1 shown in one of FIGS. 1A, 2A, 2B, 3, 5 to 10A, and

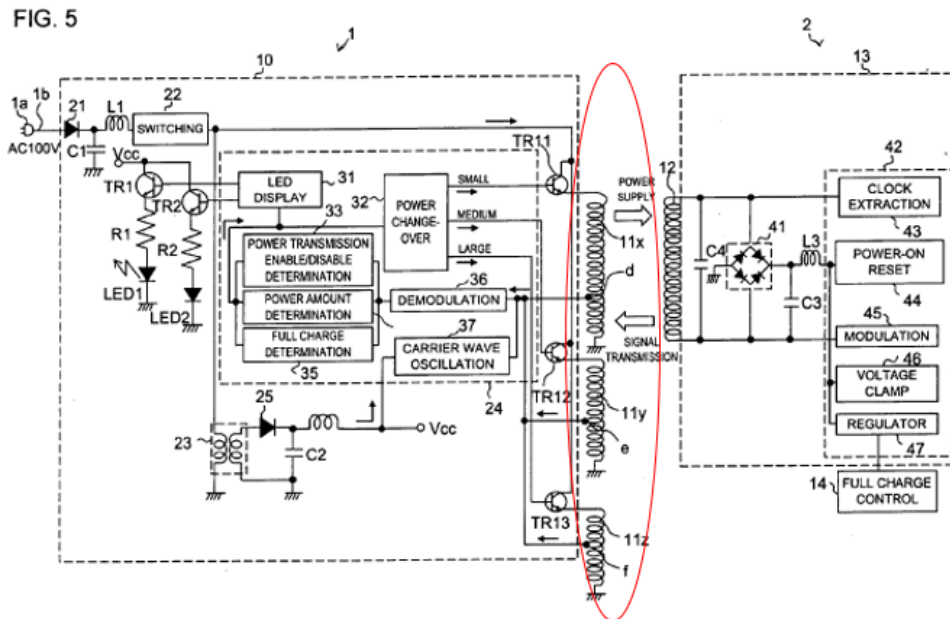
10B is embedded in a floor”), ¶¶0124, 0125 (“same constituents as in the power supply system shown in FIG. 3 are attached with the same symbols [in FIG. 21]”), ¶¶0126-0154.)

- b) a base unit having a surface, and comprising a plurality of primary coils arranged behind and parallel to the surface, wherein each of the primary coils is positioned within the base unit, and

113. In my opinion, *Nakamura* discloses this limitation. As I explained above for limitation 1(a), the power transmission apparatus 1 is a “**base unit**” in the power supply system (“**charger system**”). (See Section IX.A.1(a).) *Nakamura* discloses that apparatus 1 (“**base unit**”) in the power supply system (“**charger system**”) has a “**surface**” and a “**plurality of primary coils arranged behind and parallel to the surface**” and can be “**positioned within the base unit.**” (See my analysis and discussions above for limitation 1(a); see also e.g., Ex. 1005, ¶¶0017-0019, 0064-0065.)

114. For example, FIG. 5 shows three exemplary primary coils (11x-11z) (“**plurality of primary coils**”) of apparatus 1 (“**base unit**”). (Ex. 1005, ¶¶0090 (“The power supply system shown in FIG. 5 is different from the power supply system shown in FIG. 3 in that a **primary side coils 11 x, 11 y, and 11 z are provided** instead of the primary side coil 11 of the power transmission apparatus 1. **The three primary side coils are attached with the symbols 11 x, 11 y, and 11 z**

in the descending order of the number of turns thereof, and one ends thereof are all grounded . . .”), 0091 (“[T]he power **transmission apparatus 1** has the **configuration in which three coils for power transmission and respective transistors are provided**. It is also possible to transmit power in the same manner as in the case of the power transmission apparatus 1 shown in FIG. 3 where one primary side coil 11 is used.”).)



(Ex. 1005, FIG. 5 (annotated to show primary coils).)

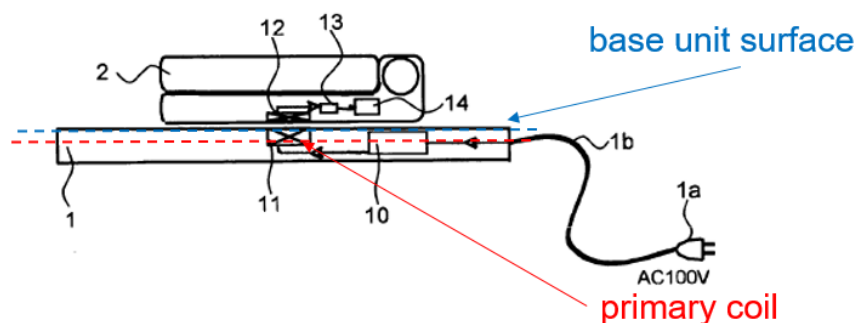
115. With respect to FIGS. 2A and 2B, *Nakamura* explains how primary side coils 11 can be positioned within apparatus 1 (“**base unit**”), and arranged behind and parallel to a surface of the apparatus (“**base unit**”) (*id.*, ¶0064), which (as with other described configurations/figures of *Nakamura*) provides power inductively

through magnetic coupling for device 2. (*Id.*, ¶¶0065, 0068-0073, 0076-0088, 0090-0091); *see also* discussions in Section IX.A.1(a).) For example, *Nakamura* explains:

[D]escription will be given of a principle of a non-contact transmission system with reference to FIGS. 2A and 2B. FIGS. 2A and 2B are schematic diagrams for describing schematic constructions of the **interiors of the power transmission apparatus 1** and the portable telephone 2 shown in FIG. 1A. **FIG. 2A is an entire view showing the power transmission apparatus 1** and the portable telephone 2. **FIG. 2B shows an enlarged view of coil portions.** In FIGS. 2A and 2B, the same constituents as in FIG. 1 are attached with the same symbols and descriptions thereof will not be given herein. As shown in FIG. 2A, **the power transmission apparatus 1 includes a primary side circuit 10 and a primary side coil 11**, and the portable telephone 2 includes a secondary side coil 12, a secondary side circuit 13, and a charge control circuit 14.

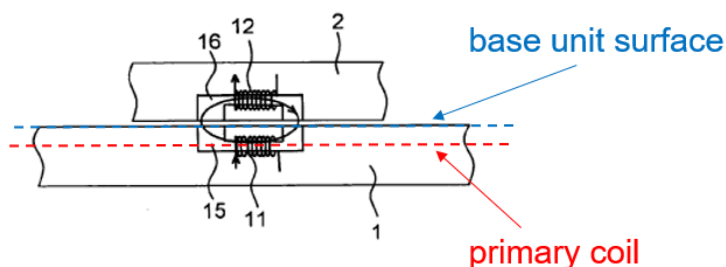
(Ex. 1005, ¶0064.)

FIG. 2A



(Ex. 1005, FIG. 2A (annotated).)

FIG. 2B



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

116. As I discussed above for limitation 1(a), a person of ordinary skill in the art would have understood that *Nakamura*'s discussions of similar components and features described in connection with the various figures are applicable to other configurations and figures of *Nakamura*, such as those shared with FIGS. 2A, 2B, 3, 5, and others. (See my analysis and discussions in Section IX.A.1(a); see, e.g., Ex. 1005, ¶¶0067 ("In FIG. 3, the same constituents as in FIGS. 1A, 2A, and 2B are attached with the same symbols and descriptions thereof will not be given herein."), 0090 ("In FIG. 5, the same constituents as in FIG. 3 are attached with the same symbols and descriptions thereof will not be given herein."); see also *id.*, ¶¶0068-0075, 0091-0092, 0096-0101.)

117. *Nakamura* also discloses various applications encompassing the multi-primary coil configuration of FIG. 5 (see my analysis and discussions in Section IX.A.1(a)) where apparatus 1 is embedded in a top plate of a desk, shelves, locker,

holder, dashboard, mat, wall, floor, floor covering fabric, etc. (Ex. 1005, FIGS. 13A-20, ¶¶0107-0124, 0153, 0159.) In such configurations, apparatus 1 and its primary circuit 10 with primary coil(s) 11 are embedded, positioned, arranged, or otherwise placed behind a surface of apparatus 1 (“**base unit**”), to allow a present and properly positioned device 2/3 to be charged or powered inductively. (*Id.*; *see also* discussions in Section IX.A.1(a).) Further, in my opinion, a person of ordinary skill in the art would have understood any of the exemplary host components noted above (e.g., desk, shelves, locker, holder, dashboard, mat, wall, floor, floor covering fabric, etc.) is another example of a “**base unit**” given it has a surface with an embedded apparatus 1 with its primary coils 11 (e.g., FIG. 5) parallel to such surface. (*Id.*; *see also* Ex. 1005, FIGS. 1A-3, 5, 13A-20, ¶¶0064-0065, 0068-0073, 0076-0088, 0090-0091, 0107-0124, 0153, 0159.) Thus, in my opinion, *Nakamura* (alone and/or as modified below) discloses the claimed “**base unit**” under either mapping (apparatus 1 or an exemplary host component containing apparatus 1). (*Id.*)

118. In my opinion, the teachings of *Nakamura* are consistent with the plain language of claim 1 and the various coil configurations described in the '208 patent. Also, a person of ordinary skill in the art would have recognized that *Nakamura*'s disclosures are consistent with conventional / state of the art configurations described in *Nakamura*. (*See* Ex. 1005, ¶0008 (discussing JP 2001-16789 having primary coil “installed below a body placement section of the charger”).) For

example, while the '208 patent describes the use of PCB coils, planar or spiral coils, etc., the '208 patent discusses such features in context of exemplary embodiments. (*See generally* Ex. 1001; *see, e.g., id.*, 4:50-4:35, 4:39-44 (“[i]n accordance with **an embodiment**, a pad or similar base unit comprises a **primary**, which creates a magnetic field by applying an alternating current to a **winding, coil, or any type of current carrying wire**”), 6:26-30, 6:59-62 (“In accordance with **an embodiment**, the coils in the mobile device charger ... **can be** printed circuit board (PCB) coils”), 7:5-8, 8:10-14, 8:54-57, 9:1-4 (“providing coils of different geometry or size”), 9:28-32, 9:48-50, 14:47-60 (“[i]n **one implementation of the invention**, the electronics of the charger are placed on a thin flexible PCB or the coils made of wires that be rolled up or shaped”), 18:62-65, 19:29-48, 21:43-49.)

119. Therefore, in my opinion, the plain language of claim 1 (in context of the '208 patent's specification) does not require planar type coils, and does not provide any language that in my opinion limits or otherwise details the claimed “parallel” nature of such claimed coils to the surface of the base unit (*see id.*; *see generally* Ex. 1001).⁵ For example, I reviewed the specification of the '208 patent

⁵ I discuss below in Section IX.C my opinions as to how and why a person of ordinary skill in the art would have been motivated to implement planar, thin-type coils relevant to limitation 1(b). (*See* Section IX.C.)

and found that it only uses the word “parallel” six times. Three of those appear to be related to magnetic fields generated by known wires (Ex. 1001, 2:57-65) and a magnet used for alignment purposes (*id.*, 11:30-44). The other three mentions of “parallel” appear to relate to circuit configurations (*id.*, 17:25-47). In my opinion, a person of ordinary skill in the art would have understood that such disclosures do not provide limiting details as to the “parallel” nature of coils to the surface of the base unit like that recited in the claim. (*Id.*, 2:57-65, 11:30-44, 17:25-47; *see also generally* Ex. 1001.) Thus, in my opinion, a person of ordinary skill in the art would have understood the disclosures regarding the primary coils in *Nakamura* that I discussed above (and elsewhere in this declaration) disclose primary coils that are positioned within apparatus 1 (or other “**base unit**”) and parallel to its surface like that claimed. (*See* my analysis and discussions above in this section; *see also* discussions in Sections IX.A.1(a), (c)-(k).)

- c) **wherein each of the primary coils is associated with a switching circuit in the base unit, which switching circuit is capable of being selectively switched to activate its associated primary coil so that, when an electrical current is passed through that activated primary coil, a magnetic field is generated by that activated primary coil in a direction substantially perpendicular to the surface of the base unit, and**

120. In my opinion, *Nakamura* discloses this limitation. (*See* my analysis and discussions below in this section; *see also* discussions in Sections IX.A.1(a)-(b),

IX.A.1(h).) For example, the primary side circuit 10 in apparatus 1 in the FIG. 5 configuration of *Nakamura* includes transistors TR11-TR13, which provide switching circuits that are each respectively associated with a primary side coil 11x-11z. (Ex. 1005, ¶0090 (“primary side coil 11x is connected to the emitter of the transistor TR11 . . . primary side coil 11y is connected to the emitter of the transistor TR12 . . . primary side coil 11z is connected to the emitter of the transistor TR13”).)

121. As discussed above, *Nakamura* explains with respect to the configuration of FIG. 5 that “[i]t is also possible to transmit power in the same manner as in the case of the power transmission apparatus 1 shown in FIG. 3 where one primary side coil 11 is used.” (*Id.*, ¶0091.) However, in the multiple primary coil configuration of FIG. 5, “one of the transistors is selected by the power change-over circuit 32 according to the level of power to be transmitted determined from the signal containing the ‘information on consumed power’ received from the portable telephone 2.” (*Id.*) Accordingly, as *Nakamura* explains, “a coil for transmitting power can be selected, and power required for the power reception equipment can be transmitted.” (*Id.*) “For example, in a case where the power of the power reception equipment [e.g., device 2/3] is small, a coil with a large number of turns is used. In a case where the power of the power reception equipment is large, a coil with a small number of turns is used.” (*Id.*)

122. *Nakamura* also explains (with respect to FIG. 3, which as I explained above, is also applicable to the FIG. 5 configuration) that transistors TR11-TR13 “may be replaced with different **switching elements** such as MOSFETs, **selector switches**, or the like.” (*Id.*, ¶¶0070, 0090-0091; *see* my analysis and discussions above for Sections IX.A.1(a)-(b).)

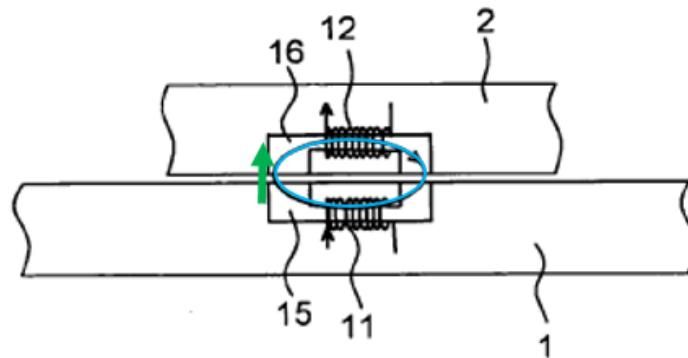
123. *Nakamura* explains that a pulsed voltage obtained from switching circuit 22 is connected to collectors of TR11-TR13, which allows the pulsed voltage to be applied across a selected coil amongst the primary coils 11x-11z similar to the FIG. 3 operations for coil 11, thereby allowing power to be transmitted from a selected/activated primary coil (11x, 11y, or 11z) to the secondary coil 12 of a present and “correctly placed” device 2/3 via magnetic coupling, similar to the operations involving coil 11 in the FIG. 3 configuration. (Ex. 1005, FIGS. 3-5, ¶¶0065, 0079-0083, 0084 (“when transistor TR11 is turned on, a pulse voltage from the switching circuit 22 is applied across the total length of primary side coil 11 to start power transmission . . . when the transistor [TR12/TR13] is turned on, a pulse voltage from the switching circuit 22 is applied to the tap [a/b] of the primary side coil 11 to start power transmission”), 0090-0091.)

124. In my opinion, a person of ordinary skill in the art would have understood that by applying the pulsed voltage to the activated primary coil (11x-11z), a **current** necessarily passes through the activated coil, because voltage and

current is necessarily included in the pulsed voltage signal provided to the activated coil. (Ex. 1005, ¶¶0065, 0076-0087, 0090-0091.) A coil is an inductor. An inductor's voltage, V , and current, I , are related to the inductor's value, L , using $V = L \cdot \frac{dI}{dt}$.

125. In my opinion, a person of ordinary skill in the art would have understood that the activated coil, due to the current flow, generates a **magnetic field** in a direction **substantially perpendicular** to the surface of the apparatus 1 (or host of apparatus 1—see my analysis and discussions above for limitation 1(b)) for charging or powering the device 2/3 or its battery as described by *Nakamura* and consistent with knowledge of the state of art of a person of ordinary skill in the art at the time of the alleged invention. For example, FIG. 2B of *Nakamura* discloses a magnetic field (**blue** in the annotated figure below) that is generated by the inductive coupling between coils 11 and 12 that is perpendicular (**green** in the annotated figure below) to the surface of apparatus 1.

FIG. 2B



(Ex. 1005, FIG. 2B (annotated).)

126. For example, *Nakamura* explains:

The primary side circuit 10 full-wave rectifies and smoothes AC 100 V supplied through the AC plug 1 a and the cord 1 b to convert the AC 100 V once to a DC voltage, and thereafter the DC voltage is subjected to switching to obtain a pulse voltage which is then supplied to the primary side coil 11. **The primary side coil 11 and the secondary side coil 12 constitute a transformer through magnetic coupling between a primary side core (ferrite) 15 and a secondary side core (ferrite) 16, wherein when the pulse voltage obtained by switching is applied across the primary side coil 11, a voltage is induced across the secondary side coil 12 by magnetic coupling** depending on a turns ratio between the primary side coil 11 and the secondary side coil 12. The induced

voltage is rectified to a DC voltage and smoothed in the secondary side circuit 13; the resultant DC voltage is supplied to a charge control circuit 14; and the charge control circuit 14 charges a battery with the supplied DC voltage. **In this way, a non-contact power supply is performed from the power transmission apparatus 1 to the portable telephone 2.**

(*Id.*, ¶0065; *see also id.*, FIGS. 2A, 2B, 3, 5.) (*See also* Ex. 1005, Abstract (“secondary side coil magnetically coupled to the primary side coil”), ¶¶0018 (“secondary side coil magnetically coupled to the primary side coil” to “supply power”), 0062 (“non-contact power supply using magnetic coupling”), 0079 (discussing power efficiencies relating to the position of device 2/3 to apparatus 1 where “a high coupling degree in magnetic coupling is established”), 0080-0082 (discussing the same where the “highest coupling degree in magnetic coupling” occurs with 0 mm deviations in left-right and forward-rearward directions), FIGS. 11A-11B, ¶¶0090-0091.)

127. As I explained above, the understanding of a person of ordinary skill in the art—that the above-discussed activated coil of an inductive/contactless power supply system, due to the current flow, generates a **magnetic field** in a direction **substantially perpendicular** to the surface of the apparatus 1 (or host of apparatus 1) (e.g., inductive power source)—is consistent with knowledge of such a person of

ordinary skill in the art. (*See* my discussions above in Section V.) For example, *Koreis* (Ex. 1009) and other references that I refer to below⁶ demonstrate such knowledge of a person of ordinary skill in the art. *Koreis* explains:

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

⁶ I cite *Koreis* (and other prior art references below) only to reflect the state of the art known to a person of ordinary skill in the art at the time of the alleged invention, which is consistent with how such a person would have understood *Nakamura's* teachings. Thus, I do not rely on such references here to supplement the teachings of *Nakamura*, which as I explained, discloses the claimed features.

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. 1009, 2:46-3:8; *see also id.*, FIG. 1.)

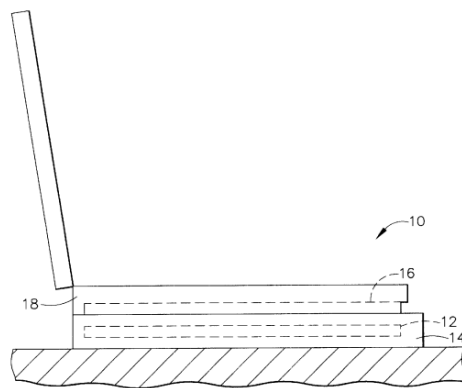


FIG. 1

(*Id.*, FIG. 1.) The above disclosures of *Koreis* show that the above-discussed “magnetic field lines [that] are approximately 90 degrees to the first part of the transformer” are also substantially perpendicular to a surface of an inductive power source such as charging unit 14. (*Id.*) This demonstrates the above-discussed

knowledge of a person of ordinary skill in the art regarding an activated coil of an inductive/contactless power supply system generating a **magnetic field** in a direction **substantially perpendicular** to the surface of an inductive power source (similar to apparatus 1 of *Nakamura*). (*Id.*; *see also id.*, 1:54-2:18, 3:20-4:11, FIGS. 1-3; *see also* Ex. 1011, 557-562, 593-594, 601; Ex. 1010, FIGS. 1-5B, 8:55-9:52 (“as is well known by those skilled in the relevant art, primary coil 510 induces a current to flow in secondary coil 230” and a magnetic field represented by arrows 564 and 565 is generated that is perpendicular to plane 520 of charger and primary coil 510), FIGS. 6A-10, 7:21-8:54, 9:53-10:22, 11:27-14:67; Ex. 1029, 3-4, 27-50.)

128. For the reasons discussed above, in my opinion, *Nakamura* discloses “each of the primary coils is associated with” a “switching circuit” in “the base unit” that is capable of being “selectively switched to activate its associated primary coil so that, when an electrical current is passed through that activated primary coil, a magnetic field is generated by that activated primary coil in a direction substantially perpendicular to the surface of the base unit” as claimed. (*See also* discussions in Sections IX.A.1(d)-(k).)

129. Further, in my opinion, *Nakamura* discloses the claimed “switching circuit” in different ways. For example, transistors TR11-TR13 describe the claimed “switching circuit” for the reasons I discussed above. Also and alternatively, in my opinion, for reasons similar to those I discussed above,

transistors TR11-TR13 collectively with other circuitry that works with TR11-TR13 to selectively activate an associated primary coil 11x/11y/11z is also a “**switching circuit**,” such as e.g., transistors TR11-TR13 with circuitry relating to power change over circuit 32, or switching circuit 22 collectively with transistors TR11-TR13, or transistors TR11-TR13 with circuitry relating to power transmission control IC 24 (e.g., via power adjusting section 32 circuitry and/or circuitry relating to one or more of power transmission enable/disable determination circuit 33, power amount determination circuit 34, full-charge determination circuit 35). (*See* Ex. 1005, ¶¶0069-0073, 0076, 0079-0087, 0090-0091, FIGS. 3, 5.)

d) wherein the base unit and/or switching circuit includes a capacitive or other component that decreases harmonics in that activated primary coil;

130. In my opinion, *Nakamura* in view of *Berghegger* discloses and/or suggests this limitation. (*See also* my discussions in Sections IX.A.1(a)-(c).) Although the primary side circuit 10 in apparatus 1 (“**base unit**”) includes capacitive circuitry for smoothing (e.g., smoothing circuit with coil L2 and capacitor C2) (*see, e.g.,* Ex. 1005, FIGS. 3, 5, ¶¶0071, 0090)), *Nakamura* does not expressly disclose using a capacitor or other component that decreases harmonics in an activated primary coil. However, in my opinion, use of capacitors and other circuits/components was known for minimizing or reducing harmonics created in

alternating or pulsed signals (and in activated coils). (*See* my analysis and discussions below in this section and above in Section V.)

131. For example, in my opinion, it was known to a person of ordinary skill in the art that alternating or pulsed signals included harmonic waves/signals that were multiple of the frequency of the reference wave/signal, and that such harmonics may create unwanted radiation that may generate heat, resulting in efficiencies in signal transmission, such as power signals transferred in a contactless inductive power transfer system. (*Id.*) The '208 patent recognizes the basic knowledge that a signal that is not a pure sinusoid may produce harmonics that are “undesirable.” (*See* Ex. 1001, 16:40-17:17.)

132. Also, in my opinion, a person of ordinary skill in the art was also well aware of techniques and technologies for mitigating those issues through proper circuit design and implementation of conventional filtering components. (*Id.*; *see* my analysis and discussions below in this section and above in Section V.) For example, resonant circuits including a capacitor and/or other components were widely utilized and known to reduce harmonics in power and/or data transmission applications prior to the time of the alleged invention of the '208 patent. (*See* Sections IV and V.C.) Thus, in my opinion, a person of ordinary skill in the art would have considered ways to improve *Nakamura*'s inductive power/data transfer system by utilizing such known and conventional features and techniques in the

design and configuration of an inductive charger system such as *Nakamura's* system. (*Id.*; *see also* Sections IX.A.1(a)-(c), IX.A.1(e)-(k).) Therefore, in my opinion, a person of ordinary skill in the art would have been motivated to modify the apparatus (“**base unit**”) or “**switching circuit**” discussed above for limitations 1(b)-1(c) to include a capacitive or other component in order to decrease harmonics in the signals transmitted from an activated primary coil (e.g., primary coil 11) to the secondary coil 12 of the “**device.**” (*Id.*)

133. In my opinion, a person of ordinary skill in the art was aware and knowledgeable of circuits, components, functionalities, and the operation of inductive-based wireless power/data transfer systems and their related components/circuits. (*See* my discussions in Section V; *see also* my discussions in this section and in Sections IX.A.1(a)-(c), (e)-(k).) Such a person of ordinary skill was also aware of and would have appreciated the benefits that filters or related circuits provided to such systems for, e.g., improving efficiency, mitigating heat, etc., such as smoothing and minimizing unwanted harmonics in the power signals transferred between inductor coils in such systems. (*Id.*; *see also* Section V.) Thus, in my opinion, a person of ordinary skill in the art would have been motivated to leverage such knowledge and consider teachings known in the art that would have guided the design, implementation, and modification of *Nakamura's* inductive

charger system to improve its operation and efficiency. (*Id.*; *see also* discussions below in this section.)

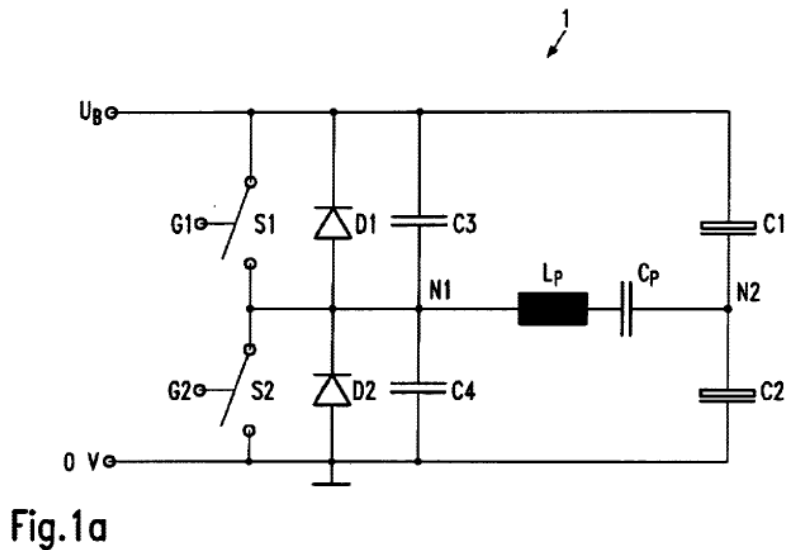
134. In my opinion, *Berghegger* is one example of such teachings consistent with state of art knowledge of a person of ordinary skill in the art at the time of the alleged invention of the '208 patent. (*See* my discussions in Section VIII.B.) Similar to *Nakamura*, *Berghegger* discloses an inductive contactless power system using primary and secondary coils for powering/charging a device and/or its battery. For example, *Berghegger* explains:

The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (L_P) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (L_P) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (L_P) on the primary side, a load (R_L) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).

(Ex. 1006, Abstract; *see also id.*, FIGS. 1a-1b, 4-6, 1:65-2:17 (discussing known inductive power transmitter system), 2:18-3:30, 5:27-30 (mobile device is placed in

the charging tray), 6:12-19 (load can include batteries), 6:37-45 (charging tray for mobile phone).)

135. In particular, *Berghegger* discloses and/or suggests the use of capacitive or other components that were known to decrease harmonics in an activated coil, such as the activated primary coil of its contactless inductive-based power system. (See my analysis and discussions below.) For example, with reference to FIG. 1a, *Berghegger* discloses a “basic circuit for driving an inductive resonant transmitter.” (See Ex. 1006, 3:51-61, FIG. 1a.) *Berghegger* explains that this circuit includes capacitors C1-C4 and a resonant capacitor C_p , and an inductor L_p on the “primary side.” (See *id.*, 3:52-56.)



(Ex. 1006, FIG. 1a.)

136. *Berghegger* explains in a charge mode, “inductor L_p on the primary side is magnetically coupled with an inductor L_s on the secondary side, as shown in FIGS. 4 and 5.” (*Id.*, 4:24-26, FIGS. 4, 5.)

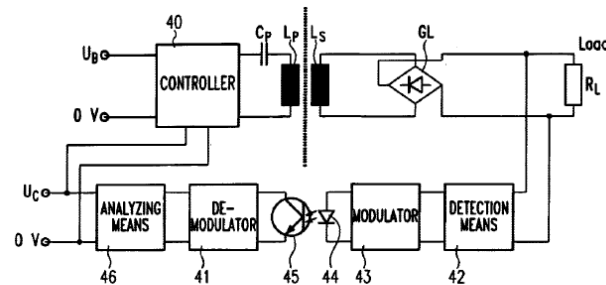


Fig.4

(Ex. 1006, FIG. 4.)

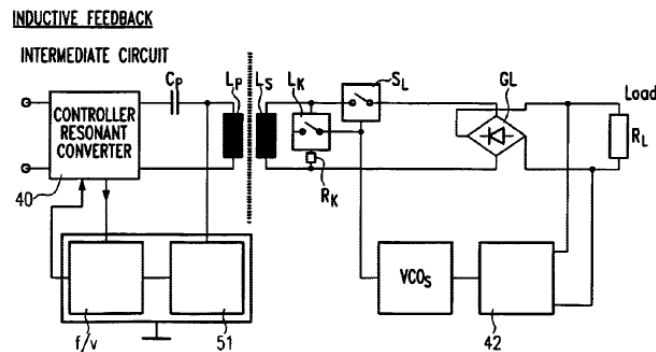


Fig.5

(Ex. 1006, FIG. 5.)

137. *Berghegger* explains that “[t]he inductor L_p on the primary side” (similar to *Nakamura*’s activated primary coil) “forms a resonant circuit with the resonant capacitor C_p ” (“**a capacitive or other component**”). (Ex. 1006, 3:58-59.) *Berghegger* further explains that “[t]he circuit operates at an oscillator frequency f_o , which is excited by switches S1 and S2.” (Ex. 1006, 3:59-61.) Thus, *Berghegger*’s

resonant circuit (including a capacitor C_p) has a resonant frequency at the operating frequency of the power being transferred. (*Id.*, 3:58-61.) In my opinion, a person of ordinary skill in the art would have understood that a resonant circuit with a resonant frequency near or at the operating frequency of a signal would decrease the harmonics of that signal and would improve transmission efficiency. (*Id.*; *see also id.*, 4:35-37 (“at a constant oscillator frequency f_o , the oscillation frequency **approaches the resonant frequency, whereby the transmitted power increases**”); *see also* my discussions in Section V.C.) Therefore, in my opinion, such a person of ordinary skill in the art would have understood that *Berghegger* discloses and/or suggests use of a capacitive or other component that decreases harmonics in the activated primary coil that wirelessly/inductively transfers power to a secondary coil of a mobile device.

138. In my opinion, this understanding is consistent with knowledge of a person of ordinary skill in the art at the time. (*Id.*; *see also* the citations below.) For one example, *Alexander* (Ex. 1016) explains that “[r]esonance is a condition in an RLC circuit in which the capacitive and inductive reactances are equal in magnitude,

thereby resulting in a purely resistive impedance. Resonant circuits (series or parallel) are useful for constructing filters.” (Ex. 1016, 631.)⁷

139. *Alexander* also explains that “[a] bandpass filter is designed to pass all frequencies within a band of frequencies, $w_1 < w < w_2$ the bandpass filter in Fig. 14.35 is a series resonant circuit.” (*Id.*, 641.) *Alexander* also explains regarding “a bandpass filter . . . [i]f the filter is made highly selective . . . , the filter passes only the fundamental component ($n=1$) of the input and **blocks out all higher harmonics.**” (*Id.*, 798.)

140. Similarly, references such as *WangII* (Ex. 1013) disclose the known use of switch(es) loaded by a capacitor coupled to a primary coil providing wireless power to secondary coil that reduces harmonics in signals generated by a primary coil, consistent with a person of ordinary skill in the art’s knowledge at the time. (See, e.g., Sections VIII.E and V.C; Ex. 1013, FIGS. 3 (see annotated figure below),

⁷ I cite *Alexander* (and other non-asserted prior art references for given grounds) to reflect the state of the art known to a person of ordinary skill in the art at the time of the alleged invention, which is consistent with how such a person would have understood *Nakamura* and *Berghegger*’s teachings. Thus, I do not rely on such references here to supplement the teachings of *Nakamura* and *Berghegger*, which as I explained, disclose and/or suggest the claimed features.

6, Abstract, 3:29-4:5 (discussing prior art where primary/secondary coils arrangement using a switching DC voltage across a tuning capacitor where “high frequency harmonic components are present in the waveform,” which “induce eddy currents” that increase temperature that is detrimental to operation of the device), 4:19-28 (battery charging device to efficiently charge a battery in device without excessive heat), 4:29-5:7 (use of capacitor-based resonant circuit with switches that provides full sinusoidal wave that “**reduce harmonics** and eddy current” to minimize heat and “without causing excessive energy loss”), 7:24-8:14, 8:17-23 (tuning capacitor 25 designed so that a sinusoidal waveform “flows through the primary coil 9 with **little high order frequency content**”), 8:24-31, 9:26-12:27).)⁸

For example, *WangII* explains:

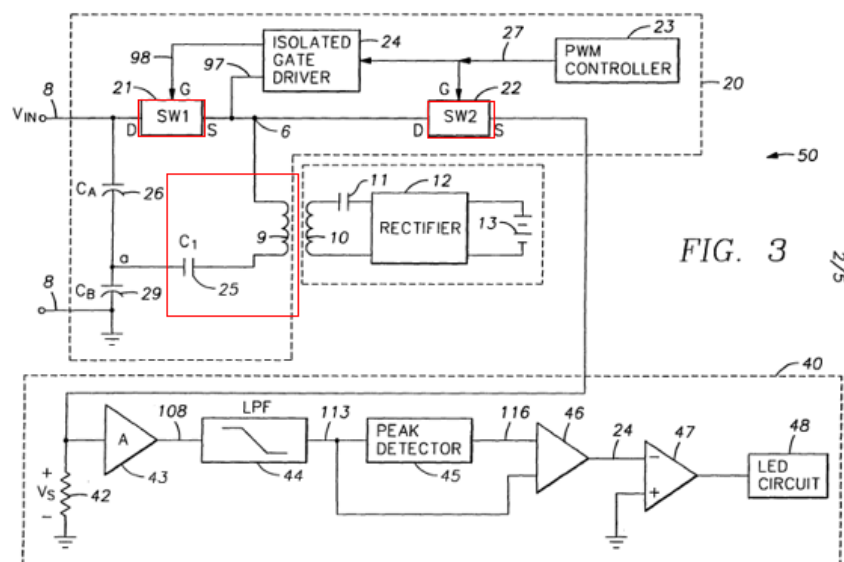
The present invention solves the shortcomings and deficiencies of the prior art by constructing a transcutaneous **energy transmission device with two solid state switches facilitating the production of a substantially sinusoidal power waveform. The generation of the full sinusoidal wave reduces harmonics and eddy currents which otherwise are generated in the housing (or can) of the implanted**

⁸ *Nakamura* also recognizes heat can be caused by eddy currents. (See Ex. 1005, ¶0066.)

device. As a result, heating of the can is minimized. The solid state switches connect a regulated DC voltage across an inductor and capacitor resonant circuit. The inductor forms a primary coil of a transformer in which current is induced in a secondary coil attached to an implanted medical device. The medical device receives the induced current for charging rechargeable batteries.

The present invention can be implemented in a circuit in which a 5 KHz gate signal turns a first MOSFET switch on and off. The gate signal also turns on and off a second MOSFET switch at opposite times than the first MOSFET switch. **In addition to minimizing harmonics, the use of the optimum switching frequency reduces the eddy current in the housing (or can) of the implanted device, without causing excessive energy loss.**

(Ex. 1013, 4:29-5:7; *see also id.*, Abstract (“A current with a sinusoidal waveform is applied to **a resonant circuit comprising a primary coil (9) and a capacitor (25).** Current is induced in a secondary coil (10) attached to the implanted medical device.”).)



(Ex. 1013, FIG. 3 (annotated).) (See also disclosures in other references I discussed above supporting my opinions as to the knowledge of a person of ordinary skill in the art at the relevant time frame, such as Ex. 1012, FIGS. 2, 5 (C1 25, inductor 9), 8 (same), 3:30-62, 8:47-9:51; Ex. 1014, 67-68 (“In a narrowband transmitter, a low-pass filter might be built in for *reduction of harmonic output*”); *id.*, 62-68; Ex. 1015, FIGS. 1-2, 5-12, Abstract, 1:55-2:10, 3:28-51, 4:22-44 (providing a capacitor 20 in parallel with power supply coil “so that [there is] a resonance”), 5:45-6:4 (“the resonant frequency f_R ” is set to a level as low as approximately 1.5 times of the output frequency f_o of the frequency converter 16 . . . [and] oscillation at a frequency

of $2 f_o$ was optimal from the standpoint of maximum circuit efficiency”)⁹; Ex. 1020, Abstract (disclosing tuning capacitor 22 in a resonant circuit in an inductively coupled power transfer system that results in reduce harmonics); Ex. 1021, ¶¶0164-0165 (“[i]t was known in the art to drive coils using parallel or series resonant circuits” to allow “maximum current flow[] through the primary coil”); Ex. 1029, 19 (“antenna coils . . . can be formed by a metallic or conductive trace on PCB board or on flexible substrate”), 22-25; Ex. 1017, 1:9-8:22 (discussing known issues with harmonics and conventional and revised ways to reduce harmonics in AC-DC/DC-AC conversion power systems with application to “battery chargers”); Ex. 1023, FIGS. 1-4, 6A-6C, 14, Abstract, ¶¶0007-0024, 0027, 0032-0034, 0074-0078 (describing mechanisms/techniques to reduce harmonics in AC and DC driven lighting systems and benefits for doing so).)

141. Therefore, in my opinion, the above-discussed teachings of *Berghegger* regarding resonant capacitor configurations disclose and/or suggest the claimed “**a capacitive or other component that decreases harmonics in that activated**

⁹ A person of ordinary skill in the art would have understood that a resonant circuit with a resonant frequency at 1.5 to 2 times the operating frequency of a signal would decrease some of the harmonics of that signal, including, for example, the 4th harmonics and higher.

primary coil.” (See my analysis and discussions regarding *Berghegger* above.) For example, as discussed above, *Berghegger* discloses FIG. 4, which shows an inductive charger with a resonant capacitor C_p coupled to an inductor L_p on the primary side that would decrease harmonics in an activated primary coil (e.g., inductor L_p) (as discussed above).

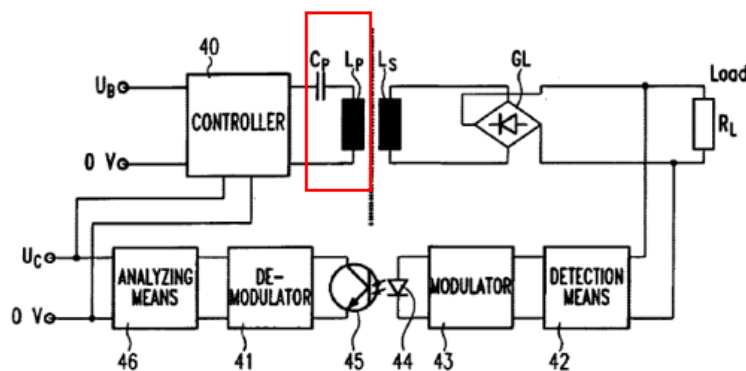
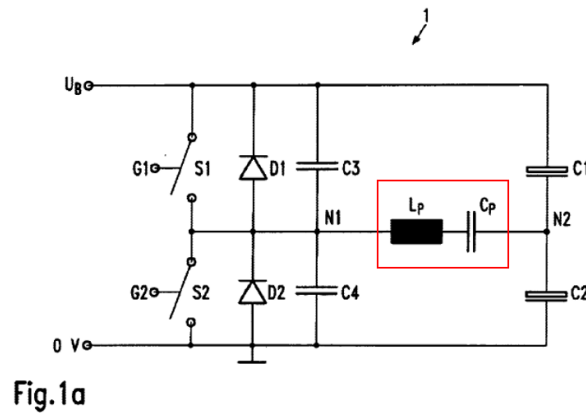


Fig.4

(Ex. 1006, FIG. 4 (annotated).) As I also discussed above, *Berghegger* explains (e.g., with respect to FIG. 1a, whose disclosures a person of ordinary skill in the art would have understood as also applicable to other figures of *Berghegger* (such as FIG. 4) with similar/corresponding configurations/components such as resonant capacitor C_p and inductor L_p) that “[t]he inductor L_p on the primary side forms a resonant circuit with the resonant capacitor C_p ” (Ex. 1006, 3:58-59) that would decrease harmonics in an activated primary coil (e.g., inductor L_p) (as discussed above). (See also my discussions above regarding *Berghegger*; Section VIII.B)

FIG. 1a also shows a resonant capacitor C_p coupled to an inductor L_p on the primary side.



(Ex. 1006, FIG. 1a (annotated).)

142. And as I discussed above, *WangII* (which discloses features consistent with the state of art knowledge of a person of ordinary skill in the art at the time), describes in FIG. 3 a similar resonant capacitor C1 coupled to an inductor 9. *WangII* also discloses use of switch(es) loaded by a capacitor coupled to a primary coil providing wireless power to secondary coil that reduces harmonics in signals generated by a primary coil (which is shown in FIG. 3). (*See also* my discussions above regarding *WangII*; Section VIII.E)

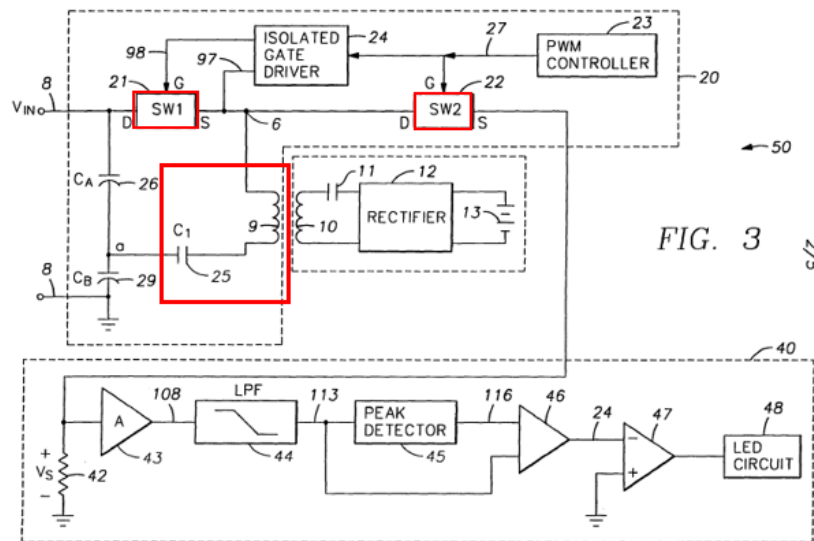


FIG. 3 2/5

(Ex. 1013, FIG. 3 (annotated).)

143. In my opinion, the above-discussed teachings of *Berghegger* disclose and/or suggest the claimed “a capacitive or other component that decreases harmonics in [an] activated primary coil” because it describes the well-known use of capacitors in a manner that reduces harmonics. (*See my analysis and discussions regarding Berghegger and my discussion of the state of art knowledge of a person of ordinary skill in the art above.*) In another example, *Berghegger* discloses other capacitors in its primary side base unit that disclose and/or suggest a capacitive or other component that decreases harmonics in an activated primary coil. For example, *Berghegger* explains that “[t]he small capacitors C3 and C4 [“a capacitive or other component”] serve interference suppression because they short-circuit high-frequency signals” (“decreases harmonics”) “that are created during opening

and closing of the switches or MOSFETs.” (Ex. 1006, 4:1-5, FIG. 1a.) *Berghegger* also explains that “[s]witches S1 and S2 are here replaced by MOSFETs (MOSFET: metal oxide semiconductor field effect transistor)” (*id.*, 4:12-15), and “[w]henever following the switching off of one of the switches the inductor L_P on the primary side [“**activated primary coil**”] produces—at node N1—a voltage” (*id.*, 3:61-66). Thus, *Berghegger* discloses and/or suggests the claimed “**a capacitive or other component that decreases harmonics in that activated primary coil**” like that recited in this limitation (e.g., capacitors C3 and C4). (*Id.*, 3:61-66, 4:1-5, 4:12-15, FIG. 1a.)

144. Accordingly, in my opinion, the teachings of *Berghegger* and *Nakamura*, coupled in context with the knowledge of a person of ordinary skill in the art (as I discussed above, including those relating to harmonics and technologies/techniques for minimizing such issues in signal transmission applications), a person of ordinary skill in the art would have been motivated to consider various methods and component/circuit designs to improve signal transmission efficiencies and operations in *Nakamura*’s inductive charging system. These would have included the use of capacitive-based circuits that were known to provide benefits in inductive power transfer configurations, like that taught and/or suggested by *Berghegger*, including reducing harmonics in the signals transmitted by the primary coils in *Nakamura*’s inductive charger system as discussed above.

(*See* my analysis and discussions above in this section; *see also* Section V; *see also* my analysis in Sections IX.A.1(a)-(c).)

145. In my opinion, a person of ordinary skill in the art would have understood, appreciated, and been motivated to contemplate various ways such features would have been implemented in such a modified *Nakamura* system, including designing and implementing circuit(s) that would have included a capacitor and/or other types of known circuit components (or available circuitry/components) to reduce harmonics generated by primary coils in the system using known circuit design skills and knowledge. In my opinion, a person of ordinary skill in the art would have been aware of various foreseeable ways to implement and achieve such functionalities and benefits, including the use of capacitor-based circuits that resulted in reduction of unwanted harmonics (including capacitor-based circuits like that demonstrated above). In my opinion, such a skilled person would have appreciated using such circuit designs to achieve similar benefits would have been a common approach in applications (e.g., where alternating or pulsed signals were used), especially in contactless inductive power/data transfer applications like those taught by *Nakamura* and *Berghegger*. (*See* my analysis and discussions above in this section; *see also* Sections V, VIII.A, VIII.B.)

146. Therefore, upon considering the teachings and suggestions by *Berghegger*, a person of ordinary skill in the art would have been motivated to

modify *Nakamura*'s "**base unit**" and/or "**switching circuit**" (as I discussed above for limitations 1(b)-(c)) to include a capacitive or other component (e.g., a capacitor-based filter circuit) that would have reduced harmonics in the activated primary coil 11x-z providing power to the mobile device. (*See* my analysis and discussions above in this section; *see also* Sections IX.A.1(b)-(c), V.) In my opinion, a person of ordinary skill in the art would have appreciated that such a modification would have increased efficiency in the energy transferred between the primary and secondary coils by decreasing harmonics in the signals generated by the activated primary coil in *Nakamura*'s system. (*Id.*)

147. For example, such a skilled person would have recognized the benefits of such a modification to *Nakamura*'s system, such as, for example, decreasing noise and distortion in the signals transmitted from the activated primary coil to the secondary coil, improved energy transfer efficiency, and providing a more efficient and safer system by reducing heat caused by such unwanted harmonics, which would have improved the strength of the power signals used to charge the mobile device or its battery. In addition, in my opinion, with respect to *Nakamura*'s data/information communications (discussed below for limitations 1(f)-1(k)), such a modification would have also provided more efficient signal transfer properties (for information exchange) by making it easier for the mobile device to process the request signal sent from the activated primary coil 11x-z to the mobile device. (*See also* my

analysis and discussions below in Sections IX.A.1(f)-(k).) Thus, in my opinion, a person of ordinary skill in the art would have been motivated to implement the above-discussed modification.

148. In my opinion, a person of ordinary skill in the art would have had reasons to review and consider the teachings of *Berghegger* given *Berghegger* describes an inductive power system including techniques and technologies similar and related to those of *Nakamura*. (See my citations and discussions regarding *Berghegger* and/or *Nakamura* in this section and above in Sections IX.A.1(a)-(c).) Similar to the technical field relating to *Nakamura*, *Berghegger* describes a power transfer system for powering/charging a device, and more specifically an inductive contactless power system using primary and secondary coils to wirelessly transfer power to a device, including a mobile device. (See *id.*; see also Ex. 1006, 1:5-10, 1:10-3:29 (summary of invention and discussing related prior art); Ex. 1001, 1:28-34; see my discussions and citations to *Nakamura* above for limitations 1(a)-1(c).)

149. Furthermore, in my opinion, a person of ordinary skill in the art would have appreciated that *Berghegger*, like *Nakamura*, also discloses features that were reasonably pertinent to one or more particular problems the '208 patent discusses. For instance, the '208 patent explains that there was a "need" for powering portable/mobile devices for use in different "applications." (See Ex. 1001, 1:32-34; see also *id.*, 1:35- 3:16.) The '208 patent also discusses issues with harmonics and

exemplary attempts to reduce them. (*See, e.g., id.*, 16:40-17:45; *see also* Ex. 1004, 508, 539, 551 (regarding amendment adding the claimed “capacitor or other component” features to now issued claim 1).) As I explained above, *Berghegger* also discloses techniques and technologies for addressing a need to power mobile devices using contactless inductive coupling, and designs that use a capacitor in a way that results in reduction of harmonics generated by a primary coil in the charger system. (*See* above citations and discussions regarding *Berghegger* in this section.) Similarly, *Nakamura* also addresses problems and solutions thereto similar to those identified in the '208 patent, including use of capacitors or other components in the primary side circuit (*see* my analysis and discussions above regarding *Nakamura* and the '208 patent) and others like inductively charging multiple devices with different power requirements (*see id.*; Ex. 1001, 1:54-3:16; *see, e.g.*, Ex. 1005, FIG. 5, ¶¶0001-0007, 0020, 0090-0091; *see also* discussions in Section IX.A.1(a).) Thus, the above-discussed teachings of *Berghegger* address similar problems identified in the '208 patent, and thus would have been consulted by a person of ordinary skill in the art, looking to address/solve such issues/problems and others relating to the design and implementation of a contactless inductive charging system, including those recited in *Nakamura* and *Berghegger*. (*Id.*; *see also* discussions above in this section.) Thus, when contemplating designing, configuring, and implementing a system like that described by *Nakamura*, a person of ordinary skill in the art would

have consulted teachings and suggestions like that found in *Berghegger* and consequently would have been motivated to modify the above-discussed “charger system” in *Nakamura* to include features like that recited in limitation 1(d). (*Id.*)

150. In my opinion, a person of ordinary skill in the art would have had the capability to design and implement, and a reasonable expectation of success in implementing, the above-discussed modification, including a capacitive or other component-based circuit to reduce harmonics in the primary coil of *Nakamura*’s “**base unit**” or “**switching circuit**,” given the skills and knowledge of such a person at the time and the teachings/suggestions of *Berghegger* and *Nakamura* (both describing known ways for wirelessly powering mobile devices). (*See* my analysis and discussions above in this section and in Sections IX.A.1(a)-(c).) For example, such a skilled person at the time would have appreciated that implementing the above-discussed modification would have involved applying known technologies (e.g., capacitive-based filtering technologies (*see* my analysis and discussions above regarding *Berghegger* and corroborating state of art knowledge of a person of ordinary skill in the art) with wireless power transfer/charging systems (*Nakamura* and *Berghegger*)) and known methods/techniques (e.g., capacitor-based filtering technologies to improve efficiencies (e.g., by reducing harmonics) on a transmitting coil) that would have led to a foreseeable result of providing wireless power in a contactless inductive power/charging system with reduced heat, improved energy

transfer, and/or less distortion and/or interference in signals, and with flexibility to maintain the contactless power functionalities sought by *Nakamura*. (See my analysis and discussions above in this section and in Sections IX.A.1(a)-(c).)

151. In my opinion, there were various ways a person of ordinary skill in the art would have implemented such a modification with *Nakamura*'s system. As a non-limiting example, a person of ordinary skill in the art would have understood that an appropriately designed capacitor-based filter circuit positioned between switching circuit 22 and transistors TR11-13 would have achieved a reduction in harmonics in primary coils 11x-z. (See, e.g., Ex. 1005, FIG. 5; see also discussions above regarding *Nakamura* and *Berghegger* in this section and regarding *Nakamura* in Sections IX.A.1(a)-(c).) Similarly, an appropriately designed capacitor-based filter circuit positioned between transistors TR11-13 and primary coils 11x-z (similar to that described by *Berghegger*) would have achieved similar results.¹⁰

¹⁰ While I provide such exemplary configuration, they are not intended to limit the way a person of ordinary skill in the art would have implemented such a modification. Nor are they intended to represent a specific limiting design (e.g., schematic, etc.) of the modified *Nakamura* system. In my opinion, other designs/configurations would have been contemplated by a person of ordinary skill

(*Id.*) In my opinion, a person of ordinary skill in the art would have further considered necessary design adjustments to the circuitry to ensure the modification properly provided wireless power consistent with *Nakamura's* operations.

152. Therefore, in my opinion, a person of ordinary skill in the art would have had the requisite skills, knowledge and capabilities to design and implement such a capacitive-based circuit to mitigate the effects of unwanted harmonics in the power signals transferred from each activated and selected primary coil in *Nakamura's* system, and done so with a reasonable expectation of success. *Berghegger* (and the state of art disclosures that support my opinions regarding a person of ordinary skill in the art's knowledge and appreciation of such configurations) demonstrate successful use of capacitive or other components that would have resulted in reduced harmonics in signals like those generated by the primary coils in *Nakamura's* system. In my opinion, because such conventional features and concepts were widely known, disclosed, and implemented, a person of ordinary skill in the art would have had confidence in designing and implementing similar features in *Nakamura's* inductive power system to operate for its intended purpose of reducing harmonics and the resulting benefits that come from such a

in the art when designing/implementing such a modification depending on given applications that would have achieved similar results.

reduction. And while there were different ways to implement a design to achieve the above modification, a person of ordinary skill in the art would have understood the underlying concepts, designs, components, etc. would have been based on foreseeable technologies and concepts known to provide filtering signals that achieve efficient signal transmissions for given applications. Therefore, a person of ordinary skill in the art would have been motivated to use a capacitive-based circuit to provide improved signal transmission (e.g., as in *Berghegger* and known in the art at the time) with *Nakamura's* system because such a modification would have been a foreseeable implementation/solution utilizing technologies/techniques known to such a person of ordinary skill in the art.

153. In my opinion, a person of ordinary skill in the art would have considered tradeoffs with the different available designs, and configurations regarding implementing a harmonic reduction circuit (e.g., capacitor or other component-based designs) in *Nakamura's* system. Therefore, even where such a modification would have required additional components and circuitry, a person of ordinary skill in the art would have appreciated that the benefits of implementing the above-discussed features (e.g., improved efficiencies, reduced heat, etc.) would have outweighed any potential additional costs, weight, and/or other factors to improve the performance of *Nakamura's* system as I discussed above. (*See also* my discussions in Sections IX.A.1(e)-(k).)

- e) **a power supply for passing a current through the primary coils when activated, to generate the magnetic field in a direction substantially perpendicular to the plane of the primary coils;**

154. In my opinion, *Nakamura* (including as modified) discloses this limitation. (See my analysis and discussions below in this section; see also my analysis and discussions in Sections IX.A.1(a)-(d).) For example, the “**charger system**” in *Nakamura*’s FIG. 5 configuration (see, e.g., my discussions for limitation 1(a)) includes a power supply that is used to generate power (and thus current) that is passed through activated primary coils 11x/11y/11z to generate the magnetic field used to power the mobile device to charge its battery (“**a power supply for passing a current through the primary coils when activated, to generate the magnetic field in a direction substantially perpendicular to the plane of the primary coils**”). (See my analysis and discussions in Sections IX.A.1(a)-(d); Ex. 1005, FIGS. 1A-B, 2A-2B, 3-5, ¶¶0062, 0065, 0068, 0079-0083, 0084, 0090-0091.) For example, *Nakamura* explains:

Description will be given of an embodiment of the present invention below with reference to the accompanying drawings. FIGS. 1A and 1B are views showing outer appearances of power supply systems embodying the present invention. In FIGS. 1A and 1B, a numerical symbol 1 indicates a power transmission apparatus for supplying power. . . . **The power transmission apparatus**

1 is equipped with an AC plug **1a** and a cord **1b**. The AC plug **1a** is inserted into a socket provided on a wall surface or the like to thereby feed a commercial power supply (AC 100 V) to the power transmission apparatus **1** through the cord **1b**. The power transmission apparatus **1** converts the supplied AC 100 V to a DC voltage, thereafter, the DC voltage is subjected to switching and supplied to a battery of the portable telephone **2** or the notebook PC **3**, which is power reception equipment, so that the battery is charged by means of the non-contact power supply using magnetic coupling. The DC voltage can be also used as a power supply for directly driving the portable telephone **2** and the notebook PC **3**.

(Ex. 1005, ¶0062.)

FIG. 1A

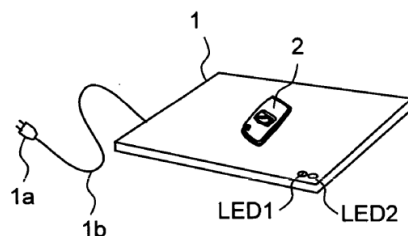
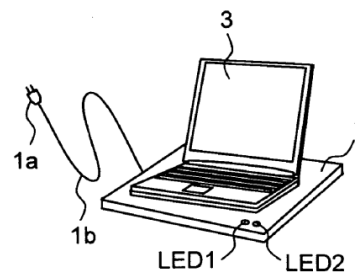
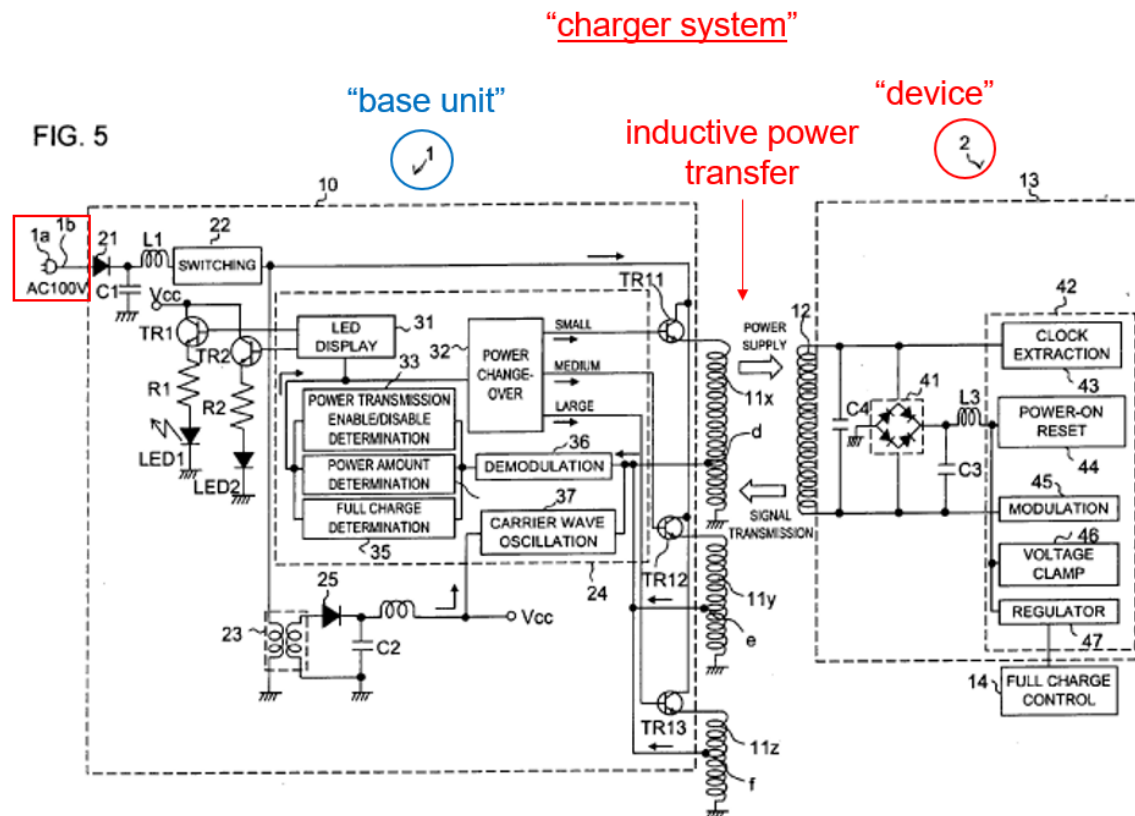


FIG. 1B



(Ex. 1005, FIGS. 1A-1B.) As I explained above for limitation 1(a), *Nakamura's* disclosures regarding figures, including those discussed with respect to FIGS. 1A and 1B, are applicable to other applicable figures/configurations, including the FIG.

5 configuration. (See my analysis and discussions in Section IX.A.1(a).) FIG. 5 shows transmission apparatus 1 with an AC plug 1a and a cord 1b.



(Ex. 1005, FIG. 5 (annotated).)

155. *Nakamura* also explains:

The primary side circuit 10 full-wave rectifies and smoothes AC 100 V supplied through the AC plug 1a and the cord 1b to convert the AC 100 V once to a DC voltage, and thereafter the DC voltage is subjected to switching to obtain a pulse voltage which is then supplied to the primary side coil 11. The primary side coil 11 and the secondary side coil 12 constitute a

transformer through magnetic coupling between a primary side core (ferrite) 15 and a secondary side core (ferrite) 16, wherein when the pulse voltage obtained by switching is applied across the primary side coil 11, a voltage is induced across the secondary side coil 12 by magnetic coupling depending on a turns ratio between the primary side coil 11 and the secondary side coil 12. The induced voltage is rectified to a DC voltage and smoothed in the secondary side circuit 13; the resultant DC voltage is supplied to a charge control circuit 14; and the charge control circuit 14 charges a battery with the supplied DC voltage. In this way, a non-contact power supply is performed from the power transmission apparatus 1 to the portable telephone 2.

(*Id.*, ¶0065; *see also id.*, FIG. 5.)

156. Thus, *Nakamura* describes how apparatus 1 (“**base unit**” of the “**charger system**”) “is equipped with an AC plug 1a and a cord 1b” that receives commercial power for use by apparatus 1, which is converted via rectification/smoothing (rectifier 21, L1, C1) and subject to switching (switch 22) that is provided to the primary coil(s) and subsequently “supplied to a battery of the portable telephone 2 or the notebook PC 3 . . . so that the battery is charged by means of the non-contact power supply using magnetic coupling.” (Ex. 1005, ¶¶0062, 0065; *see also id.*, ¶¶0068, 0089, 0090-0091, 13A-13E, ¶¶0108 (although “not

shown” in FIGS. 13A-13E, commercial power is fed to apparatus 1 through a supply cord or the like “embedded in the interiors of the desk or the table and the top plate thereof”), 0111, 0113, 0115, 0117, 0121, 0123, 0129.)

157. As discussed above (e.g., for limitation 1(c)), a person of ordinary skill in the art would have understood that by applying the pulsed voltage to activated primary coils (e.g., 11x/11y/11z), a **current** is passed through the activated coils, and thus that the “**power supply**” of *Nakamura* (as discussed above and below in this section) is “**for passing a current through the primary coils when activated.**” (See my analysis and discussions above in Section IX.A.1(c); see also Ex. 1005, ¶¶0065, 0076-0087, 0090-0091.)

158. In my opinion, a person of ordinary skill in the art would have understood that the magnetic field generated by activated primary coils 11x/11y/11z would be “**in a direction substantially perpendicular to the plane of the primary coils,**” as claimed for reasons similar to those I discussed above for limitation 1(c). (See my analysis and discussions above in Section IX.A.1(c); Ex. 1005, Abstract, FIGS. 2B, 5, ¶¶0018, 0062, 0065, 0079-0082, 0090-0091; see also state of art disclosures (e.g., Ex. 1011, 557-562, 593-594, 601; Ex. 1009, FIGS. 1-3, 1:54-2:18, 2:62-3:8, 3:20-4:11; Ex. 1010, FIGS. 1-5B, 6A-10, 7:21-10:22, 11:27-14:67).)

159. Accordingly, in my opinion, *Nakamura* discloses the claimed “**power supply**” in different ways. For example, the commercial AC power components (1a,

1b) and/or interface components associated with apparatus 1 connecting thereto in the FIG. 5 configuration is a “**power supply**” since it is the source of power in the system that leads to the current generated and passed through the primary coils 11x/11y/11z in apparatus 1 that generates the magnetic field. (*Id.*; *see also* Sections IX.A.1(a)-(d).) Alternatively, in my opinion, the AC power interface components (1a, 1b) and/or interface components in apparatus 1 and rectifier 21 (or rectifier 21 alone) is a “**power source**” for similar reasons. (*Id.*) Another example of the claimed “**power supply**” is switching component 22 alone, or collectively with one or more other components, such as rectifier 21, AC power components (1a, 1b), and/or interface components connecting thereto. As I explained above, switching circuit 22 provides the pulse voltage that is passed through primary coils 11x-11z, and thus is a source of power for passing the current through the primary coils. (*Id.*; Ex. 1005, ¶0068 (“A pulse voltage obtained by subjecting the DC voltage to switching in a switching circuit 22 is supplied to the primary side coil 11 through transistors (power change-over section) TR11, TR12, and TR13.”); *see id.*, ¶¶0065, 0090-0091, FIGS. 3, 5; *see also* discussions in Sections IX.A.1(f)-(k).)

160. In my opinion, a person of ordinary skill in the art would have understood that the above-discussed understandings and teachings are consistent with descriptions of a power source or supply in the '208 patent, which provides disclosures that appear to encompass external power sources. For example:

The charger pad or pad can be powered by plugging into a power source such as a wall socket. The pad can also be powered by another electronic device, such as the pad being powered through the USB outlet of a laptop or by the connector that laptops have at the bottom for interfacing with docking stations, or powering other devices.

(Ex. 1001, 6:38-45.) In my opinion, the '208 patent refers to “the charger or power supply” when discussing certain configurations (*see, e.g.*, Ex. 1001, 4:66-5:4, 6:26-30), including power “sources” external to the charger pad. (*See, e.g., id.*, 6:34-45, 8:13-22 (generic power source 18), 17:63-18:2, FIG. 10 (showing a source of power VC).) Thus, in my opinion, the above-discussed understandings and teachings in *Nakamura* are consistent with descriptions of a power source or supply in the '208 patent. (*Id.*)

161. Therefore, in my opinion, *Nakamura* (including as modified) discloses this limitation. (*See* my analysis and discussions above in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(d), (f)-(k).)

- f) **a communications interface that the base unit, and the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, use to communicate with one another during powering or charging, to**

162. In my opinion, *Nakamura* (including as modified) discloses this limitation. (See my analysis and discussions below in this section; see also my analysis and discussions in Sections IX.A.1(a)-(e), (g)-(k).) For example, *Nakamura* explains how the “**charger system**” is configured to exchange information between the primary side and secondary side circuits via magnetic coupling between the primary side coils (e.g., of power transmission apparatus 1) and secondary side coil (e.g., of device 2/3). (Ex. 1005, FIGS. 3-5, Abstract, ¶¶0066 (“A signal including such as information on power supply or the like is transmitted between the primary side circuit 10 and the secondary side circuit 13 by the noncontact transmission method”), 0070, 0075 (power receiving control IC 42 includes components for performing “signal processing for a signal transmitted through the primary side coil 11 and secondary side coil 12”), 0076-0077 (oscillation circuit 37 outputs a carrier wave supplied to primary coil 11 and subsequently “transmitted to the secondary side coil 12 which is magnetically coupled with the primary side coil 11”).)

163. The carrier wave signal transmitted from coil 11 is processed so that information regarding device 2/3 (e.g., “power reception equipment” code, “consumed power” information, and “full charge” information) is modulated and

transmitted back to apparatus 1. (Ex. 1005, FIGS. 4-5, ¶¶0077-0078.) The transmitted information signal is used to control powering/charging operations. For example, *Nakamura* explains:

The carrier wave outputted from the carrier wave oscillation circuit 37 is supplied to the tap c of the primary side coil 11, and in a case where the portable telephone 2 is placed on the power transmission apparatus 1, the carrier wave is transmitted to the secondary side coil 12 which is magnetically coupled with the primary side coil 11. The carrier wave transmitted onto the secondary side coil 12 is rectified and smoothed by the rectification circuit 41, the coil 3, and the capacitor C3, and thereby converted to a DC voltage. The power-on reset circuit 44 detects the DC voltage obtained by converting the carrier wave and thereby recognizes that the carrier wave has been transmitted. The clock extraction circuit 43 connected to the secondary side coil 12 extracts a clock signal required for modulation from the carrier wave, and the modulation circuit 45 modulates the carrier wave based on information regarding the portable telephone 2, namely, “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge” and supplies the modulated wave to the secondary side coil 12. . . .

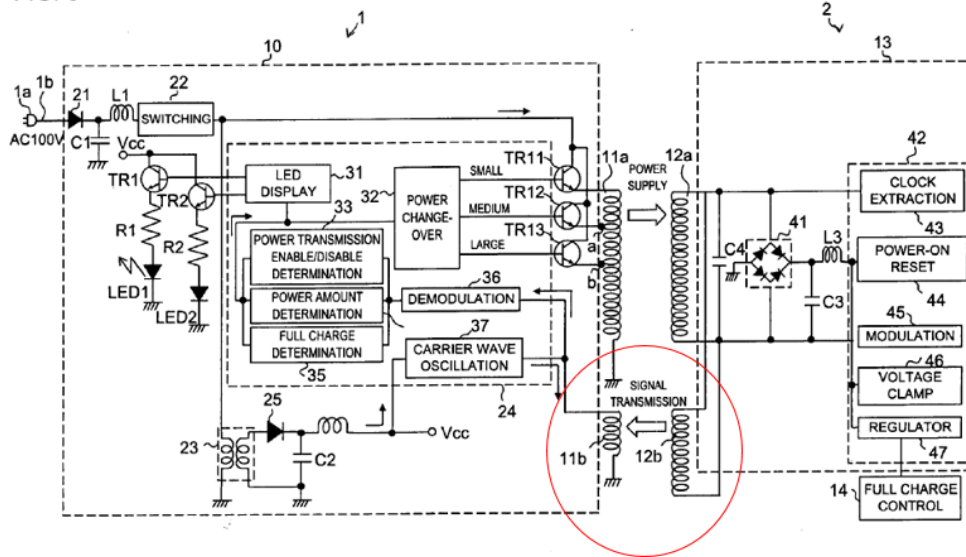
The modulated wave supplied to the secondary side coil 12 from the modulation circuit 45 is transmitted to the primary side coil 11 magnetically coupled thereto. The demodulation circuit 36 connected to the tap c of the primary side coil 11 receives and demodulates the transmitted modulated wave and supplies the “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge”, which are included in the demodulated information signal, to the power transmission enable/disable determination circuit 33, the power amount determination circuit 34, and the full-charge determination circuit 35. . . .

(Ex. 1005, ¶¶0077-0078; *see also id.*, FIGS. 4-5, ¶¶0079-0089; *id.*, ¶¶0090, 0091 (“possible to transmit power in the same manner” as that discussed for FIG. 3, and “one of the transistors is selected by the power change-over circuit 32 according to the level of power to be transmitted determined from the signal containing the ‘**information on consumed power**’ received from the portable telephone 2.”).)

164. In addition, *Nakamura* also discloses how the above-discussed communication features can be implemented using a separate primary coil 11b from primary coils used for power transfer. (Ex. 1005, FIG. 6 (annotated below), ¶¶0092-0094.) Although FIG. 6 shows such an implementation consistent with the single primary coil configuration of FIG. 3, *Nakamura* explains it can also be implemented

in the multi-primary coil configuration of FIG. 5. (*Id.*, ¶¶0092; *see also* discussions in Section IX.A.1(a).)

FIG. 6



(Ex. 1005, FIG. 6 (annotated).)

165. Moreover, *Nakamura* discloses that the “**base unit**” (apparatus) 1 and “**device**” 2/3 can “**communicate with one another during powering or charging.**”

For example, *Nakamura* explains:

Even after the power transmission is started, the carrier wave is regularly transmitted (step S13), and it is checked whether or not the portable telephone 2 which is power reception equipment, has been removed from on the power transmission apparatus 1 according to the information included in the modulated wave transmitted back against the carrier wave (step S14).

(Ex. 1005, ¶0086; *see also id.*, ¶¶0077-0078.) Therefore, *Nakamura* discloses that the carrier wave (from apparatus 1 to device 2/3) and the modulated wave (from device 2/3 back to apparatus 1) are communicated “during powering” via the magnetic coupling of primary coil(s) 11 and secondary coil 12. (*Id.*)

166. *Nakamura* explains that during powering/charging of device 2/3 or its battery, the device 2/3 communicates information, such as “full charge” information, to apparatus 1, which is used by the primary circuit 10 of apparatus 1 to stop charging/powering the battery/device. For example, *Nakamura* explains:

On the other hand, if the positional deviation of the portable telephone 2 from the power transmission apparatus 1 does not exceed the predetermined value, then **the process moves to a process in which it is determined whether or not the portable telephone 2 has been fully charged (step S18). The determination process is performed in a way such that the full-charge determination circuit 35 determines whether or not the portable telephone 2 is in a state of full charge, based on the “information on full charge” included in the information signal demodulated in the demodulation circuit 36. If the information shows a state of full charge, the power change-over circuit 32 turns off all of the transistors TR11, TR12, and TR13 to cease power output (step S19), and the LED1 is turned on in**

red and the LED2 is turned on in green (step S20) so as to indicate that the power transmission ceases, because the power reception equipment is in a full charge state. Thereafter, the carrier wave is outputted to thereby continue confirmation of a state of the power reception equipment (step S13). **On the other hand, if the information does not show a state of full charge, the confirmation of a state of the power reception equipment continues while performing power transmission (step S13).** In this way as described above, a non-contact power supply is performed from the power transmission 1 to the portable telephone 2.

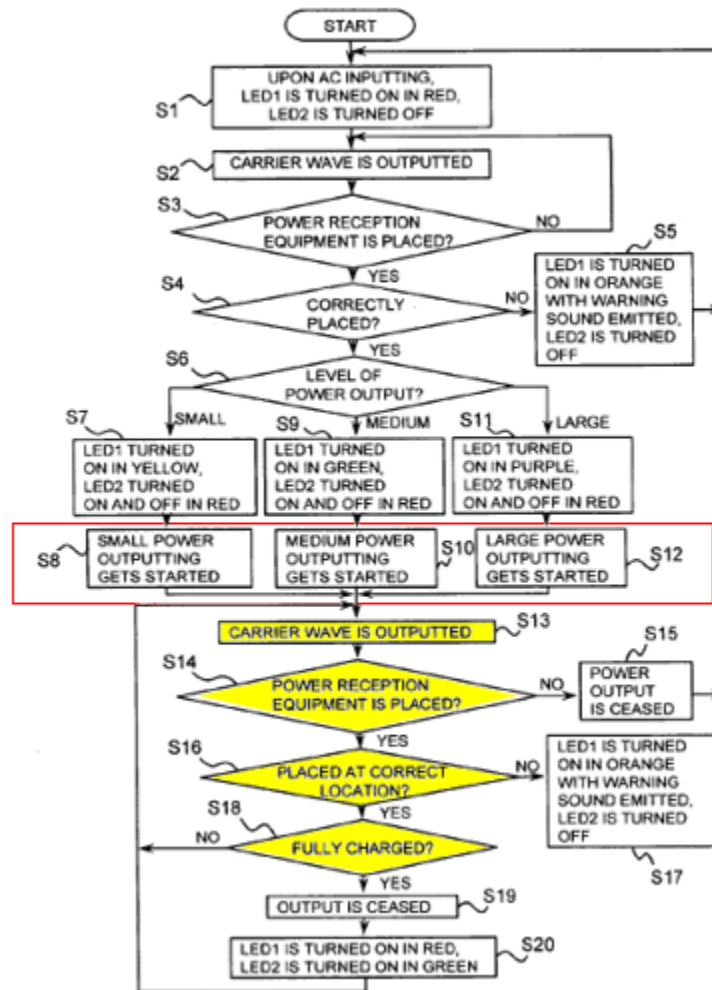
(Ex. 1005, ¶0088; FIG. 4, *see also id.*, ¶¶0066 (“necessary to cease power transmission” when device 2 is “fully charged”), 0077-0078, 0079-0087 (providing power when device 2 is determined to be present and correctly placed to allow power/charge operations at the appropriate power level to occur), 0090-0091, 0096-0097.)

167. Moreover, *Nakamura* explains that if the device 2/3 is determined to be not present or not properly positioned (e.g., based on the “code indicating being power reception equipment” communicated from device 2/3 (in response to a carrier wave transmitted from apparatus 1 to device 2/3) or lack thereof) after power/charge

operations begun, transistors TR11-13 are “turned off to thereby enable power transmission to be ceased.” (*Id.*, FIG. 4, ¶0097; ¶¶0078-0082, 0086-0089.)

168. FIG. 4 illustrates how “**base unit**” (apparatus) 1 and “**device**” 2/3 communicate after power/charging has begun. As FIG. 4 and the above-discussed disclosures of *Nakamura* indicate, the above-discussed communications between *Nakamura*’s apparatus 1 and devices 2/3 (e.g., transmission of a carrier wave from apparatus 1 to device 2/3 and transmission of a modulated wave including information such as “code indicating being power reception equipment” and “information on full charge” back from device 2/3 to apparatus 1) (e.g., steps S13 to S18) also take place after power/charging has begun (e.g., at steps S8, S10, or S12). (*Id.*; *see also id.*, ¶¶0077-0091, 0096-0097, FIGS. 4, 5; *see also* citations to *Nakamura* in this section.)

FIG. 4

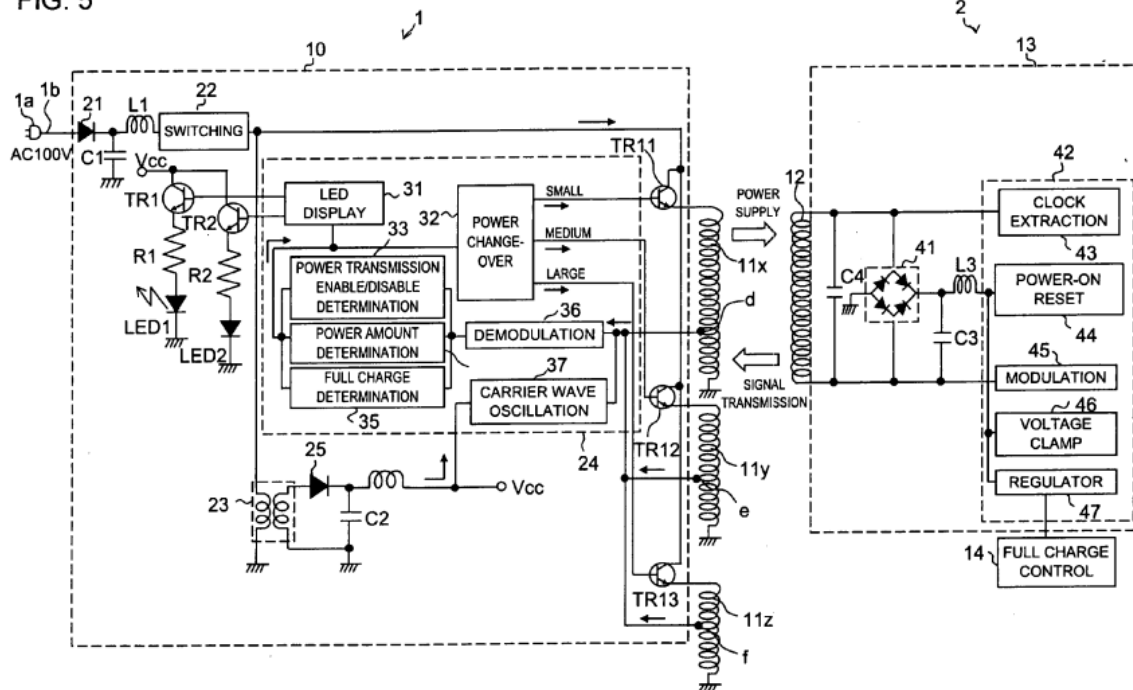


(Ex. 1005, FIG. 4 (annotated).)

169. Therefore, in my opinion, *Nakamura* discloses the claimed “communications interface” that the “base unit” (apparatus) 1 and the mobile “device” 2/3 “use to communicate with one another” in different ways. For example, power adjusting section 32 is a “communications interface” since it is used by both device 2/3 and apparatus 1 to facilitate communications of the carrier wave and information signal, as discussed. (Ex. 1005, ¶¶0066, 0070, 0075-0091,

0096-0097, FIGS. 4, 5; *see also* citations to *Nakamura* in this section.) As another example, and for similar reasons, “a power-on reset circuit (carrier wave detection circuit) 44” is an example of such a “**communications interface**.” (*Id.*; *see also* Ex. 1005, ¶¶0074-0075, 0077-0078, 0086-0091.) Similarly, in my opinion, modulation circuit 45 alone or in combination with circuit 44 is an example of a “**communications interface**” since it is used by both apparatus 1 and device 2/3 to communicate information signals. (*Id.*) Also, for similar reasons, carrier wave oscillation component 37 is another example of a “**communications interface**” since it provides the signal that facilitates the subsequent modulation/generation of information signals communicated to apparatus 1 from device 2/3. (*Id.*; *see also* Ex. 1005, ¶¶0069-0070, 0076-0078, 0086-0091.) Similarly, in my opinion, demodulation component 36, alone or collectively with other components in power transmission control IC 24 (e.g., components 32, 33, 34, and/or 35), is another example of a “**communications interface**.” (*Id.*; *see also* Ex. 1005, ¶¶0070, 0078, 0083, 0086-0091.) Alternatively, in my opinion, circuitry/components relating to primary coils 11x/11y/11z and/or secondary coil 12 is a “**communications interface**” given they are used by device 2/3 and apparatus 1 to communicate the carrier wave and/or information/signals used to control power/charge operations. (*Id.*; *see also* Ex. 1005, ¶¶0070, 0076-0091.)

FIG. 5



(Ex. 1005, FIG. 5.)

170. In addition, in my opinion, where the features of FIG. 6 are implemented with the FIG. 5 configuration, primary coil 11b is an example of a “**communications interface**” since it is used by device 2/3 and apparatus 1 to exchange signals/information between the two. (Ex. 1005, FIGS. 5-6, ¶¶0092-0094; *see also* citations to *Nakamura* in this section.) Alternatively, in my opinion, secondary coil 12b (alone or collectively with coil 11b) is a “**communications interface**” for similar reasons. (*Id.*) Alternatively, for similar reasons, communications coil 11b collectively with one or more components of control IC 24 (e.g., components 32, 33, 34, 35, 36 and/or 37) is a “**communications interface.**”

(*Id.*; *see also* discussions below for limitations 1(g)-1(k) and above for limitations 1(a)-1(e).) (*See* Sections IX.A.1(a)-(e), (g)-(k).)

171. In my opinion, the above-discussed teachings of *Nakamura* disclosing a “**communications interface**” are consistent with the plain language of claim 1 in context of the ’208 patent. For example, other than in the claims, the ’208 patent does not mention a “communication(s) interface.” (*See generally* Ex. 1001.) The ’208 patent specification does refer to “[d]ata communications and storage units,” but in doing so, it only states:

Data communications and storage units 234 can also be attached in a modular fashion. This approach would enable the customer to use the technology at a low cost entry point and grow his/her capabilities over time.

(Ex. 1001, 15:19-22; *see also id.*, FIG. 8 (234).)

172. Other discussions in the ’208 patent similarly do not limit what a person of ordinary skill in the art would have understood “**communications interface**” as claimed to be or what it encompasses. (*See generally* Ex. 1001.) For example, while the specification discusses components for a “communications and/or storage unit” for the FIG. 21 embodiment, those are non-limiting examples associated with one of the devices in the system (e.g., charger unit). (*Id.*, FIG. 21, 23:7-19 (“[e]xamples of components that *can* be incorporated include . . .”).) The specification also discloses

that a charger cover or skin can provide “communications” capabilities (*id.*, 24:43-48).”

173. Therefore, in my opinion, *Nakamura* (including as modified) discloses this limitation in a manner consistent with the language of the claim in context of the '208 patent. (*See* my analysis and discussions above in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(e), (g)-(k).)

- g) **poll each of the primary coils, or receive a signal from a sensor associated therewith, to verify the presence of the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device placed upon or close to the surface of the base unit,**

174. In my opinion, *Nakamura* (as modified above) discloses and/or suggests this limitation. (*See* my analysis and discussions below in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(f), 1(h)-1(k).)

175. As I explained above, *Nakamura* discloses “**verify[ing] the presence of the mobile [device]**” 2/3 that is “**placed upon or close to the surface of the base unit**” (apparatus 1). (*See* my analysis and discussions in Sections IX.A.1(a)-1(f).) For example, *Nakamura* explains that apparatus 1 has “functions of recognizing power reception equipment placed on the power transmission apparatus 1 so as to transmit power necessary . . . depending on the type.” (Ex. 1005, ¶0063.) Moreover, as discussed above, *Nakamura* explains:

The clock extraction circuit 43 connected to the secondary side coil 12 extracts a clock signal required for modulation from the carrier wave, and **the modulation circuit 45 modulates the carrier wave based on information regarding the portable telephone 2, namely, “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge” and supplies the modulated wave to the secondary side coil 12. . . .**

The modulated wave supplied to the secondary side coil 12 from the modulation circuit 45 is transmitted to the primary side coil 11 magnetically coupled thereto. The demodulation circuit 36 connected to the tap c of the primary side coil 11 receives and demodulates the transmitted modulated wave and supplies the “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge”, which are included in the demodulated information signal, to the power transmission enable/disable determination circuit 33, the power amount determination circuit 34, and the full-charge determination circuit 35.

(Ex. 1005, ¶¶0077-0078.)

176. Demodulation circuit 36 (connected to primary side coil 11) receives/demodulates the modulated information signal from device 2/3, which includes a **“code indicating being power reception equipment,”** and provides it to **“power transmission enable/disable determination circuit 33.”** (*Id.*; *see also id.*, FIGS. 4-5.)

177. *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).

(Ex. 1005, ¶0078.)

178. Thus, the 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).”** (*Id.*) If the code 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).”** (*Id.*) If not, **“the carrier wave is outputted again (Step S2).”** (*Id.*; *see also id.*, ¶0077.)

179. Regarding the above-referenced process of determining whether the power reception equipment (device 2/3) is correctly placed on the power transmission apparatus 1, *Nakamura* also explains:

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.

(Ex. 1005, ¶0079; *see also id.*, ¶¶0080 (“portable telephone 2 are located at positions where the highest coupling degree in magnetic coupling is established . . . the deviation is given 0” and “deviations” left-to-right or forward-to-rearward from “the position with the deviation of 0 are measured in units of mm”), 0081 (“deviation” of device 2 from apparatus 1 “can be recognized by **measuring a signal intensity of the information signal**”), 0082 (“it is determined **whether or not the positional deviation** of the portable telephone 2 from the power transmission apparatus 1 **exceeds a predetermined value**”), FIGS. 5, 11A-11B, ¶¶0083, 0086-0088, 0096, 0109 (placement of device 2/3 at apparatus 1 portion of desk/table is “detected as described above” to allow power to be “adjusted and supplied”), FIGS. 13A-13E.)

180. For the reasons I discussed above, the exemplary “**communications interface(s)**” identified for limitation 1(f) provide the communication between the “**base unit**” (apparatus 1) and “**device**” (device 2/3) to facilitate the above-discussed verification features. (*See my analysis and discussions above in Section IX.A.1(f).*)

181. Based on the above-discussed disclosures, a person of ordinary skill in the art would have understood that *Nakamura* discloses a demodulation circuit 36 that is connected to primary side coil(s) 11 (in apparatus 1) and demodulates the

modulated information signal containing code(s) (e.g., including “code indicating being power reception equipment”) transmitted from device 2/3 to supply the code(s) to determinations circuits 33-35 (e.g., including power transmission enable/disable determination circuit 33), which is used to verify/sense the presence of device 2/3, as I explained above. (*Id.*; Ex. 1005, FIGS. 3-5, ¶¶0069-0070, 0077-0083; *see also* citations above in this section.) Thus, a person of ordinary skill in the art would have understood that *Nakamura* discloses receiving a signal from a sensor associated with the primary coil(s) to verify/sense the presence of device 2/3. (*Id.*)

182. Nonetheless, although *Nakamura* does not expressly disclose/state “receiv[ing] a signal from a sensor associated” with “each of the primary coils,” as I mention above, *Nakamura* does disclose that the presence of device 2/3 “**placed upon or close to the surface of the base unit**” (apparatus 1) is “**verif[ied]**” by measuring the intensity of the power or information signal(s) communicated via primary coil(s) 11 and secondary coil 12. (Ex. 1005, ¶¶0078, 0079 (correctly placed phrase is “whether or not the coil of the [device 2] and the coil of [apparatus 1] are arranged at positions where a high power transmission efficiency in a non-contact power supply system is obtained” or a “high coupling degree in magnetic coupling is established”), 0080 (“transmission efficiency of power and the information signal” where “‘information signal’ means the modulated wave transmitted back from the

secondary side circuit 13 in response to a carrier wave transmitted from the primary side circuit 10”), 0081-0082.)

183. While a person of ordinary skill in the art would have understood that such mechanisms discussed above would include a “**sensor**” associated with the primary coil(s) 11x/11y/11z, *Nakamura* does not expressly state so. However, in my opinion, such a skilled person would have been motivated to configure and implement a “**sensor**” associated with each of primary coils 11x/11y/11z (FIG. 5) in the above-discussed *Nakamura-Berghegger* system to provide the information signal (e.g., “code indicating being power reception equipment”) used to verify “whether or not power reception equipment is placed on the power transmission apparatus 1.” (*Id.*, ¶0078, FIGS. 4, 11A-11B, ¶¶0079-0081; *see also* citations to *Nakamura* in this section.)

184. In my opinion, a person of ordinary skill in the art would have been motivated to implement such a modification because of the above-discussed teachings and suggestions in *Nakamura* that use, for example, signal intensity as a way of determining and verifying the presence of device 2/3 “**placed upon or close to the surface of the base unit**” (apparatus 1). In my opinion, such disclosures, and the circuitry and components that use the signals received from primary coils 11x/11y/11z would have motivated a person of ordinary skill in the art to consider and use known techniques and technologies for enabling the *Nakamura-Berghegger*

system to receive signals used for determining whether device 2/3 is present and in a proper position for receiving power. (Ex. 1005, ¶¶0062, 0065, 0077-0082, FIGS. 3-5, 11A-11B.) For example, a person of ordinary skill in the art would have been motivated to configure the modified *Nakamura* system with a “**sensor**” that senses current modulation in the primary coils 11x/11y/11z based on the information signals received from device 2/3. (*Id.*) A person of ordinary skill in the art would have understood in one example that such sensors would be (or may be) implemented in association with the primary coils 11x/11y/11z, demodulation component 36, or other components to allow measuring of the intensity of the information signal(s) as disclosed by *Nakamura*. (Ex. 1005, ¶0081.)

185. In my opinion, for similar reasons, a person of ordinary skill in the art would have been similarly motivated to consider and implement other types of sensors (e.g., proximity sensors) known to provide signals used to indicate the presence of an object (e.g., via capacitive, optical, pressure, resistive, magnetic mechanisms). A person of ordinary skill in the art would have known of such available options for generating sensor signals that would have been used by apparatus 1 to complement the above-discussed features *Nakamura* uses to ensure that device 2/3 is present and properly placed before and/or during transferring power. (*Id.*; see also discussions in Sections IX.A.1(a)-(f), IX.A.1(h)-(k).)

186. In my opinion, a person of ordinary skill in the art would have had the necessary skills, knowledge, and capabilities to design and implement such “**sensor**”-type features in the combined *Nakamura-Berghegger* system, and would have done so with a reasonable expectation of success given the teachings of *Nakamura* (which describe receiving signals from primary coils 11x/11y/11z and use of components like demodulation component 36 and signal intensity measurements) and the knowledge of such a skilled person at the time. (*Id.*)

187. Moreover, in my opinion, implementing the above modification would have involved applying known technologies (e.g., use of conventional circuitry such as a sensor for sensing current modulation, reception of information signals, conventional proximity, sensor technologies, etc. with contactless inductive power/charge systems (*Nakamura* and *Berghegger*)) according to known techniques (e.g., verifying proper positioning (and presence) of a mobile device (to be inductively charged/powered) on the surface of a charging unit (apparatus 1) (*Nakamura*)) that would have led to a foreseeable result of configuring the modified system using known sensor component(s) to provide signal(s) used to verify the presence of a properly positioned mobile device (device 2/3), consistent with that described by *Nakamura*. (Ex. 1005, ¶¶0069-0070, 0077-0083, FIGS. 3-5; *see also* citations above in this section.)

188. Therefore, in my opinion, *Nakamura* (including as modified) discloses and/or suggests this limitation. (See my analysis and discussions above in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(f), 1(h)-1(k).)

- h) select, based on the polling or sensing, from within the plurality of primary coils, and selectively switch, using their associated switching circuits to activate, only those one or more primary coils which are determined to be most closely aligned with a receiver coil at the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, and**

189. In my opinion, *Nakamura* (including as modified above) discloses and/or suggests this limitation. (See my analysis and discussions below in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(g), (i)-1(k).)

190. For example, my analyses above for limitations 1(a)-1(g) demonstrate how *Nakamura* discloses using “**switching circuits**” (limitation 1(c)) associated with one of the primary coils 11x/11y/11z to power/charge the mobile “**device**” 2/3. (See Section IX.A.1(c); *see also* Sections IX.A.1(a)-(b), 1(d)-(g); Ex. 1005, FIGS. 1-5, ¶¶0062-0065, 0069-0076, 0083-0090-0091.) As I explained, one of the primary coils 11x/11y/11z is selected using an associated selected switch TR11-TR13 based on the “information on consumed power” included in the information signal transmitted from device 2/3 to apparatus 1 and demodulated by demodulation component 36. (Ex. 1005, FIGS. 4-5, Ex. 1005, ¶¶0083-0085, 0090-0091.) Determination circuit 34 uses the information signal to determine whether a small,

medium, or large power level is to be provided by apparatus 1 to device 2/3, and thus “**selectively switch[es]**” one of the associated transistors TR11-13 (“**switching circuit**”) to allow current to pass through the appropriate primary coil 11x/11y/11z that generates a magnetic field to facilitate the transfer of such selected power via the magnetic coupling established between an activated primary coil 11x/11y/11z and secondary coil 12. (See my analysis and discussions in Sections IX.A.1(a)-1(h); Ex. 1005, FIGS. 1-5, ¶¶0083-0085, 0090-0091.) For example, *Nakamura* explains:

[I]f the positional deviation of the portable telephone 2 from the power transmission apparatus 1 does not exceed the predetermined value, the process moves to **a process for determining a level of power to be transmitted (step S6). The determination process is performed in the power amount determination circuit 34 based on the “information on consumed power” included in the information signal demodulated in the demodulation circuit 36. The power of the portable telephone 2 is recognized based on the “information on consumed power”. A power transmission output is adjusted at one of three levels of large, medium, and small depending on the recognized power. A result of the determination from the power amount determination circuit 34 is transmitted to the LED display circuit 31 and the power change-over circuit 32 so as to perform the process described below in response to one of the large,**

medium, and small levels as the result of the determination.

If the determination result shows the small level, . . . the power change-over circuit 32 turns on the transistor TR11. When the transistor TR11 is turned on, a pulse voltage from the switching circuit 22 is applied across the total length of the primary side coil 11 to start power transmission (step S8). Then, when the determination result shows the medium level, . . . the power change-over circuit 32 turns on the transistor TR12. When the transistor TR12 is turned on, a pulse voltage from the switching circuit 22 is applied to the tap a of the primary side coil 11 to start power transmission (step S10). When the determination result shows the large level, . . . the power change-over circuit 32 turns on the transistor TR13. When the transistor TR13 is turned on, a pulse voltage from the switching circuit 22 is applied to the tap b of the primary side coil 11 to start power transmission (step S12).

(Ex. 1005, ¶¶0083-0084, FIGS. 3, 5.)

191. I discussed above for limitation 1(a) how the above-disclosure (that *Nakamura* provides with respect to its FIG. 3) is also applicable to *Nakamura's* FIG.

5 configuration. (*See* my analysis and discussions in Sections IX.A.1(a).) Moreover, *Nakamura* further explains (with respect to the FIG. 5 configuration):

In this embodiment, the power transmission apparatus 1 has the configuration in which **three coils for power transmission and respective transistors are provided. It is also possible to transmit power in the same manner as in the case of the power transmission apparatus 1 shown in FIG. 3 where one primary side coil 11 is used.** In this embodiment, to be specific, **one of the transistors is selected by the power change-over circuit 32 according to the level of power to be transmitted determined from the signal containing the “information on consumed power” received from the portable telephone 2. Accordingly, a coil for transmitting power can be selected, and power required for the power reception equipment can be transmitted. For example, in a case where the power of the power reception equipment is small, a coil with a large number of turns is used. In a case where the power of the power reception equipment is large, a coil with a small number of turns is used.**

(Ex. 1005, ¶0091; *see also id.*, FIG. 5, ¶0090.)

192. My analyses for limitations 1(a)-1(g) above also explain how *Nakamura* discloses providing power to device 2/3 via the primary and secondary

coils when it is determined that a “**device**” 2/3 is present and properly positioned on or near the surface of apparatus 1 (“**base unit**”) such that a high degree of magnetic coupling is established. (See my analysis and discussions above for Sections IX.A.1(f)-1(g); Ex. 1005, ¶¶0062, 0065, 0078-0082, 0086, 0087 (“determining whether or not a deviation” of device 2 from apparatus 1 “exceeds a predetermined value”), 0088, 0090-0091, 0096, 0109.) My analyses for limitations 1(f)-1(g) also explain how *Nakamura* discloses, or that a person of ordinary skill in the art would have been motivated to modify the *Nakamura-Berghegger* system to implement, using a “**sensor**” to facilitate such verification functionalities. (See my analysis and discussions above for Sections IX.A.1(f)-1(g).)

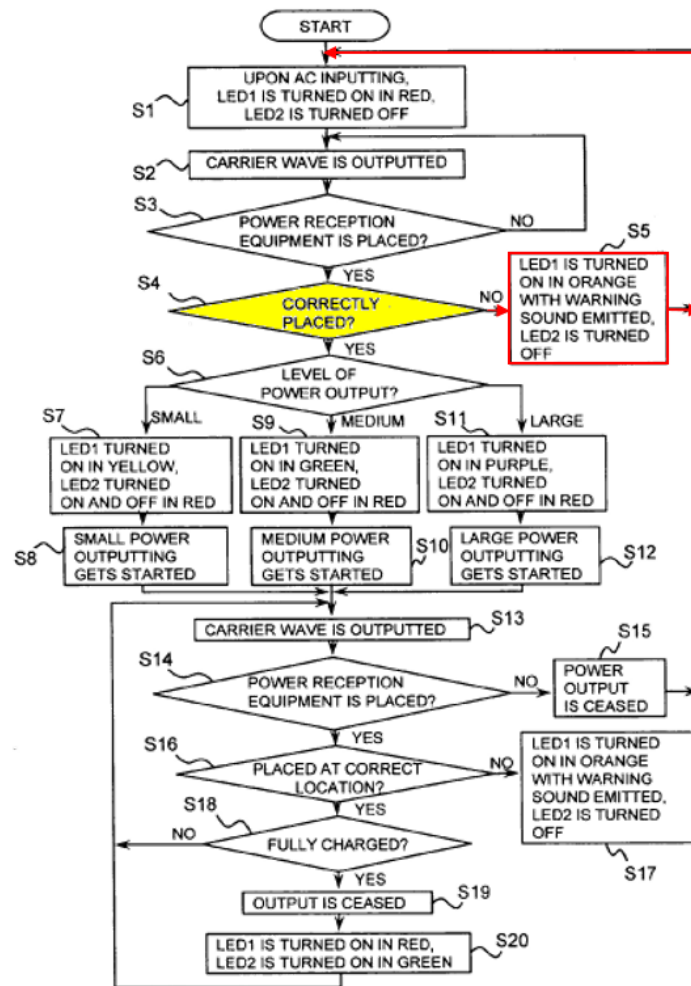
193. For such reasons, and those I further explained below, the *Nakamura-Berghegger* system that I discussed above for this claim discloses and/or suggests selectively switching, using the switching circuits, to activate, only those one or more primary coils that are determined to be most closely aligned with the receiver coil of device 2/3, like that claimed in this limitation. (*Id.*; see also citations to *Nakamura* in this section.) As I discussed, only when a properly aligned/positioned device 2/3 is detected, will *Nakamura*’s system allow power/charge operations to commence/continue. (See Sections IX.A.1(f)-(g).)

194. For example, *Nakamura* explains:

[I]t is determined whether or not the positional deviation of the portable telephone 2 from the power transmission apparatus 1 exceeds a predetermined value (step S4). If it exceeds, no power transmission is performed from the power transmission apparatus 1, and the LED1 is turned on in orange and the LED 2 is turned off as a warning indication (step S5). In this situation, a warning sound may be emitted instead.

(Ex. 1005, ¶0082.) Similarly, consistent with the above disclosure, FIG. 4 shows that if the determination at step S4 is “No,” then the process proceeds to step S5 and then goes back to steps S1-S3, and thus does not proceed to steps S6-S12 that pertain to selection of transmission power level and transmission of power at a selected power level. (*Id.*, FIG. 4 (below).)

FIG. 4



(Ex. 1005, FIG. 4 (annotated); *see also id.*, ¶¶0076-0081, 0082 (no power transmission is performed if positional deviation of device 2 from apparatus 1 “exceeds a predetermined value (step S4)”), 0086 (ceasing power transmission by turning off TR11-13 when device 2 has been removed).)

195. As I discussed above for limitation 1(a) and also in this section, *Nakamura*’s disclosures pertaining to certain figures (e.g., such as those of FIGS. 3 and 4) are also applicable to other figures/configurations of *Nakamura* such as

Nakamura's FIG. 5 configuration. (See my analysis and discussions in Sections IX.A.1(a).) For example, *Nakamura* explains that "FIG. 4 is a flowchart showing power supply operations in a power transmission apparatus shown in FIG. 3" (Ex. 1005, ¶0029; see also *id.*, ¶0076 ("FIG. 4 is a flowchart showing power supply operations in the power transmission apparatus 1")), and that "[i]n FIG. 5, the same constituents as in FIG. 3 are attached with the same symbols and descriptions thereof will not be given herein." (*id.*, ¶0090). *Nakamura* also explains that "[i]n this embodiment [FIG. 5], the power transmission apparatus 1 has the configuration in which three coils for power transmission and respective transistors are provided. It is also possible to transmit power in the same manner as in the case of the power transmission apparatus 1 shown in FIG. 3 where one primary side coil 11 is used." (*Id.*, ¶0091.) *Nakamura* further explains:

Note that, although the primary side coils 11x, 11y, and 11z are illustrated apart from one another in FIG. 5, the primary side coils are actually disposed very close to one another. Therefore, the secondary side coil 12 can be disposed in close proximity to any of the three primary side coils.

(Ex. 1005, ¶0090; see also *id.*, FIGS. 3-5.)

196. Therefore, for the reasons provided above and based on the teachings of *Nakamura*, the *Nakamura-Berghegger* modified system above discloses and/or

suggests “**activat[ing], only those *one* or more primary coils** [one of coils 11x/11y/11z] **which are determined to be most closely aligned with a receiver coil** [coil 12] **at the mobile [device 2/3]**” as claimed since *Nakamura* encompasses configurations where power/charge transmissions only occur when device 2/3 (and its coil 12) is present and determined to be properly aligned (“**most closely aligned**”) with a primary coil 11 where high magnetic coupling is established. (*See* my analysis and discussions above.) In *Nakamura*, the level of power determined according to the processes discussed by *Nakamura*, is used to select which coil to transfer power from, and that only occurs when the receiver coil is appropriately positioned, and thus most closely aligned with the selected primary coil. (*See, e.g.,* Ex. 1005, FIG. 4, (S3-S8).)

197. Thus, for the reasons I explained above, it is my opinion that the *Nakamura-Berghegger* modified system discloses and/or suggests using the identified “**communications interface**” that the apparatus 1 (“**base unit**”) and device 2/3 (“**device**”) “**use to communicate with one another during powering or charging**” (limitation 1(f)) to “**select, based on the polling or sensing, from within the plurality of primary coils**” (limitations 1(a), 1(g) and above for this limitation 1(h)), “**and selectively switch, using their associated switching circuits** [limitation 1(c) and above for this limitation] **to activate, only those *one* or more primary coils** [one of coils 11x/11y/11z] **which are determined to be most closely aligned**

with a receiver coil at the mobile [device]” (limitations 1(c)-1(d) above for this limitation). (*See also* my discussions for limitations 1(a)-(b), 1(e)-1(g) and discussions above in this section for limitation 1(h)). (*See also* Sections IX.A.1(i)-(k).)

- i) **periodically thereafter exchange information to provide power transfer to the device and/or battery, including device and/or battery charging or power status or presence; and**

198. In my opinion, *Nakamura* (as modified above) discloses and/or suggests this limitation. (*See* my analysis and discussions below in this section; *see also* discussions in Sections IX.A.1(a)-(h), (i)-1(k).)

199. For example, my analyses for limitations 1(f)-1(h) above and my analyses for limitation 1(k) below explain how *Nakamura* discloses that ***after*** one of the transistors TR11-13 is selected to allow current to pass to an associated activated primary coil 11x/11y/11z appropriate for device 2/3 that has been verified as present and properly positioned, and after power transmission has started between apparatus 1 (“**base unit**”) and “**device**” 2/3, the “**communications interface**” (limitation 1(f)) is used “**to exchange information to provide power transfer to the device and/or battery**” (device 2/3 or its battery) that includes “**device and/or battery charging or power status or presence**” as claimed in this limitation 1(i). (*See* my analysis

and discussions in Sections IX.A.1(f)-(h) above and discussions in Section IX.A.1(k) below.) As discussed, *Nakamura* explains:

Even after the power transmission is started, the carrier wave is regularly transmitted (step S13), and it is checked whether or not the portable telephone 2 which is power reception equipment, has been removed from on the power transmission apparatus 1 according to the information included in the modulated wave transmitted back against the carrier wave (step S14).

(Ex. 1005, ¶0086; *see also id.*, ¶0088 (“**Thereafter**, the carrier wave is outputted to thereby **continue confirmation of a state of the power reception equipment** (step S13)”); *see also id.*, ¶¶0066, 0077-0089, 0090-0091, 0096-0097, FIG. 4.)

200. As discussed above, the information exchanged between primary side circuit 10 and secondary side circuit 13 includes the carrier wave signal and subsequent information signal (modulated wave) providing “**device**” information (e.g., “code indicating being power reception equipment,” “information on consumed power,” and “information on full charge”) (“**device and/or battery charging or power status or presence**”). *Nakamura* explains:

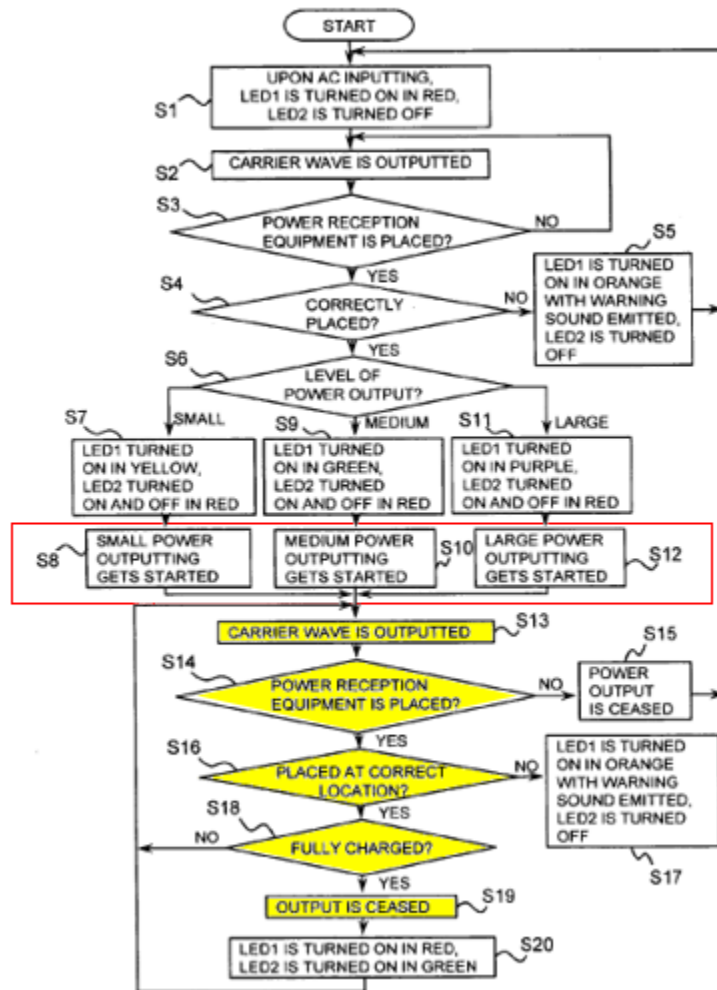
The carrier wave outputted from the carrier wave oscillation circuit 37 is supplied to the tap c of the primary side coil 11, and in a case where the portable telephone 2 is placed on the power transmission

apparatus 1, the carrier wave is transmitted to the secondary side coil 12 which is magnetically coupled with the primary side coil 11. . . . The clock extraction circuit 43 connected to the secondary side coil 12 extracts a clock signal required for modulation from the carrier wave, and the **modulation circuit 45 modulates the carrier wave based on information regarding the portable telephone 2, namely, “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge” and supplies the modulated wave to the secondary side coil 12. . . .**

The modulated wave supplied to the secondary side coil 12 from the modulation circuit 45 is transmitted to the primary side coil 11 magnetically coupled thereto. The demodulation circuit 36 connected to the tap c of the primary side coil 11 **receives and demodulates the transmitted modulated wave and supplies the “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge”, which are included in the demodulated information signal, to the power transmission enable/disable determination circuit 33, the power amount determination circuit 34, and the full-charge determination circuit 35. . . .**

(Ex. 1005, ¶¶0077-0078; *see also id.*, ¶¶0076, 0079-82 (steps S1-S5 of FIG. 4 (determining presence / proper positioning of device 2/3)), 0086-0087 (steps S13/S14/S16 (similar operations as S2/S3/S4)), 0088 (full charge status determination information (S18)).)

FIG. 4



(Ex. 1005, FIG. 4 (annotated).)

201. *Nakamura* also explains that the above-discussed processes take place and continue “*regularly*”:

[I]t is preferable that the power adjusting section comprise a carrier wave oscillation circuit, included in the primary side circuit, for *regularly supplying a carrier wave to the primary side coil*, and a demodulation circuit, included in the primary side circuit, for receiving an information signal through the primary side coil and demodulating the **received information signal, the information signal including information on the power reception equipment, modulated, and transmitted from the power reception equipment in response to the carrier wave**, wherein the power adjusting section adjusts, in accordance with the information signal demodulated by the demodulation circuit, the level of power to be transmitted through a change-over operation performed by the power change-over section. With this configuration, the level of power ~~s s~~ transmitted from the power transmission apparatus can be adjusted according to the information signal fed from the power reception equipment.

(Ex. 1005, ¶0020.)

202. In my opinion, a person of ordinary skill in the art would have understood the exchange of information (e.g., steps S13/S14/S16/S18 (FIG. 4)) that occurs after the initial communications (e.g., steps S1-S12 (FIG. 4)) is necessarily performed “**periodically**” because *Nakamura* discloses communicating, e.g., the

carrier wave from apparatus 1 to device 2/3 continuously and regularly while performing power transmission, which results in the modulated information signals being continuously and regularly generated and transmitted back to apparatus 1 from device 2/3. For example, *Nakamura* explains:

Even after the power transmission is started, the carrier wave is regularly transmitted (step S13), and it is checked whether or not the portable telephone 2 which is power reception equipment, has been removed from on the power transmission apparatus 1 according to the information included in the modulated wave transmitted back against the carrier wave (step S14). In the confirmation, the power transmission enable/disable determination circuit 33 determines, in a similar manner to that in step S3, **whether or not the power reception equipment is placed on the power transmission apparatus 1, based on the “code indicating being power reception equipment”.** If a predetermined “code indicating being power reception equipment” has not been received, it is determined that the power reception equipment has been removed from on the power transmission apparatus 1, and the power change-over circuit 32 turns off all of the transistor TR11, TR12, and TR13 to cease power transmission (step S15).

On the other hand, if the predetermined “code indicating being power reception equipment” has been received, it is recognized that the power reception equipment has been placed on the power transmission apparatus 1, and then, it is determined whether or not the power reception equipment has been placed correctly on the power transmission apparatus 1 (step S16). The determination is performed in a similar manner to that in step S4 by determining whether or not a deviation of the portable telephone 2 from the power transmission apparatus 1 exceeds a predetermined value. If the positional deviation exceeds the predetermined value, no power transmission is performed from the power transmission apparatus 1. Then, in a similar manner to that in step 5, the LED1 is turned on in orange and the LED2 is turned off as a warning indication (step S17). In this situation, a warning sound may be emitted instead.

On the other hand, if the positional deviation of the portable telephone 2 from the power transmission apparatus 1 does not exceed the predetermined value, then **the process moves to a process in which it is determined whether or not the portable telephone 2 has been fully charged (step S18).** The determination process is performed in a way such that the full-charge determination circuit 35 determines whether or not the portable telephone 2 is in a state of full charge, **based on the**

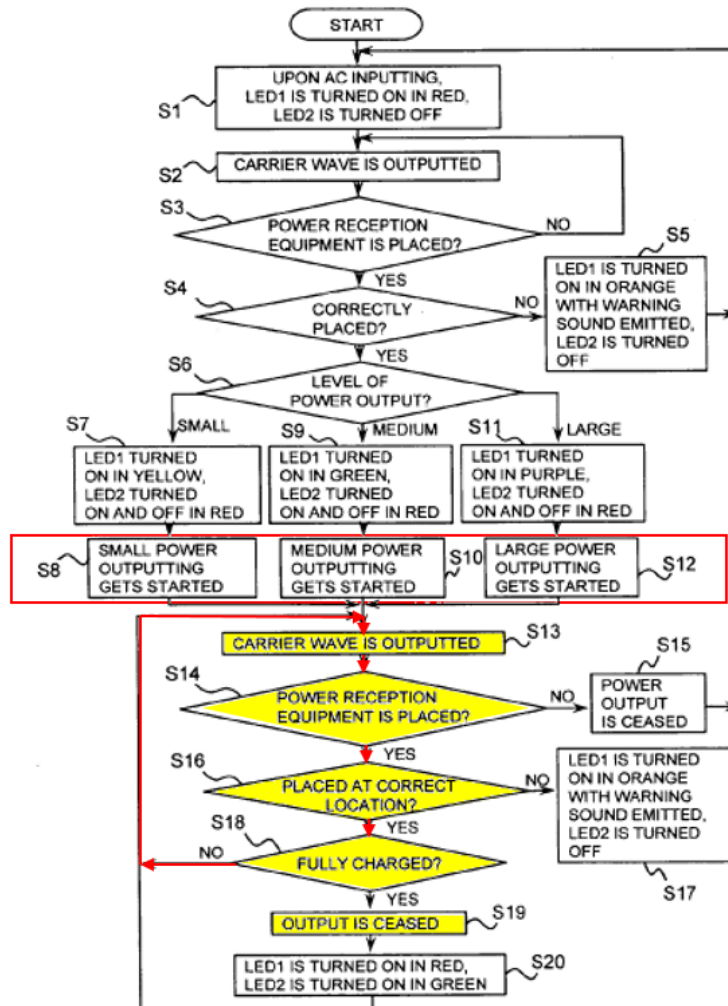
“information on full charge” included in the information signal demodulated in the demodulation circuit 36. If the information shows a state of full charge, the power change-over circuit 32 turns off all of the transistors TR11, TR12, and TR13 to cease power output (step S19), and the LED1 is turned on in red and the LED2 is turned on in green (step S20) so as to indicate that the power transmission ceases, because the power reception equipment is in a full charge state. **Thereafter, the carrier wave is outputted to thereby continue confirmation of a state of the power reception equipment (step S13).** On the other hand, **if the information does not show a state of full charge, the confirmation of a state of the power reception equipment continues while performing power transmission (step S13).** In this way as described above, a non-contact power supply is performed from the power transmission 1 to the portable telephone 2.

(Ex. 1005, ¶¶0086-0088; *see also id.*, FIG. 4.)

203. In my opinion, based on the above-disclosures, including those relating to FIG. 4 (*see, e.g.*, annotated figure below), a person of ordinary skill in the art would have readily understood that steps S13/S14/S16/S18 (which involve **“exchang[ing] information to provide power transfer to the device and/or battery, including device and/or battery charging or power status or presence”**) form a loop within the overall FIG. 4 process of *Nakamura*, and thus and continue

continuously and regularly until device 2/3 and/or its battery is fully charged (while the device is present and correctly placed). (*Id.*; see also FIG. 4.)

FIG. 4



(Ex. 1005, FIG. 4 (annotated).) Thus, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura* discloses and/or suggests “*periodically thereafter exchange information to provide power transfer to the device and/or battery, including device and/or battery charging or power status or presence.*” (Ex. 1005, ¶¶0086-0088, FIG. 4; see also *id.*, ¶¶0020, 0066, 0076-

0085, 0090-0091, 0096-0097, FIG. 5; *see also* citations to *Nakamura* in this section; *see also* discussions in this section and discussions in Sections IX.A.1(a)-(h), (i)-1(k).)

204. I have been asked to consider the scenario where such “periodic[]” information exchange is not disclosed or suggested. Under that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to configure the *Nakamura-Berghegger* system to periodically send the carrier wave from apparatus 1 to device 2/3 after power transmission has started, which in turn would have resulted (e.g., in view of *Nakamura*’s disclosures discussed above) in the modulated information signals (which, as discussed above, contains information such as “code indicating being power reception equipment” and “information on full charge”) being periodically generated and transmitted back to apparatus 1 from device 2/3. (*Id.*) In my opinion, such a modification would have provided a routine and foreseeable sequence for the charging system to follow to ensure that the state of the device 2/3 is routinely checked for proper device presence and positioning and charge status, consistent with the operations of *Nakamura*. (*Id.*)

205. In my opinion, a person of ordinary skill in the art would have been motivated to implement such predictable features in light of *Nakamura*’s above-discussed teachings and suggestions of continuously and regularly checking the state/status of the device 2/3 during power transmissions to avoid overcharging the

device (e.g., charging beyond the full charge state) and efficient power transmission (e.g., maintaining presence and proper positioning for charging). (*Id.*) In my opinion, such a skilled person would have had the requisite skills, capabilities, and knowledge to design and implement such features (e.g., via clock/timer circuitry, configuration of the integrated circuitry in apparatus 1 (e.g., power transmission control IC 24), etc.) with a reasonable expectation of success, especially in light of *Nakamura*'s teachings and suggestions, and those of *Berghegger* and the state-of-art knowledge discussed above and below. (*Id.*; *see* my analysis and discussions in Sections IX.A.1(a)-1(h), IX.A.1(j)-(k).)

- j) **wherein the substantially perpendicular magnetic field is used to inductively generate a current in the receiver coil within or on the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device placed upon the activated primary coil of the base unit, to charge or power the device and/or battery, and**

206. In my opinion, *Nakamura* (including as modified above) discloses and/or suggests this limitation. (*See* my analysis and discussions below in this section; *see also* discussions in Sections IX.A.1(a)-(i), (k).)

207. For example, my analyses for limitation 1(c) explain how *Nakamura* discloses *generating* a “**substantially perpendicular magnetic field**” in the inductive coupling formed by primary coil(s) 11x/11y/11z and secondary coil 12 used to power/charge device 2/3 and/or its battery. (*See* my analysis and discussions

in Section IX.A.1(c).) The analyses, teachings, and suggestions discussed above for other limitations also support such an understanding, and also explain how the substantially perpendicular magnetic field **“is used to inductively generate a current in the receiver coil within or on the mobile [device] placed upon the activated primary coil of the base unit, to charge or power the device and/or battery”** as claimed. (*See* analyses and discussions of *Nakamura* for limitations 1(a)-1(i), 1(k) (explaining how the presence of a properly positioned device 2/3 on apparatus 1 results in the power transmission operations discussed by *Nakamura*).)

208. As I explained, *Nakamura*’s system (as modified above) provides inductive coupling that transfers power when apparatus 1 determines that device 2/3 is present and properly positioned for sufficient magnetic coupling between a primary coil 11x/11y/11z and secondary coil 12 (*see, e.g.*, Ex. 1005, ¶¶0079-0082) in order **“to charge or power the device [device 2/3] and/or battery [device 2/3 battery]”** (*see id.*, ¶¶0008 (“battery located in the body [of device 2/3] is charged”), 0062 (“DC voltage is subjected to switching and supplied to a battery of the portable telephone 2 or the notebook PC 3 . . . so that the battery is charged by means of the non-contact power supply using magnetic coupling”), 0063, 0065, 0083-0091; *see also* discussions in Sections IX.A.1(a)-(i) above and discussions in Section IX.A.1(k) below.)

209. In my opinion, a person of ordinary skill in the art would have understood that a “**current**” is inductively generated in the receiver coil (coil 12) consistent with known features/operations of inductive power transfer systems that use a magnetic field between coils to power/charge a receiving device via a receiving coil, as known in the art and as discussed in *Nakamura*.

210. For example, as I explained above for limitation 1(c), a person of ordinary skill in the art would have understood that by applying the pulsed voltage to an activated primary coil (11x/11y/11z) in order to inductively power/charge device 2/3 (inductive power receiver) and/or its battery through a secondary coil 12 (“**receiver coil**”) of the device 2/3 (“**mobile [device]**”), a **current** necessarily passes through the activated primary coil to the secondary/receiver coil, “**inductively generat[ing] a current in the receiver coil within or on the mobile [device],**” because voltage and current is necessarily included in the pulsed voltage signal provided to the activated coil and then to the receiving coil. (*See* my analysis and discussions in Section IX.A.1(c); *see also* Ex. 1005, ¶¶0065, 0076-0087, 0090-0091, 0100 (discussing “current flowing in the power reception equipment”); *see also* Section V.)

211. This understanding is consistent with knowledge of a person of ordinary skill in the art. (*Id.*) For example, as discussed above for limitation 1(c),

Koreis (that I reference to support my opinions concerning a person of ordinary skill in the art's state of the art knowledge) explains:

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. 1009, 2:46-3:8; *see also id.*, FIG. 1.)

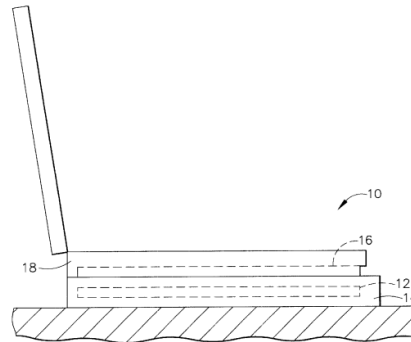


FIG. 1

(*Id.*, FIG. 1.)

212. Similarly, *Odendaal* (Ex. 1008) (referenced here to support my opinions regarding a person of ordinary skill in the art's state of the art knowledge) explains:

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. 1008, 1:13-27; *see also* Ex. 1013, Abstract (“current induced in a secondary coil”), 4:29-5:2; Ex. 1021, Abstract, ¶¶0039 (electromagnetic field induces a current), 0088; Ex. 1025, 1:10-15, 12:5-9, FIG. 1; *see also* my discussions in Section IX.A.1(c); *see also* Section V.)

- k) wherein the base unit, and receiver coil or circuitry associated therewith, use current modulation performed by the receiver coil or its circuitry, to provide an indication that is then used by the base unit to
 - (1) determine and regulate one or more of output voltage, current, or power provided by the base unit to the device and/or battery to be within the range of one or more of a value of a required voltage, current, or other power parameter for the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device,
 - (2) and/or verify the continued presence of the receiver coil near the base unit.

213. I understand that limitation 1(k) encompasses features where the “current modulation” is used to “provide an indication that is then used by the base unit to” (1) “determine and regulate . . .” as recited in 1(k)(1) “and/or” (2) verify the continued presence of the receiver coil as recited in 1(k)(2). In my opinion, *Nakamura* (including as modified above) discloses and/or suggests this limitation in both ways. (*See* my discussions below in this section; *see also* my discussions in Sections IX.A.1(a)-(j).)

214. For example, consistent with what I have explained above, apparatus 1 and device 2/3’s coil 12 and/or its associated circuitry in device 2/3 use modulation techniques to communicate the information signals that provides an “**indication**” that is used by apparatus 1 to regulate/control power/charge operations by

determining, regulating, and/or controlling the level of power, and/or verify the continued presence and proper alignment of coil 12 near apparatus 1 (and its primary coil(s) 11x/11y/11z). (See my analysis and discussions above for Sections IX.A.1(a)-(j); *see also* my discussions in Section VIII.A.) For example, as I discussed above, *Nakamura* explains:

The carrier wave outputted from the carrier wave oscillation circuit 37 is supplied to the tap c of the primary side coil 11, and in a case where the portable telephone 2 is placed on the power transmission apparatus 1, the carrier wave is transmitted to the secondary side coil 12 which is magnetically coupled with the primary side coil 11. . . . The clock extraction circuit 43 connected to the secondary side coil 12 extracts a clock signal required for modulation from the carrier wave, and the modulation circuit 45 modulates the carrier wave based on information regarding the portable telephone 2, namely, “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge” and supplies the modulated wave to the secondary side coil 12. . . .

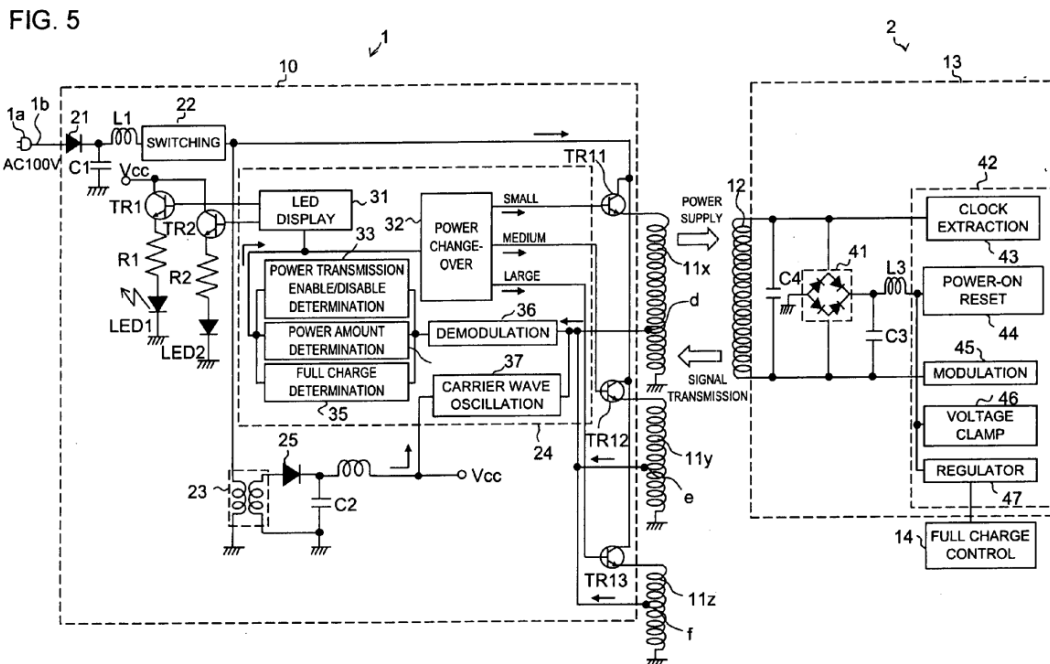
The modulated wave supplied to the secondary side coil 12 from the modulation circuit 45 is transmitted to the primary side coil 11 magnetically coupled thereto.

The demodulation circuit 36 connected to the tap c of the primary side coil 11 receives and **demodulates the transmitted modulated wave and supplies the “code indicating being power reception equipment”, “information on consumed power”, and “information on full charge”, which are included in the demodulated information signal**, to the power transmission enable/disable determination circuit 33, the power amount determination circuit 34, and the full-charge determination circuit 35. Herein, the **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).**

(Ex. 1005, ¶¶0077-0078; *see also id.*, ¶¶0075, 0077 (“power supplied from the carrier wave is used as a driving power for the . . . modulation circuit 45”), 0080 (information signal is the “**modulated** wave transmitted back from the secondary side circuit 13 in response to a carrier wave transmitted from the primary side circuit 19”), 0083 (level of power determination process performed by circuit 34 based on “information on consumed power” included in the signal “**demodulated** in the demodulation circuit 36”), 0088 (circuit 35 determines full charge state “based on the ‘information on full charge’ included in the information signal demodulated in the demodulation circuit 36”), FIGS. 3-5; *see also* citations and discussions above for limitations 1(a)-1(j).) *Nakamura* also discloses that the “modulation system adopted at this time is a phase modulation in which a carrier wave is cyclically intensity modulated to express 0/1 information with phase change information of a signal.” (Ex. 1005, ¶0077.) A person of ordinary skill in the art would have understood that in performing such modulation, the information/code(s) communicated by the mobile device 2/3 is configured to provide indication(s) that is used by the base unit (apparatus 1) to determine/verify the presence/alignment of the mobile device/secondary coil 12 and to determine/regulate the amount of voltage, current, or power provided by the base unit to the mobile device.

215. As I have explained, *Nakamura* discloses how coil 12 (and related circuitry in receiver component 13) use magnetic coupling and **modulation** to

generate/transmit the information signal to primary coil(s) 11x/11y/11z (and related components in apparatus 1) for subsequent use in accordance with the disclosed power transfer operations. (See Section VIII.A; see also my analysis and discussions above for Sections IX.A.1(a)-(j).)



(Ex. 1005, FIG. 5.) Consistent with a person of ordinary skill in the art's knowledge, *Nakamura's* system makes use of mutual inductance where current flowing in secondary coil 12 would produce an electromagnetic field that induces current to flow in primary coil(s) 11x/11y/11z when the modulated information signal(s) are communicated as discussed above. (See my discussions above in Section V.B; see also e.g., Ex. 1011, 593-94, 601; Ex. 1035, 34-35; Ex. 1013, Abstract ("current induced in a secondary coil"), 4:29-5:2; Ex. 1021, Abstract, ¶¶0039 (electromagnetic

field induces a current), 0088.) Those information signal(s) (which have current) are modulated by modulation circuit 45 in device 2/3 and transmitted via coil 12, and subsequently received by the primary coil(s) 11x/11/y/11z and demodulated by circuit 36 and processed/used by circuits 32-35, and as explained, *Nakamura* discusses that the carrier wave is cyclically intensity modulated with phase change information (Ex. 1005, ¶0077).

216. To the extent *Nakamura* does not disclose that the receiver coil/circuitry in the above-discussed *Nakamura* system uses “current modulation” to provide an indication to apparatus 1 as recited in limitation 1(k), it is my opinion that a person of ordinary skill in the art would have been motivated to configure the *Nakamura-Berghegger* system to use “**current modulation**” to facilitate communication of the modulated signals containing or relating to an “**indication**” (like that claimed in limitation 1(k)). Such a skilled person, in light of the teachings and suggestions of *Nakamura*, and the knowledge in the art, would have been motivated to configure the system to use “**current modulation**” to communicate between apparatus 1 and device 2/3 since such features would have been a predictable configuration/implementation of known modulation techniques and use of components in the modified system to adjust the intensity/property of the carrier wave signals for including/encoding information (e.g., current and voltage (both present in the carrier wave signals communicated between apparatus 1 and device

2/3)) including those used to represent, e.g., the “code(s)” that is used to confirm power reception equipment, full charge, and/or power level that allow the system to selectively charge/power device 2/3 (or its battery), verify continued presence and alignment of the receiver coil near apparatus 1, etc., consistent with that disclosed by *Nakamura*. A person of ordinary skill in the art would have been aware of, and appreciated, the known and limited ways data/information could have been coded/represented when communicated wirelessly/inductively between apparatus 1 and device 2/3. Current modulation was one such known technique, including in inductively coupled systems like that taught by *Nakamura* and *Berghegger*.

217. For example, state-of-the art references to *Delatorre* (Ex. 1044), *Cunningham* (Ex. 1045), and *Due-Hansen* (Ex. 1046) describe use of current modulation/demodulation at receiver and primary side devices/circuits for communicating data in inductively coupled systems. (See e.g., Ex. 1044, Abstract (“Data from the instrument is translated by current modulation (60) which is demodulated at the one location (50, 64, 66, 68, 70)”), 2:7-9, 2:38-44 (“Data transmission is effected by a well tool current modulation means which modules the power current as function of the data being transmitted by the well tool in response to the address signal. At the surface location, a current demodulation transforms the current signals into digital signals representative of the well tool signals”), 4:21-34 (“current modulation means 60”), 5:12-14, 6:12-33; Ex. 1045, 9:20-24, 15:16-21

(“Each power supply can be provided with a signal transceiver 14A employing a standardized format and protocol to send data along the inductive loop in a compatible way, such as by modulating the 20 kHz current in the loop (See Figs. 12 and 13). This will also be transferred inductively across the gap to reach the ferrite-cored pickups at the receivers”), 21:21-22:3 (“the circulating resonant current is halted or quenched (1303) in a relatively complete manner” and the set period “becomes the data bit time 1304 and the length of the data bit (short or long) comprises one binary bit of transmitted information. More preferably, the presence of a quenched period can be considered as a binary ‘1’ and the absence of a quenched period as a ‘0’”), FIGS. 1-3, 11-13; Ex. 1046, Abstract, FIGS. 1, 3A-8, 3:25-4:35, 5:27-7:23, 10:22-24 (“the pressure data signal transmission will be implemented by a current modulation” which is “explained more fully by means for figures 3 and 4”), 10:25-12:17.)¹¹ In my opinion, in light of such knowledge, coupled with the

¹¹ The '208 patent also describes conventional technologies that used current modulation for communications, which is consistent with my opinion that a person of ordinary skill in the art would have been aware of, and capable of implementing with a reasonable expectation of success, such features in the *Nakamura-Berghegger* system. (Ex. 1001, 18:44-55 (describing technologies, such as those found in the

teachings of *Nakamura* (*see above*), a person of ordinary skill in the art would have been motivated to modify the *Nakamura-Berghegger* system such that the receiver coil or its circuitry (as I discussed above) was configured to perform “current modulation” to convey/provide information (e.g., an “indication”) to apparatus 1 that is used to perform the power transfer operations consistent with those taught by *Nakamura* as I explained above (and below).

218. Therefore, and consistent with that discussed above in this section and in previous sections, it is my opinion that the *Nakamura-Berghegger* system (based on the teachings of *Nakamura*, a person of ordinary skill in the art would have been motivated to configure the *Nakamura-Berghegger* system such that the “**base unit** [apparatus 1], **and receiver coil** [secondary side coil 12] **or circuitry associated therewith**” (e.g., circuitry in secondary side circuit 13 associated with secondary side coil 12 (e.g., capacitor C4, rectifier 41, LC circuit (L3C3), and/or modulation circuit 45)) “**use current modulation performed by the receiver coil or its circuitry** (e.g., modulation circuit 45 performs “signal processing” and current modulation to send modulated information signals to apparatus 1 via the magnetic

ATMEL e5530 or “other inexpensive microcontroller[s]” that “modulates the current in the secondary that can be detected as current modulation in the primary”); Ex. 1043 (ATMEL e5530 Datasheet).)

coupling between secondary side coil 12 and primary side coil(s) 11x/11y/11z). (See e.g., my discussions above and Ex. 1005, ¶¶0075, ¶¶0077-0078.) Additionally, for similar reasons, the above-discussed *Nakamura-Berghegger* system would have been configured such that demodulation circuit 36 (of apparatus 1) was configured to properly demodulate the transmitted modulated wave in order to supply the “code” information to determination circuits 33-35 (*see id.*, ¶¶0078) “**to provide an indication**” (information signal including code/information (e.g., “code indicating being power reception equipment” and/or “information on consumed power”)) “**that is then used by the base unit.**” For example, as I discussed above, apparatus 1 uses the information code/signal to determine/verify presence (and proper positioning) of device 2/3 and its secondary coil 12 and selectively provide power (e.g., appropriate level of power) via magnetic coupling between the activated primary coil 11x/11y/11z and secondary coil 12. (See my analysis and discussions and citations above for limitations 1(a)-1(j) and below for limitations 1(k)(1)-(2); Ex. 1005, FIGS. 1-6, 13A-13E, ¶¶0062-0065, 0070-0075, 0076-0091.) A person of ordinary skill in the art would have had the motivation and capabilities to configure, and a reasonable expectation of success in implementing, such a modification in the *Nakamura-Berghegger* system especially in light of teachings/suggestions in *Nakamura* (e.g., including use of intensity modulated techniques to “express 0/1 information” (Ex. 1005, ¶¶0077)) and such a skilled person’s state-of-art knowledge of “current

modulation” to facilitate data communications in inductively coupled systems like *Nakamura-Berghegger*.

219. Therefore, concerning **limitation 1(k)(1)**, as I explained, *Nakamura* discloses determining the level of power to provide to a detected device 2/3 based on information relating to the device. (See my discussions above for limitations 1(a)-1(j).) For example, as explained, *Nakamura* discloses that the demodulated information signal includes “information on consumed power” that is provided to power amount determination circuit 34. (Ex. 1005, ¶0078.) Circuit 34 determines a level of power to be transmitted based on the demodulated “information on consumed power.” (*Id.*, ¶0083.) The power transmission output can be adjusted, for example, at one of three levels (e.g., large, medium, small) “depending on the recognized power.” (*Id.*) Power change over circuit 32 turns on a selected transistor TR11-13 corresponding to the primary coil 11x/11y/11z for the determined level of power to be transmitted to device 2/3 and its secondary side coil 12. (*Id.*, ¶¶0084-0085, FIG. 4.) For example, *Nakamura* explains:

[I]f the positional deviation of the portable telephone 2 from the power transmission apparatus 1 does not exceed the predetermined value, the process moves to **a process for determining a level of power to be transmitted (step S6). The determination process is performed in the power amount determination circuit 34 based on the**

“information on consumed power” included in the information signal demodulated in the demodulation circuit 36. The power of the portable telephone 2 is recognized based on the “information on consumed power”. A power transmission output is adjusted at one of three levels of large, medium, and small depending on the recognized power. A result of the determination from the power amount determination circuit 34 is transmitted to the LED display circuit 31 and the power change-over circuit 32 so as to perform the process described below in response to one of the large, medium, and small levels as the result of the determination.

If the determination result shows the small level, . . . the power change-over circuit 32 turns on the transistor TR11. When the transistor TR11 is turned on, a pulse voltage from the switching circuit 22 is applied across the total length of the primary side coil 11 to start power transmission (step S8). Then, when the determination result shows the medium level, . . . the power change-over circuit 32 turns on the transistor TR12. When the transistor TR12 is turned on, a pulse voltage from the switching circuit 22 is applied to the tap a of the primary side coil 11 to start power transmission (step S10). When the determination result shows the large level, . . . the power change-over circuit 32 turns on the transistor TR13. When

the transistor TR13 is turned on, a pulse voltage from the switching circuit 22 is applied to the tap b of the primary side coil 11 to start power transmission (step S12).

(Ex. 1005, ¶¶0083-0084, FIGS. 3, 5.)

220. As discussed above for limitations 1(a) and 1(h), the above-disclosure (that *Nakamura* provides with respect to its FIG. 3) is also applicable to *Nakamura*'s FIG. 5 configuration. (See my analysis and discussions in Sections IX.A.1(a), (h).) Moreover, *Nakamura* further explains (with respect to the FIG. 5 configuration):

In this embodiment, the power transmission apparatus 1 has the configuration in which **three coils for power transmission and respective transistors are provided. It is also possible to transmit power in the same manner as in the case of the power transmission apparatus 1 shown in FIG. 3 where one primary side coil 11 is used.** In this embodiment, to be specific, **one of the transistors is selected by the power change-over circuit 32 according to the level of power to be transmitted determined from the signal containing the “information on consumed power” received from the portable telephone 2. Accordingly, a coil for transmitting power can be selected, and power required for the power reception equipment can be transmitted.** For example, in a case where the power of the power reception equipment is small, a coil with a large

number of turns is used. In a case where the power of the power reception equipment is large, a coil with a small number of turns is used.

(Ex. 1005, ¶¶0091; *see also id.*, FIG. 5, ¶¶0019, 0020, 0090.)

221. Thus, for reasons explained, the *Nakamura-Berghegger* system discloses or suggests (as modified above) the “**base unit**” (apparatus 1 with primary circuit 10) using the “**indication**” provided by the “**current modulation performed by the receiver coil or its circuitry**” (*see* my discussions above) “**to determine and regulate one or more of output voltage, current, or power** [e.g., by selecting an appropriate level of power (e.g., large, medium, small), apparatus 1 regulates the output of power (voltage and current) by primary coil 11x/11y/11z] **provided by the base unit** [apparatus 1] **to the device and/or battery** [device 2/3 and/or its battery] **to be within the range of one or more of a value of a required voltage, current, or other power parameter for the mobile** [device].” (*See* my analysis and discussions and citations above.) For instance, a person of ordinary skill in the art would have understood that the modulated information signal (e.g., information on consumed power) informs apparatus 1 of the power requirements for device 2/3 so that the appropriate level of voltage/power (e.g., large, medium, small) is selected “depending on the power required by the power reception equipment” (*see* Ex. 1005, ¶¶0017-0019, 0077-0078, 0083-0085, 0090-0091, FIGS. 3-5; *see also* my

discussions and citations above in this section; *see also* my discussions in Sections IX.A.1(a)-(j)). A person of ordinary skill in the art would have thus understood that by using the information signals provided by device 2/3 (via the current modulation aspects as I discussed above) to determine/regulate/control the level of power (e.g., small, medium, large) to provide to a detected and properly positioned device (e.g., when a device's presence and position is detected/verified), the *Nakamura* system (as modified above) ensures that such controlled (regulated) power/voltage/current is within a range of "one or more of" a value of a required voltage, current or other power parameter for device 2/3. A person of ordinary skill in the art would have understood that a device 2/3 that required small power level, for example, would receive that level of power (voltage, current, etc.) via the power transfer operations like that described by *Nakamura*, that is within a range of "*one* or more of" a value of a required voltage, current, or power parameter consistent with that claimed in this limitation. However, I have been asked to consider that such "range" features were not disclosed by *Nakamura*. In that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to configure the above-discussed modified *Nakamura* system to determine/regulate output voltage, current, or power provided by apparatus 1 to the device/battery to be within a "range of one or more of a value of a required voltage, current, or other power parameter" so that the appropriate level of voltage/current/power is provided to the mobile device (or its

battery) to avoid damage or insufficient performance during charging/powering operations. Such a skilled person would have been motivated to configure/implement such features in light of the teachings and guidance provided by *Nakamura* and a skilled artisan's knowledge/motivation of wanting to ensure mobile device charging/powering operations are performed with minimal (or no) detrimental effects to the device or battery being charged/powered. Regulating the output voltage, current, or power provided by apparatus 1 to the mobile device (or its battery) to be within an acceptable range of appropriate value(s)/level(s) would have been a predictable application of known technologies/techniques, consistent with the controlled level of power, voltage, or current *Nakamura*'s system provides (as modified in the manner I discussed above).

222. Concerning **limitation 1(k)(2)**, my analyses above demonstrate how *Nakamura* discloses that the presence/alignment of device 2 (and its secondary/receiver coil 12) near apparatus 1 is continuously checked and **verified** during power/charge operations (e.g., using the "indication" containing "code indicating being power reception equipment"), and thus discloses this limitation. (See my analysis and discussions above for limitations 1(f)-1(i) (demonstrating how *Nakamura* discloses and/or suggests continuously checking for the continued presence and proper positioning of device 2/3 (and its secondary coil 12) near the apparatus 1 (and its activated primary coil 11x/11y/11z) to allow power/charge of

the device or its battery to continue); *see also* Ex. 1005, FIGS. 3-4, ¶¶0076-0083, 0086 (“after power transmission is started...”), 0089-0091, 0096, 0109.) For one example, as discussed above, *Nakamura* explains:

Even after the power transmission is started, the carrier wave is regularly transmitted (step S13), and it is checked whether or not the portable telephone 2 which is power reception equipment, has been removed from on the power transmission apparatus 1 according to the information included in the modulated wave transmitted back against the carrier wave (step S14). In the confirmation, the power transmission enable/disable determination circuit 33 **determines, in a similar manner to that in step S3, whether or not the power reception equipment is placed on the power transmission apparatus 1, based on the “code indicating being power reception equipment”.** If a predetermined “code indicating being power reception equipment” has not been received, it is determined that the power reception equipment has been removed from on the power transmission apparatus 1, and the power change-over circuit 32 turns off all of the transistor TR11, TR12, and TR13 to cease power transmission (step S15).

On the other hand, if the predetermined “code indicating being power reception equipment” has been received, it is recognized that the power reception

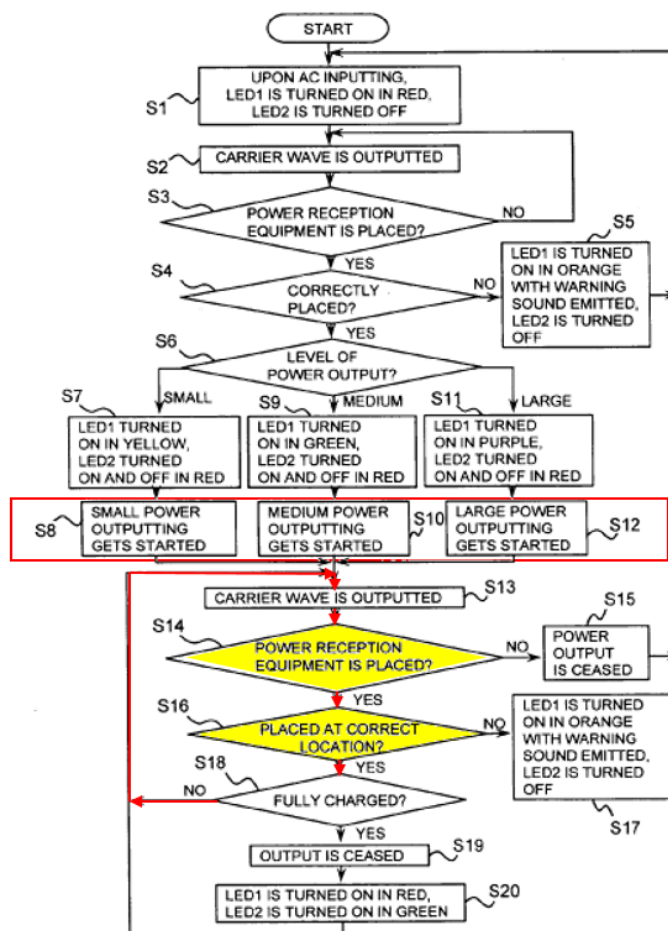
equipment has been placed on the power transmission apparatus 1, and then, it is determined whether or not the power reception equipment has been placed correctly on the power transmission apparatus 1 (step S16). . . .

(Ex. 1005, ¶¶0086-0087; *see also id.*, ¶¶0077-0078, FIG. 4.)

223. As I explained above for limitation 1(i), based on the disclosures pertaining to FIG. 4 (e.g., including the above-quoted disclosures and others relating to steps S13, S14, S16, and S18 of FIG. 4), a person of ordinary skill in the art would have understood that steps S13, S14, S16, and S18 (which include the above-discussed steps S14 / S16, where continued presence/proper positioning of a receiver (device 2/3) and its secondary coil 12 (**“receiver coil”**) on or near apparatus 1 (**“base unit”**) is checked using information included in the above-discussed **“indication”** / modulated wave/signal/information (e.g., “code indicating being power reception equipment”) that is generated/transmitted by device 2/3 and its secondary coil 12 and associated circuitry (using **“current modulation performed by the receiver coil or its circuitry”** as I explained above in modifying *Nakamura*’s system)) form a loop within the overall FIG. 4 process of *Nakamura*, and thus would have been understood to be continuously and regularly performed, thus resulting in the continued presence/alignment of device 2/3 and its secondary coil 12 near apparatus 1 being checked continuously and regularly until device 2/3 and/or its battery is fully

charged, device 2/3 or its secondary coil 12 ceases to be present, etc. (*Id.*; *see also* my discussions in Section IX.A.1(i); *see also* my discussions in Sections IX.A.1(f)-(h).)

FIG. 4



(Ex. 1005, FIG. 4 (annotated).) Such features would have been implemented in the *Nakamura-Berghegger* system as I discussed above (including as modified).

224. Therefore, in my opinion, for the above reasons, and the disclosures in *Nakamura* (*see also* my discussions in Sections IX.A.1(a)-1(g)), the *Nakamura-Berghegger* system (as I discussed above) discloses and/or suggests that the “**base**

unit [apparatus 1], **and receiver coil** [secondary side coil 12] **or circuitry associated therewith** [e.g., those discussed above], **use current modulation performed by the receiver coil or its circuitry, to provide an indication that is then used by the base unit to**” (*see* above) “**verify the continued presence of the receiver coil near the base unit**” (*see* above; *see also* my discussions above in Sections IX.A.1(f)-1(i)). (*See also* my analysis and discussions in Sections IX.A.1(a)-1(j).)

2. Claim 18

- a) **The system of claim 1, wherein the charger system includes one or a plurality of LED's and/or audio signals that identify charging occurring or which of the plurality of primary coils are currently activated.**

225. In my opinion, *Nakamura* (including as modified above) discloses this limitation. (*See* my analysis and discussions below in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(k).)

226. For example, *Nakamura* discloses that apparatus 1 (“base unit”) of the “**charger system**” discussed above for claim 1 includes LEDs that indicate a state of power supply to a power reception equipment (e.g., device 2/3 (“device”)) of the “**charger system**” (“**the charger system includes one or a plurality of LED's . . . that identify charging occurring**”). *Nakamura* explains:

The power transmission apparatus 1 is equipped with light emitting diodes (display section) LED1 and LED2 (hereinafter referred to simply as LED1 and LED2) indicating an input state of AC 100 V, a state of power supply to power reception equipment, and other information.

(Ex. 1005, ¶0063.)

227. Moreover, with respect to FIG. 4 discussed above for limitation 1, *Nakamura* explains that “it is determined whether or not the positional deviation of the portable telephone 2 from the power transmission apparatus 1 exceeds a

predetermined value (Step S4). If it exceeds, no power transmission is performed from the power transmission apparatus 1, and the **LED1** is turned on in orange and the **LED 2** is turned off as a warning indication (step S5). In this situation, a *warning sound* may be emitted instead” (“**the charger system includes one or a plurality of LED’s and/or audio signals that identify charging occurring**” or not occurring). (*Id.*, ¶0082, FIG. 4.) In my opinion, a person of ordinary skill in the art would have understood, based on the above (and below) disclosures, that *Nakamura*’s system uses LEDs and audio signals to identify charging occurring or not occurring. (*Id.*; *see also* citations to *Nakamura* in this section.)

228. I have been asked to consider the scenario where that the above-quoted disclosure does not disclose audio signals being used to identify charging occurring. Under such a scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to make a simple modification to the system (*e.g.*, relatively straight forward program/component modification) such that audio signals (as well as LEDs) are used to indicate/identify charging occurring, for example, so that there are multiple ways to notify a user regarding a state of the system (“**charger system**”) relating to its intended use (*e.g.*, charging/powering a device), such as a state of charging a device (“**charging occurring**”). (*Id.*)

229. *Nakamura* explains that depending on the power level (to be transmitted from apparatus 1 to device 2/3 in order to charge/power device 2/3 and/or

its battery) determined by apparatus 1, LED1 and LED2 are turned on and/or off in various ways “to **indicate that power transmission is performed at the [small/medium/large] level.**” (*Id.*, ¶0084, FIG. 4.) (*See also id.*, ¶0089, FIG. 12 (below) (exemplary LED display states associated with, e.g., power level transfer to device 2/3 and positional deviation).)

FIG. 12

AC CONNECTION AND OPERATION CONDITIONS	LED1 DISPLAY	LED2 DISPLAY
WHEN AC PLUG IS NOT CONNECTED	OFF	OFF
WHEN AC PLUG IS CONNECTED	ON IN RED	OFF
WHEN AC PLUG IS CONNECTED WITH NO POWER TRANSMISSION	ON IN RED	OFF
WHEN AC PLUG IS CONNECTED WITH SMALL POWER TRANSMISSION (DURING CHARGING)	ON IN YELLOW	ON AND OFF IN RED
WHEN AC PLUG IS CONNECTED WITH MEDIUM POWER TRANSMISSION (DURING CHARGING)	ON IN GREEN	ON AND OFF IN RED
WHEN AC PLUG IS CONNECTED WITH LARGE POWER TRANSMISSION (DURING CHARGING)	ON IN PURPLE	ON AND OFF IN RED
WHEN AC PLUG IS CONNECTED WITH NO POWER TRANSMISSION IN FULL CHARGE	ON IN RED	ON IN GREEN
WHEN AC PLUG IS CONNECTED WITH POSITIONAL DEVIATION OF A PREDETERMINED VALUE OR MORE	ON IN ORANGE	OFF

(Ex. 1005, FIG. 12.)

230. Therefore, in my opinion, *Nakamura* discloses (and/or suggests) at least “**the charger system** [*see* limitation 1(a)] includes one **or a plurality of LED’s** [LED1, LED2] **and/or audio signals** [warning sound] **that identify charging occurring**” as claimed. (*See also* Sections IX.A.1(a)-1(k).) A person of ordinary skill in the art would have been motivated to implement such features in the *Nakamura-Berghegger* system given *Nakamura* discloses them (or suggests them (e.g., audio signals)) and the reasons for modifying *Nakamura* in view of

Berghegger as I discuss above for claim 1. Accordingly, in my opinion, the *Nakamura-Berghegger* combination discloses at least “**the charger system** (limitation 1(a)) **includes one or a plurality of LED’s (LED1, LED2) and/or audio signals** (warning sound) **that identify charging occurring**” like that claimed in claim 18.

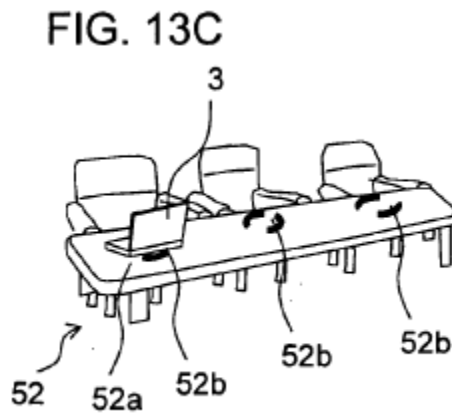
B. Ground 2: *Nakamura* in view of *Berghegger* and *Hsu* Discloses and/or Suggests the Features of Claims 1 and 18

231. In my opinion, *Nakamura* in view of *Berghegger* and *Hsu* discloses and/or suggests all of the features of claims 1 and 18 of the '208 patent. (*See* my discussions below in this section; *see also* my discussions in Section IX.A.) As I explained above, it is my opinion that *Nakamura* alone or in combination with *Berghegger* discloses and/or suggests claims 1 and 18 for the reasons I explained in Ground 1. (*See* my analysis and discussions in Section IX.A.) While the *Nakamura-Berghegger* system discloses and/or suggests the selectively switching and activating, polling/sensing, and selecting features recited in claim 1 (e.g., limitations 1(c), 1(g)-(h) (*see* my analysis and discussions in Sections IX.A.1(c), IX.A.1(g)-(h)), in my opinion, a person of ordinary skill in the art would have been motivated to modify the combined *Nakamura-Berghegger* system, in light of teachings of *Hsu*, to configure apparatus 1 with multiple primary coils and associated switching circuits that use polling to select appropriate primary coils to power a detected device 2/3 (like that recited in limitations 1(c), 1(g)-(h)) to expand the applications and versatility of *Nakamura's* system and how it verifies present and properly positioned/aligned devices in order to inductively charge/power such devices. (*Id.*; *see also* my discussions in this section below.) In my opinion, such a modified system discloses and/or suggests all of the limitations of claims 1 and 18 as explained

above and below. (*Id.*)

232. In my opinion, a person of ordinary skill in the art would have had reasons and motivation to consider alternate configurations for the *Nakamura-Berghegger* system, since *Nakamura* teaches and/or suggests various implementations and applications concerning its inductive power supply system, including those involving the configuration of FIG. 5. (*See* my analysis and discussions in Section IX.A.1.) For example, *Nakamura* describes configurations that use an array of apparatuses 1, which would have a plurality of primary coils that power/charge multiple devices, applicable to the power/charging system configuration of FIG. 5 (among others). (*See* Section IX.A.1(a); *see, e.g.*, Ex. 1005, FIGS. 13A-13E, 20, ¶¶0108, 0123; *see also* Section IX.A.)

233. As one example, with respect to FIG. 13C (shown below), *Nakamura* describes a configuration where multiple apparatuses 1 are embedded in a conference desk/table so that multiple (and different types) of mobile devices can be powered/charged, in accordance with features discussed for FIG. 5. (Ex. 1005, ¶¶0107-0109.)



(Ex. 1005, FIG. 13C.)

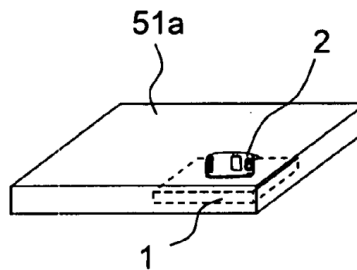
234. *Nakamura* explains:

FIGS. 13A to 13E are views showing outer appearances of power supply systems of an eighth embodiment of the present invention. The **power supply systems** shown in FIGS. 13A to 13E are characterized by that the **power transmission apparatus 1** shown in one of FIGS. 1A, 1B, 2A, 2B, 3, 5 to 9, 10A, and 10B is embedded in a **top plate of a desk** (utensil), of which some examples are shown. In FIG. 13A, there is shown an outer appearance of a study desk 51 placed in a study room or the like and having a top plate 51a in which a power transmission apparatus 1 is embedded. **In FIG. 13B, there is shown a partial enlarged view of a portion 51b, in which the power transmission apparatus 1 is embedded, of the top plate 51a.** The power transmission apparatus 1 is embedded the inside of the top plate 51a so as not to protrude from the surface of the top plate 51a.

In FIG. 13C, there is shown an outer appearance of a conference desk placed in a conference room or the like and having a top plate 52a in which power transmission apparatuses 1 are embedded. In FIG. 13C, a numerical symbol 52b indicates portions where the power transmission apparatuses 1 are embedded. The power transmission apparatuses 1 are embedded in the same manner as in FIG. 13B.

(Ex. 1005, ¶¶0107-0108; *see also id.*, FIGS. 5, 13A-13C.)

FIG. 13B

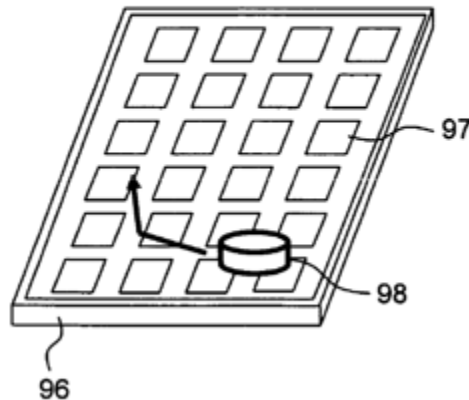


(*Id.*, FIG. 13B.)

235. As another example, with respect to FIG. 20, *Nakamura* discloses a configuration (“characterized that the power transmission apparatus 1 shown in one of FIGS. 1A, 2A, 2B, 3, 5 to 9, 10A, and 10B is embedded in a floor”) where a “plurality of apparatuses 1 are embedded [in a floor] in a similar manner to that shown FIG. 13B” that provide power to a cleaning robot 98, “which is power reception equipment having a power adjusting section corresponding to the power

transmission apparatus 1 as in the case of a portable telephone 2 shown in one of FIGS. 1A, 2A, 2B, 3, 5 to 9, and 10B.” (*Id.*, ¶¶0123-0124.)

FIG. 20



(Ex. 1005, FIG. 20.) *Nakamura* also explains that “[c]harging can also be performed on . . . other types of equipment such as notebook PCs” and the apparatuses 1 “can be embedded in floor covering fabrics” (e.g., rug, carpet, mat). (*Id.*, ¶0124.)

236. Thus, in my opinion, a person of ordinary skill in the art would have recognized *Nakamura*’s multi-coil configuration of FIG. 5 (among others) was versatile and applicable to many different applications and modifications to accommodate multiple types of devices/arrangements. (*See* my analysis and discussions and citations above; *see also* my analysis and discussions in Section IX.A.1.) In my opinion, such teachings and suggestions, coupled with a person of ordinary skill in the art’s knowledge in the art, would have motivated such a skilled person to contemplate, design, and implement other variations of *Nakamura*’s

configurations that expand the applications, versatility, and usefulness of *Nakamura's* power supply system. (*Id.*) In my opinion, *Hsu* demonstrates such known applications and configurations.

237. *Hsu* (similar to *Nakamura*) discloses a contactless inductive power/charging system that uses inductive coupling to provide power to a mobile device (e.g., laptop, PDA, etc.) having a secondary coil placed on or near one or more primary coils in the surface of a powering device (e.g., conference table, desk, powering pad, etc.). (Ex. 1007, Title, Abstract, ¶¶0002, 0006-0007, 0018-0025, 0029-0034.) For example, *Hsu* explains:

[T]he present invention provides a powering device for providing power to a portable device. The powering device has a plurality of primary coils that can be energized to transfer power via inductive coupling with a secondary coil in the portable device, when the portable device is placed on the inductive powering surface.

(*Id.*, ¶0006.)

238. Thus, in my opinion, as further discussed below, a person of ordinary skill in the art would have had reasons to consider the teachings of *Hsu* in context of the *Nakamura-Berghegger* system, given *Hsu* describes an inductive power supply system including techniques and technologies similar and related to those of *Nakamura* and *Berghegger*. (See my discussions of *Nakamura* and *Berghegger* in

Section IX.A; *see also* my discussions of *Hsu*, *Nakamura*, and *Berghegger* in this section.) Accordingly, in my opinion, *Hsu* describes features relating to the technical features described in the '208 patent, *Nakamura*, and *Berghegger* (e.g., *Hsu* describes a system with inductive/contactless power transfer techniques and technologies for powering/charging a remotely positioned device). (*See* citations to *Hsu* in this section; *see also* discussions in Sections IX.A.1(a), (d).)

239. Moreover, in my opinion, a person of ordinary skill in the art would have understood that *Hsu* (similar to *Nakamura* and *Berghegger*) discloses features that were reasonably pertinent to one or more particular problems the '208 patent discusses. (*See* my discussions in Section IX.A.1(d).) *Hsu* (like *Nakamura* and *Berghegger*) also discloses techniques and technologies for addressing the need to power mobile devices using contactless inductive coupling. (*Id.*; *see also* Ex. 1007, ¶¶0006-0007, 0018-0025, 0029-0034; Ex. 1005, FIG. 5, ¶¶0020, 0090-0091.) In my opinion, such teachings of *Hsu* (like those of *Nakamura* and *Berghegger*) address similar problems identified in the '208 patent, and thus would have been consulted by a person of ordinary skill in the art, looking to address and solve such issues/problems and others relating to design and implementation of a contactless inductive charging system, like those of *Nakamura* and *Berghegger*. (*Id.*) Therefore, in my opinion, a person of ordinary skill in the art would have consulted teachings and suggestions like those of *Hsu* when contemplating designing,

configuring, and implementing a system like that in the *Nakamura-Berghegger* system discussed above, and consequently would have been motivated to modify the system to include features like those described by *Hsu* and known in the art. (*Id.*; *see also* my discussions regarding *Hsu* in this section; *see also* Sections V, IX.A.1.)

240. In my opinion, a person of ordinary skill in the art would have appreciated that *Hsu*'s teachings and features are applicable to improvements to the *Nakamura-Berghegger* system. For example, *Hsu* describes an inductive coupling power system that provides a plurality of primary coils 26 in a powering device 20, such as a desk, pad, table, etc. (*see, e.g.*, Ex. 1007, ¶¶0007, 0018, 0029-0030; *see also* discussions below) (similar to *Nakamura* (*see* my analysis and discussions above in this section)) that form a transformer with a secondary coil 25 in a portable device when placed on or near surface 21 of device 20, where magnetic flux generated by the primary coil(s) is picked up by the secondary coil 25 and induces an alternating voltage (and current) in the coil that is converted to power for the portable device (Ex. 1007, ¶¶0018-0021).

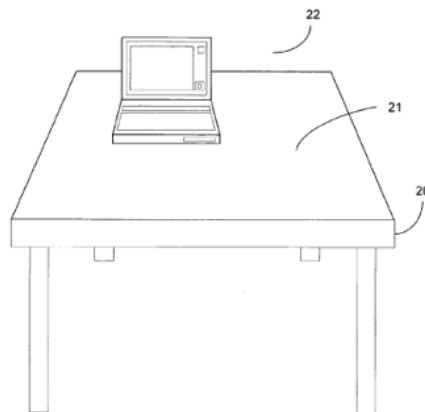


FIG. 1

(Ex. 1007, FIG. 1.)

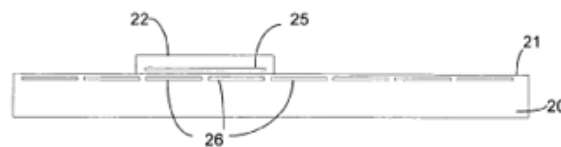


FIG. 2

(*Id.*, FIG. 2.) *Hsu* explains that primary coils 26 can have different shapes. (*Id.*, ¶0033; *see also id.*, FIGS. 6, 8A-8B.)

241. *Hsu* explains that powering device 20 can determine/verify the presence and location of the portable device using information sent from the portable device. (Ex. 1007, FIG. 5, ¶¶0021-0025, 0029-0030.) *Hsu* also explains that “primary coils are sized such that multiple primary coils overlap with the secondary coil when the portable device is placed on the inductive powering surface.” (*Id.*, ¶0034.) *Hsu* performs a sensing mode, where primary coil 26 is driven to send

signals that portable device is tuned to receive, and upon determining the presence/location of the portable device on the powering device, a power transfer mode to provide power using inductive coupling. (*Id.*, FIG. 5, ¶¶0025-0029.) *Hsu* also explains that “the controller scans the primary coils” for detecting/sensing the presence/location of the portable device using a “scan pattern,” such as one that “loops through the rows or columns of the primary coils, or [] any other desired pattern.” (*Id.*, ¶0029.) For example, *Hsu* explains:

As mentioned above, **the inductive powering surface has a plurality of primary coils 26, and only those that are covered by or overlapping with the secondary coil 25 are to be energized for transferring power to the portable device. To that end, the controller 36 of the powering device first determines whether any portable device is present on the powering surface and, if so, the location of the secondary coil of that device. Referring to FIG. 5, to detect the presence and location of the secondary coil, the controller scans the primary coils. The *scan pattern* may be a linearly progressive pattern in which the controller loops through the rows or columns of the primary coils, or may be any other desired pattern.** For each primary coil 26, the controller operates an appropriate driver circuit to energize the coil at a *sensing frequency*, such as 13.56 MHz, and at a lower power level (step 50). **If a secondary coil is present and**

overlaps with that primary coil, the RFID circuit in the portable device will pick up the waves sent by the primary coil (step 51), power up the RFID chip, and return RF waves containing information about the portable device. As mentioned above, the information may include power requirements of the portable device that may be used by the controller to facilitate the power transfer operation. *The RF waves returned by the RFID device are picked up by the primary coil (step 52).* The detection of the returned waves indicates that a secondary coil is present and overlaps with the primary coil. The location of that primary coil is recorded by the controller. (step 53) In this way, the controller goes through the primary coils according to the scan pattern, and identifies those primary coils that have picked up responses from the RFID device. Those primary coils are then energized at a power delivery frequency, such as 100 KHz (step 54), to transfer power to the portable device via inductive interaction with the secondary coil.

(Ex. 1007, ¶0029.)

242. Hsu explains that multiple primary coils can be arranged such that each is associated with one or more switching circuits that selectively switch/activate (e.g., “turned on (i.e., energized or excited)”) one or more primary coils 26 based on

the position/location of the secondary coil 25 detected according to the above-discussed scanning (“poll”) features. (Ex. 1007, FIG. 6 (annotated below), ¶¶0030; *id.*, ¶¶0007, 0029, 0031-0032.)

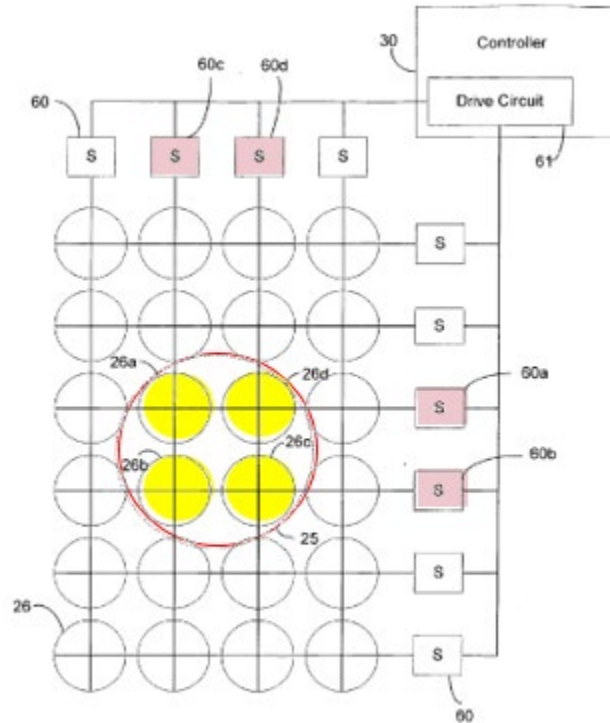


FIG. 6

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

243. *Hsu* explains (with respect to FIG. 6 (*see, e.g.,* annotated figure above)) that four primary coils 26a-26d overlap with secondary coil 25 (of a portable device), such that during the “scan phase” (e.g., using the above-discussed scanning/sensing techniques/features) the four coils 26a-26d are identified using RFID transmissions (*see* Ex. 1007, ¶¶0021-0025, 0029 (a portable device picks up waves sent by primary

coil(s) 26 that are overlapping with the portable device's secondary coil 25, and returns "RF waves [that] are picked up by the primary coil" to detect/sense the presence/location of the portable device and its secondary coil 25)), and switches 60a-60d are actuated to connect those primary coils 26a-26d to a drive circuit, thus energizing the four coils 26a-26d (and only those coils) to facilitate power transfer to the overlapping secondary coil 25. (*Id.*, ¶0030; *see also id.*, ¶¶0007, 0020, 0029, 0034.) For example, *Hsu* explains:

As shown in FIG. 6, **the primary coils 26 are arranged generally in a two-dimensional matrix with multiple rows and columns, each row or column can be switchably connected to a drive circuit 61 by means of respective switches 60.** The drive circuit may comprise, for example, semiconductor or relay switches, and the drive circuit for each primary coil may be a single switch or multiple switches depending on the circuit configurations. . . . A primary coil 26 can be **turned on, i.e., energized or excited**, when both its row and column are connected to the drive circuit. By way of example, in the example shown in FIG. 6, **four primary coils 26a, 26b, 26c, 26d overlap with the secondary coil 25. During the scan phase as described above, the controller 26 identifies these four primary coil by means of the RFID transmission. Thereafter, the controller 26 actuates the switches 60a, 60b, 60c, 60d to**

connect the four primary coils 26a, 26b, 26c, 26 d to the drive circuit, thereby energizing these coils, while the other coils are not energized. The primary coils under the secondary coil 25 are preferably energized in phase as a group to maximize the rate of power transfer to the portable device.

(Ex. 1007, ¶0030.)

244. Therefore, in my opinion, *Hsu* discloses features like those recited in limitations 1(c) (e.g., selectively switching, switching circuits, etc.), 1(g) (e.g., polling each of the primary coils to verify the presence of portable device on surface of powering device, etc.), 1(h) (e.g., selecting and selectively switching, using associated switching circuits, based on the polling, to activate, only those one or more primary coils which are determined to be most closely aligned with the receiver coil, etc.). (Ex. 1007, ¶¶0003-0007, 0029-0030, FIG. 6; *see also* discussions and citations regarding *Hsu* in this section.)

245. In my opinion, based on the similarities in the teachings and suggestions of *Hsu*, *Nakamura*, and *Berghegger*, including the teachings and suggestions of *Hsu* in context of the disclosures in *Nakamura* (e.g., which include configurations with embedded apparatus 1 in a desk, table, floor, mat, rug, etc. (similar to configurations discussed above regarding *Hsu*), which also can be a “**base unit**”) and the knowledge in art, a person of ordinary skill in the art would have been

motivated to modify the *Nakamura-Berghegger* system to use a plurality of primary coils in such a “**base unit**” (e.g., apparatus 1 embedded in a desk, table, floor, mat, rug, etc.) in order to provide expanded versatility in the applications of the modified *Nakamura-Berghegger* system, and improved versatility and flexibility in terms of the device placement on such a base unit for receiving power. (*Id.*; *see also* discussions in this section; *see also* discussions in Section IX.A.)

246. In my opinion, a person of ordinary skill in the art would have recognized the benefits and advantageous of such an arrangement based on *Hsu*. (*Id.*; *see* my analysis and discussions above regarding *Hsu* (*see, e.g.*, Ex. 1007, ¶¶0003-0007, 0029-0030, FIG. 6).) In considering *Hsu*’s teachings and suggestions in context of *Nakamura* and *Berghegger* and the benefits and advantages of an arrangement based on *Hsu*, a person of ordinary skill in the art would have been motivated by, and leveraged, *Hsu*’s teachings and suggestions to employ scanning/polling functionalities and techniques that use associated switching circuits to aid in determining the location/position/presence of a secondary coil 12 in device 2/3 that overlaps with one or more primary coils (e.g., coils 11 as modified/arranged in an array, matrix, etc. in apparatus 1/desk/table/mat/rug/floor/wall, etc.), similar to that disclosed by *Hsu* and *Nakamura* (and as known in the art (*see, e.g.*, Ex. 1034, ¶¶0044-0045 (polling operations to charge multiple device battery pack assemblies))), to accurately detect and verify which of the primary coils are aligned

with the device 2/3 and its secondary coil so that only those primary coils are selectively activated to provide power to device 2/3, similar to that disclosed by *Hsu*. (Ex. 1007, ¶¶0003-0007, 0018-0034, FIGS. 1-2, 5-6, 8A-8B; *see also* discussions and citations regarding *Hsu* and *Nakamura* in this section; *see also* discussions in Section IX.A.) In my opinion, such a modification would have predictably resulted in the *Nakamura-Berghegger-Hsu* system including features and/or functionalities like those recited in claim 1, including the selectively switching and activating features and polling and selecting features recited in limitations 1(c), 1(g)-(h). (*Id.*)

247. In my opinion, a person of ordinary skill in the art would have understood that *Nakamura-Berghegger-Hsu* system would have been configured in various ways while still providing improved and efficient inductive power transfer consistent with the applications and objectives discussed by *Nakamura* as modified by *Berghegger*. In one non-limiting example, a person of ordinary skill in the art would have been motivated to modify the *Nakamura-Berghegger* system to operate consistent with *Nakamura*'s FIG. 3 configuration (e.g., using taps on a single coil 11 to provide various power levels (Ex. 1005, FIG. 3, ¶¶0067-0089)), but further configured it such that a plurality of such primary coils were used that would have been selectively activated based on determined overlapping presence (via polling) with device 2/3, consistent with the features disclosed and/or suggested by *Hsu*. (*Id.*; Ex. 1007, ¶¶0003-0007, 0018-0034, FIGS. 1-2, 5-6, 8A-8B; *see also* discussions and

citations regarding *Hsu* and *Nakamura* in this section; *see also* discussions in Section IX.A.)¹² In my opinion, such a configuration would have allowed the modified system to selectively activate primary coils, while also providing appropriate power levels consistent with *Nakamura*'s teachings. (*Id.*; Ex. 1005, ¶¶0006-0007, 0062-0089; 0096-0124.) In my opinion, a person of ordinary skill in the art would have recognized and considered the tradeoffs with different designs (e.g., due to costs, weight, complexity, efficiencies, etc.) to identify and implement a modified system appropriate for a given application, consistent with the discussions above. (*Id.*) Therefore, other designs and configurations would have also been considered and implemented by such a skilled person with a reasonable expectation of success that such configurations would have operated as intended and in accordance with design parameters for a given application. (*Id.*)

¹² As discussed above for limitation 1(a) (and for other limitations of claim 1), *Nakamura*'s FIG. 3 configuration operates consistent with the FIG. 5 configuration (despite a difference of a single-coil setup as opposed to a multi-coil setup), and thus would have been equally and similarly modified based on *Berghegger* for the reasons that I explained for limitation 1(d). (*See* my analysis and discussions in Sections IX.A.1(a), (d); *see also* Sections IX.A.1.)

248. In my opinion, a person of ordinary skill in the art would have had the skills, knowledge, and rationale to design and implement such a modification, and would have done so with an expectation that the resulting system would have operated as intended and consistent with the teachings of *Nakamura*, *Berghegger*, and *Hsu*, especially given such references disclose technologies and techniques that would have been leveraged to facilitate the modification. (*Id.*; *see also* Section IX.A.1.) Thus, in my opinion, a person of ordinary skill in the art would have appreciated implementing the above modification would have involved applying known technologies (*e.g.*, primary coil array/matrix arrangements (*e.g.*, *Hsu* and a person of ordinary skill in the art's state of art knowledge as I discussed above)) with wireless inductive power transfer/charging systems (*Nakamura*, *Berghegger*, and *Hsu*) according to known methods and techniques (*e.g.*, scanning/polling for selectively activating/switching overlapped coils in array/matrix) (*e.g.*, *Hsu* and a person of ordinary skill in the art's state of art knowledge as I discussed above) that would have led to a foreseeable result of providing a **"base unit"** (*e.g.*, apparatus 1 and/or supporting/host unit (desk, table, floor, mat, rug, etc.)) having a plurality of arranged primary coils that are selectively activated based on determined overlapping presence (and proper positioning/alignment) of primary and secondary coils (via associated switch circuits and polling techniques) that efficiently provide power to a mobile device with a secondary coil placed near or on overlapped primary

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coils, consistent with the functionalities and features provided in the above-discussed *Nakamura-Berghegger-Hsu* system. (*Id.*; see also Section IX.A.)

C. Ground 3: *Nakamura* in view of *Berghegger* and *Odendaal* Discloses and/or Suggests the Features of Claims 1 and 18

249. In my opinion, *Nakamura* in view of *Berghegger* and *Odendaal* discloses and/or suggests all of the features of claims 1 and 18 of the '208 patent. (See my discussions below in this section; *see also* my discussions in Section IX.A.)

250. *Nakamura* (alone or as modified in view of *Berghegger*) discloses and/or suggests limitations 1(a), 1(c)-1(k) and claim 18 for the reasons I explained above in Ground 1. (See my analysis and discussions in Sections IX.A.1(a), IX.A.1(c)-1(k), IX.A.2.) As I explained in Ground 1, *Nakamura* also discloses limitation 1(b). (See my analysis and discussions in Section IX.A.1(b).)

251. However, I have been asked to consider the scenario where *Nakamura* does not disclose each of the primary coils being “**arranged behind and parallel to the surface**” and “**positioned within the base unit**,” as recited in limitation 1(b). In that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to configure the *Nakamura* system (including as modified in view of *Berghegger*) to implement and use thin, planar-type primary coils that are positioned within *Nakamura*’s apparatus 1 (“**base unit**”) and arranged behind and parallel to the surface of apparatus 1 (and complement such a design with corresponding planar-type secondary/receiver coil(s) in device 2/3) in light of the

teachings/suggestions of *Odendaal*, consistent with such a skilled person's knowledge in the art. (*Id.*; *see also* discussions below.)

252. In my opinion, a person of ordinary skill in the art was aware at the time of the alleged invention of the '208 patent that wireless power/data transfer could be achieved in various ways. (*See* my analysis and discussions in Section IX.A; *see also* Section V.) As with *Nakamura*, inductive power/data transfer was known to use inductive coils to wirelessly transfer power/data to another electronic device. In my opinion, such a skilled person would have known and appreciated the types of inductor coil designs available to achieve desired applications of inductive power/data transfer depending on the application. (*Id.*) For example, in my opinion, a person of ordinary skill in the art was well aware of planar, spiral, and similar thin loop-type inductors, and their characteristics, and also techniques for designing and implementing circuits that use such inductors to achieve desired contactless power/data transfer. (*Id.*; Section V.B.3.)

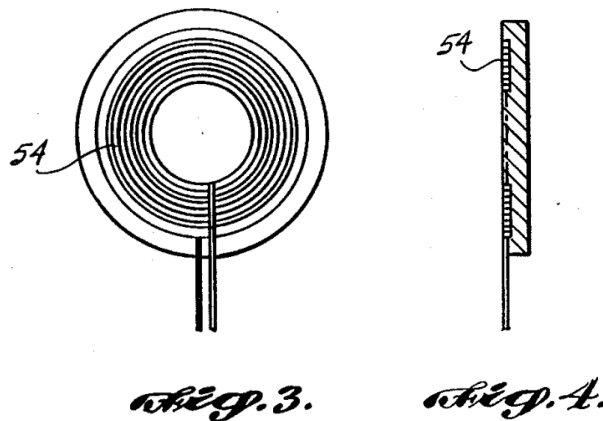
253. For example, as I have discussed above (*id.*) there are state of the art references with disclosures that demonstrate and exemplify such knowledge of a person of ordinary skill in the art. For one example, *Sano* (Ex. 1015) discusses a thin coil and a flat disk-like core.

Currently, the preferred form of the power receiving coil

54 is a **thin coil** which facilitates efficient interlinkage of

the magnetic flux developed from the power supplying coil 18 with the power receiving coil 54. More particularly, the currently preferred power receiving **coil** 54 is a **flat disc-like core** on which is formed a single layer or several layers of wire-like electrical conductors. Such conductors can be formed, for example, by depositing conductive material on a side of the disc-like core that faces the power supplying apparatus 10. FIG. 3 is a front view of such a **sheet coil** and FIG. 4 is a vertical sectional view taken along its middle plane.

(Ex. 1015, 3:39-51; *see also id.*, FIGS. 1-2, 3-4, 7-12, Abstract, 1:5-2:29, 2:64-3:27, 5:5-47, 5:48-9:5.)



(*Id.*, FIGS. 3-4.)

254. As another example, *Lee* (Ex. 1027) discusses a planar spiral inductor.

Since the arrival of the silicon-based RF IC era, much effort has been put into the **spiral inductor designs**. The main focus of the endeavor was to improve the quality

factor. The major concern for the silicon-based spiral inductors has been the resistivities of the metal and the silicon substrate. **Numerous techniques have been proposed** to reduce the resistivities of the interconnect lines and the silicon substrates [1,2]. Yet, **many planar spiral inductor structures have been designed and evaluated** without a clear understanding for the layout dependences of the quality factor. Simple and clear guidelines of inductor layout rules for optimum quality factor are presented for the required inductance and process information. . . . **Figure 1 shows the top view of a square spiral inductor layout.** Mohan [3] reported a simple and very accurate expression for the **planar spiral inductor inductances**. Modifying the Mohan's work, for the inductor dimensions shown in Fig. 1, the inductance can be expressed as . . .

(Ex. 1027, 1; *see also id.*, 1-3.)

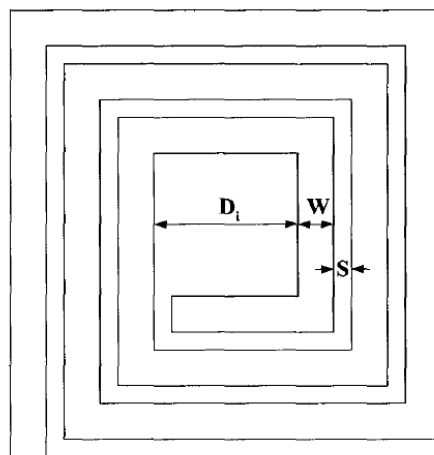


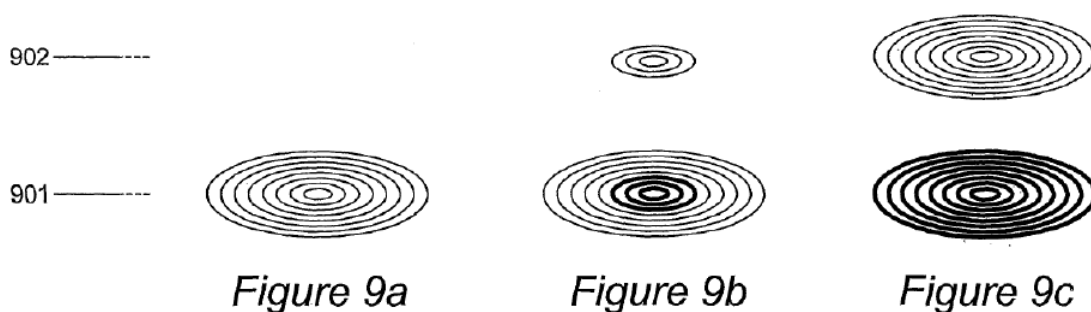
Fig. 1. A planar square spiral inductor structure.

(*Id.*, FIG. 1 (showing a “**planar square spiral inductor** structure”).) References such as *ChengII* (Ex. 1026) (which also disclose features consistent with the state of art knowledge of a person of ordinary skill in the art at the time) also show the known use of thin, planar-type coils in an inductive power source/charger and an inductive power receiver (device).

Figure 9 extends these two means of generating a rotational degree of freedom by adding universality. A charger 901 consists of a number of such coils, arranged concentrically, each of which can be driven independently. The charger behaves differently depending on which type of device is present 902.

- In Figure 9a no device is present, and so no charger coils are driven.
- In Figure 9b a physically small device with correspondingly small power requirements is present, and so only a few of the inner coils are driven.
- In Figure 9c a physically large device with correspondingly large power requirements is present, and so many of the coils are driven.

(Ex. 1026, 11:4-12; *see also id.*, Abstract.)



(*Id.*, FIGS. 9a-9c.)

255. There are other state of the art references that demonstrate and exemplify the above-discussed knowledge of a person of ordinary skill in the art. (Ex. 1007 (*see* my analysis and discussions and citations of *Hsu* in Section IX.B); Ex. 1025, FIGS. 1, 3, 8-9, 13, 1:10-2:3, 2:5-12 (reasons to consider thin coil designs), 2:14-3:2, 4:19-32, 7:25-9:28, 12:27-32 (very thin printed coil), 14:4-17; Ex. 1026, FIGS. 1-2, 5 (conventional primary coil array arrangement), 9A-9C, Abstract, 1:3-4:4 (conventional designs), 4:6-9:4, 11:4-15 (concentric selectively active flat coils); Ex. 1009, Abstract, FIGS. 1-3, 1:4-51, 1:54-2:26, 2:47-3:8 (flat configurations), 3:9-39 (thin flat coil), 4:18-60); Ex. 1024, FIGS. 3, 8-9, 1:12-15, 1:39-2:29, 9:41-53, 10:45-57, 11:60-13:4; Ex. 1028, Abstract, FIGS. 2-7, ¶¶0001, 0004-0007, 0025-0032, 0041; Ex. 1029, 1-4, 9-19 (planar, spiral coils); Ex. 1030, FIGS. 3-7B, 1:5-9, 1:59-61, 3:19-56, 4:62-567, 5:25-44; Ex. 1004, 166-236 (WO 2003/105308 (planar

inductive battery charger with PCB spiral planar primary coil substantially parallel to planar charging surface)), 237-284 (WO 2005/109598), 875.)

256. Accordingly, in my opinion, a person of ordinary skill in the art was well aware of available designs and options for implementing inductor coils to facilitate contactless power/data transfer, including the circuitry relating to such coils types, and the tradeoffs, benefits, advantages, etc. associated with their use. (*Id.*; *see also* my discussions and citations in this section and in Section V.) In my opinion, a person of ordinary skill in the art would have referenced and used such knowledge when considering the design and implementation options for the above-discussed *Nakamura-Berghegger* modified system. In my opinion, for example, such a skilled person would have considered how known coil designs would have improved the modified system based on given applications and looked to implement configurations that took into account factors such as size, weight, cost, efficiencies, performance, design constraints and/or applications, etc. (e.g., physical dimensions/form factors (e.g., thin, spiral, loop, etc. type coils that may be printed/etched onto a substrate, thin core configurations, etc.), heat issues, signal power, etc.). (*Id.*; *see e.g.*, Ex. 1007, ¶0033 (describing size/shape attributes of coils and known characteristics in a contactless inductive power/charge system); *see also* discussions in Section IX.B.) In my opinion, a person of ordinary skill in the art would have considered tradeoffs in such design options when contemplating ways

to design and implement a charger system / device like that disclosed by *Nakamura*, including for example, cost, weight, efficiency, etc., and the benefits provided by alternate coil designs for given applications. (*Id.*)

257. In my opinion, *Odendaal* is one of many examples demonstrating such knowledge. *Odendaal* (like *Nakamura*) discloses a contactless inductive power/charging system that uses inductive coupling to provide power to a mobile device (e.g., cellphone, computer, etc.) having a secondary coil placed on or near the primary coils in the surface of a powering device (e.g., charger for cellphones, powering pad, or charger embedded in a thin surface, including fabrics, etc.). (Ex. 1008, Title, Abstract, 1:5-3:57.) As discussed below, a person of ordinary skill in the art would have had reasons to consider the teachings of *Odendaal* in context of the *Nakamura-Berghegger* system since *Odendaal* describes an inductive power system including techniques/technologies similar and related to those of *Nakamura* and *Berghegger*. For example, *Odendaal* explains that “[t]he present invention is related to **contactless power transfer systems**” (Ex. 1008, 1:6-7) and discloses configurations of its invention, including one where:

a battery charging circuit can be coupled to one of the first and second spiral-shaped conductors, and a load can be coupled to the other of the first and second spiral-shaped conductors. **The coupling between battery charging circuit and the battery may comprise** capacitive

coupling and/or **magnetic coupling, and wherein power is transferred by the coupling of an electric field and/or magnetic flux** across the IOET [interface-of-energy-transfer].

(*Id.*, 2:56-64; *see also id.*, Title, Abstract, FIGS. 1A-4, 11-12, 1:5-3:57 (1:6-67 (known use of planar coils)), 4:50-5:8, 5:24-28, 6:59-64; *see also* above discussions and citations regarding *Nakamura* and *Berghegger* in Section IX.A.) Thus, in my opinion, *Odendaal* describes technical features related to those in the '208 patent, *Nakamura*, and *Berghegger* given it also describes a system for providing power to a remote/mobile device, and more specifically to inductive contactless power transfer techniques and technologies. (*Id.*; *see also* my discussions and citations regarding *Odendaal* in this section.)

258. A person of ordinary skill in the art would have understood *Odendaal* (similar to *Nakamura* and *Berghegger*) also discloses features that were reasonably pertinent to one or more particular problems like those discussed in the '208 patent. (*Id.*; *see also* my discussions of the '208 patent, *Nakamura*, and *Berghegger* in Section IX.A.1(d).) As I explained above and below, *Odendaal* also discloses techniques and technologies for addressing the need to power mobile devices using contactless inductive coupling. (*Id.*; Section VIII.D; Ex. 1008, Abstract, 1:5-3:57, 4:50-5:8, 5:24-28, 6:59-64; Ex. 1005, FIG. 5, ¶¶0006-0007, 0020, 0062-0094, 0096,

0102-0124; Ex. 1006, Abstract, 1:65-2:17, 2:18-3:30, 5:27-30, 6:12-45.) In my opinion, such teachings address similar problems identified in the '208 patent, and thus in my opinion would have been consulted by a person of ordinary skill in the art looking to address and solve such issues/problems and others relating to the design and implementation of a contactless inductive charging system, including those discussed in *Nakamura* and *Berghegger*. (*Id.*; *see also* discussions and citations regarding *Odendaal* in this section; *see also* Section IX.A.1.) Therefore, it is my opinion that when contemplating designing, configuring, and implementing a system like that described by *Nakamura* and *Berghegger* and a system like the modified *Nakamura-Berghegger* system, a person of ordinary skill in the art would have consulted teachings and suggestions such as those found in *Odendaal* and consequently would have been motivated to modify the above-discussed “**charger system**” in the *Nakamura-Berghegger* system to include features such as those discussed in this section and recited in claim 1. (*Id.*)

259. A person of ordinary skill in the art would have understood that *Odendaal* discloses features that would have been applicable to improvements to the *Nakamura-Berghegger* system. For instance, in addition to that discussed above, *Odendaal* discloses the known use of planar-type primary-side and secondary/receiver-side inductor coils for use in a contactless inductive power/data transfer system that transfers power/data via magnetic coupling for, e.g., charging a

battery of a cellphone, computer, wearable items, etc. (Ex. 1008, FIGS. 1A-1B, 2A, 2C, 8E, 1:58-3:5.) For example, *Odendaal* explains:

The spiral-shaped conductor may comprise pcb spiral-wound conductors. In addition, a battery charging circuit can be coupled to one of the **first and second spiral-shaped conductors**, and a load can be coupled to the other of the first and second **spiral-shaped conductors**. The coupling between battery charging circuit and the battery may comprise capacitive coupling and/or **magnetic coupling, and wherein power is transferred by the coupling of an electric field and/or magnetic flux across the IOET** [interface-of-energy-transfer].

According to an aspect of the present invention, a signal applied to the first spiral-shaped conductor can be transferred to the second spiral-shaped conductor by coupling of magnetic flux of the first and second spiral-shaped conductors across the IOET.

The first and second spiral-shaped conductors and the IOET are preferably integrated into a planar (flat/thin) structure.

(Ex. 1008, 2:55-3:5.) *Odendaal* also explains:

According to another aspect of the invention, an isolating coupling interface and a resonant tank are functionally integrated into a planar configuration for transferring

power with isolation properties. **The device may comprise two separable structures on either side of the IOET, such as, for example, a cellphone and its charger. . . .**

An advantage of the present invention is that it facilitates the use of **wearable electronics**. For example, **flex circuits may be used so as to cause the surface of the coils to be flexible**. In addition to the flexibility, the coils may be formed in any arbitrary shape to facilitate woven wire arranged in **a fabric, or pads with embedded conductors that can be attached to clothes**. In this way, for example, **one could charge a radio, cellphone, and/or computer (just to name a few of the many wearable items) by bringing the device in close proximity to the fabric**. Thus, implementation of the invention with wearable electronics could provide an **interface between the wearable device(s) and external power sources**. Digital or analog signals may also be transmitted across such interfaces to, for instance, up- or download digital information.

(Ex. 1008, 2:16-43.)

260. *Odendaal* discloses that the “interface-of-energy-transfer” (IOET) of the planar power resonator “may have a thin and/or relatively flat top coil surface” and may have coils arranged in upper and lower configurations with an air gap.”

(*Id.*, 2:44-54.) “The spiral-shaped conductor may comprise pcb spiral-wound conductors” and “a battery charging circuit can be coupled to one of the first and second spiral shaped conductors, and load can be coupled to the other” where “coupling between the battery charging circuit and the battery may comprise . . . and/or magnetic coupling, wherein power is transferred by the coupling of . . . and/or magnetic flux across the IOET.” (*Id.*, 2:55-64; *see also id.*, 2:1-15 (transferring power across IOET “in **either** an electric **or magnetic form**, or both” and “**transformer action** with or **without** capacitive energy transfer”), 2:65-3:5 (signal transfer between spiral coils “by coupling of magnetic flux”), 4:44-5:8, 6:1-18 (air coil transformer).)

261. Therefore, in my opinion, a person of ordinary skill in the art would have understood that *Odendaal* discloses inductive contactless power system designs and configurations that use thin, planer coils where planar primary coil(s) are arranged behind and parallel to the surface of a base unit (and planar secondary/receiver coil(s) are arranged/implemented in a device to be powered/charged (e.g., cellphone/computer)), consistent with that known in the art. (*Id.*; *see also* Ex. 1008, 1:23-31 (conventional road embedded coils), 1:60-67, 2:16-28, 2:29-44 (coils embedded in fabric or pads), 2:55-64, 3:3-5 (“The **first and second spiral-shaped conductors** and the IOET are preferably integrated into a **planar (flat/thin) structure.**”), 3:65-67 (spirals arranged within substrate material);

see also my discussions regarding one of ordinary skill in the art's state of art knowledge as I discussed above.)

262. Upon considering the teachings and suggestions of *Odendaal* in context of the disclosures in *Nakamura* and *Berghegger* and regarding a system/device like the modified *Nakamura-Berghegger* system/device, along with the knowledge in the art, a person of ordinary skill in the art would have been motivated to modify the *Nakamura-Berghegger* system/device to use planar, spiral, thin, type primary coil(s) in the “**base unit**” (and in the mobile device 2/3) to increase the versatility in the designs/arrangements compatible with various thin-form applications contemplated by *Nakamura*. (*Id.*; *see also* discussions and citations regarding *Odendaal* in this section and discussions and citations regarding *Nakamura* in Sections IX.A, IX.B.) For example, as I explained above, *Nakamura* discloses different applications for the contactless inductive power/data transfer system (*see* my analysis and discussion of *Nakamura* in Sections IX.A.1(a), and in Section IX.B.) A person of ordinary skill in the art would have been motivated to consider and implement planar coils to facilitate and/or expand the versatility of applications contemplated by *Nakamura*, which utilize thin, compact, and/or planar-type designs/arrangements (some shown in the figures below), *e.g.*, apparatus 1 embedded in the surface of a desk/table/locker/shelf/dashboard/mat/floor/rug, etc., thin/compact device 2/3 such as cellphone, laptop, etc. (*See* my analysis and discussions in IX.A.1(a); Ex. 1005,

¶¶0062-0075, 0090-0094, 0096-0156; *see also id.*, FIGS. 1A-2B, 8-9, and 13A-20 (apparatus 1 embedded in thin planar-type host units, where reduced thickness of primary coil(s) would have benefited the corresponding thickness/profile of apparatus 1 and its integration with such hosts), FIGS. 2A and 9 (thickness of the receiver/secondary coil placed near the device/cellphone's back panel affecting thickness of the device/cellphone), ¶¶0070 ("IC 24" of apparatus 1 "is an IC including [circuits 31-37], and *takes on a shape of an IC chip for achieving a compact and lower-profile shape*"), 0075 ("IC 42 is in the shape of an IC chip so that *a compact and lower-profile shape of the portable telephone 2 is achieved*").)

FIG. 1A

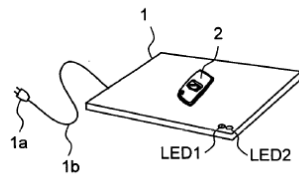


FIG. 1B

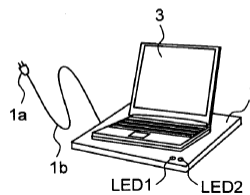


FIG. 8

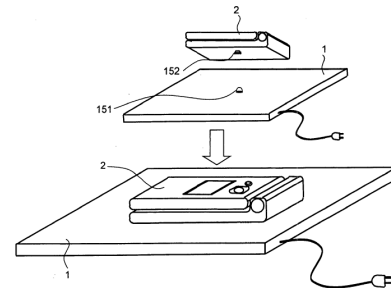


FIG. 13B

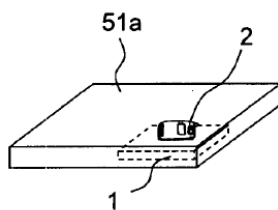


FIG. 13C

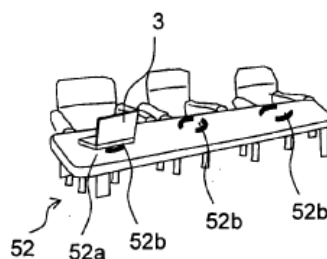


FIG. 13E

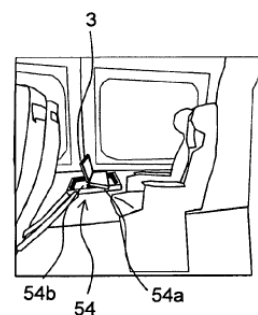


FIG. 14

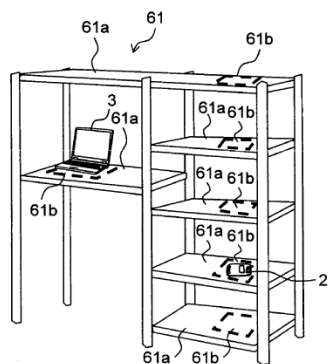


FIG. 15B

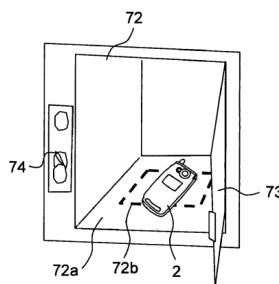


FIG. 18

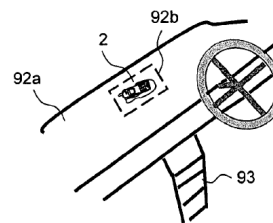


FIG. 19

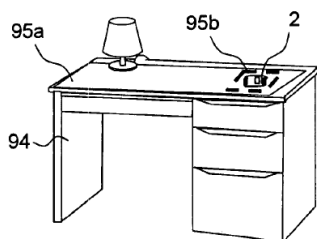


FIG. 2A

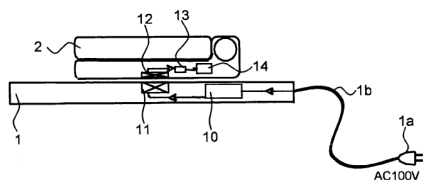
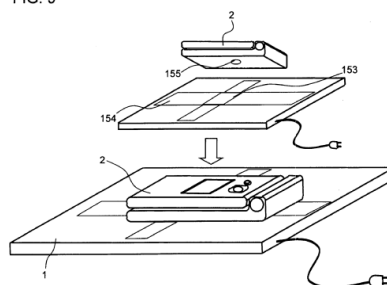


FIG. 9



(Ex. 1005, FIGS. 1A, 1B, 8, 13B, 13C, 13E, 14, 15B, 18, 19; *see also id.*, FIGS. 2A, 9.) As I discussed above, *Odendaal* also discloses the use of thin, planar type coils in similar thin, compact, and/or planar-type designs/arrangements (e.g., fabrics/pads, cellphones/computers, etc.) (*See my analysis and discussions above in this section; Ex. 1008, 1:58-3:5.*) For example, as discussed above, *Odendaal* discloses thin, planar-type coils and relevant circuitry embedded in thin objects such as fabrics or pads. (*Ex. 1008, 2:29-44.*) Similarly, as discussed above, *Nakamura* also contemplates having primary coils and apparatus 1 embedded in thin objects such as rugs, carpets, mats, etc. (*Ex. 1005, ¶0124, FIGS. 13A-20.*) Also, as discussed above, both *Odendaal* and *Nakamura* disclose having inductive secondary/receiver coils in

mobile devices such as cellphones and laptops. (*See* my analysis and discussions above in this section and in Section IX.A.)

263. In my opinion, a person of ordinary skill in the art would have appreciated the benefits thin, planar-type coils would have provided to *Nakamura's* system/device (including as modified in view of *Berghegger*), such as expanding applications to provide thin form factors, which were applicable to implementations for pad, desk, table, shelf, mat, floor, fabric, etc. based designs for powering/charging various devices, such as thin/compact mobile devices such as cellphones and laptops. (*See, e.g.*, Ex. 1008, 1:58-3:5, FIGS. 1A-1B, 2A, 2C, 8E; *see also* discussions and citations regarding *Odendaal* and *Nakamura* in this section; *see also* discussions in Sections IX.A.) In my opinion, such knowledge was consistent with that known in the art and with the teachings and suggestions in *Odendaal*. (*Id.*; *see also* my discussions and citations to references supporting my opinions regarding the state of art knowledge of a person of ordinary skill in the art above in this section.) Moreover, in my opinion, a person of ordinary skill in the art would have been motivated to configure the modified system/device with planar coils that would increase coupling areas between primary and secondary/receiver coils to improve efficiency/effectiveness of inductive power transfer (Ex. 1005, ¶¶0079-0082), which would have also been beneficial for configurations where apparatus 1 is embedded in desks/tables/shelves/floors/carpets, etc., by allowing

device 2/3 to be charged at different parts of such surfaces (*id.*, ¶0159; *see also id.*, ¶¶0107-0124, 0153, FIGS. 13A-20). Further, as I explained above (*see* Section V.B.3), a person of ordinary skill in the art would have understood complementing a primary/secondary-side planar coil with a secondary/primary-side planar coil would provide for efficient transmission of energy between the two planar coils in an inductive charging/power systems, especially where the coils were aligned to face each other to allow the perpendicular magnetic field generated from the transmitting planar coil to be received by the receiving planar coil. (*See* my discussions above in Section V.B.1.) Thus, in my opinion, where design applications in an inductive power transfer system called for planar transmitting or receiving coil designs (e.g., to provide for thin, compact, versatile devices), such a skilled person would have had reasons to likewise consider design options where the receiving or transmitting coil likewise incorporated planar-type coil(s). Such knowledge (supported by the state-of-art references I discuss above) in context of the teachings of *Nakamura* and *Odendaal* would have motivated a person of ordinary skill in the art to consider and implement the use of planar coil(s) for the apparatus 1 (“base unit”) in *Nakamura*’s system, and also to complement its inductive power transmission features, via use of a planar coil for the mobile device 2/3.

264. Thus, in my opinion, a person of ordinary skill in the art would have been motivated by *Odendaal*’s teachings/suggestions (coupled with the above-

discussed state of art knowledge) to configure the *Nakamura-Berghegger* system for applications employing planar, spiral, thin-type primary coils 11 and secondary/receiver coils 12 to expand the applications consistent with those contemplated by *Nakamura*. Such a modification would have predictably resulted in the modified *Nakamura-Berghegger-Odendaal* system including features and functionalities like those recited in claim 1, where a plurality of primary coils were positioned within the base unit, and arranged behind and parallel to the base unit surface, like that recited in limitation 1(b) (and secondary/receiver coil(s) in mobile device 2/3 were configured as planar coil(s)). Also, other features like those recited in claims 1 and 18 would have been included in the above-discussed *Nakamura-Berghegger-Odendaal* system for reasons similar to those I explained in Section IX.A. (*Id.*; see Sections IX.A.1(a)-(k), IX.A.2.) For example, a person of ordinary skill in the art would have also understood that *Nakamura-Berghegger-Odendaal* modified system would have resulted in a magnetic field generated by the planar type activated primary coil(s) in a direction substantially perpendicular to the surface of apparatus 1 (“**base unit**”) and to the plane of the primary coils, consistent with that known in the art, and as recited in limitations 1(c) and 1(e). (*Id.*; see also my analysis and discussions in Sections V, IX.A.1(c), 1(e).) For example, consistent with known planar coil designs and how magnetic coupling occurs in such configurations (see my discussions above in Section V.B and those above where I

reference state-of-art references supporting such understanding), and also consistent with *Nakamura's* teachings that look to detect and confirm coil/device position where the highest magnetic coupling is achieved based on positional offset (*see* Ex. 1005, FIGS. 4, 11A-11B, ¶¶0079-0083), a person of ordinary skill in the art would have understood (and been motivated to design/implement a system where) when the primary planar coil(s) is/are aligned with the (planar) secondary coil in the modified *Nakamura* system to maximize magnetic coupling (energy transfer), a substantially perpendicular magnetic field (relative to the surface of the apparatus 1 (base unit) and to the plane of the primary coil(s)) would be generated by the planar primary coil(s) and received by the planar secondary coil.

265. In my opinion, a person of ordinary skill in the art would have recognized that the *Nakamura-Berghegger-Odendaal* system would have been configured in various ways while still providing the power/data transfer functionalities discussed above for the *Nakamura-Berghegger* system. (*Id.*; *see* Section IX.A.) For example, the modified system may have been configured with planar primary coils 11x/11y/11z that would have been selected, configured, designed with corresponding circuitry to ensure that appropriate power is provided to device 2/3 (with planar secondary/receiver coil(s) 12) depending on the power requirements for the device, like that explained in Ground 1 and discussed in *Nakamura*. (*Id.*) In my opinion, a person of ordinary skill in the art would have

recognized and considered the tradeoffs with different designs (e.g., due to costs, weight, complexity, efficiencies, etc.) to identify and implement a modified system appropriate for a given application. (*Id.*) Accordingly, a person of ordinary skill in the art would have considered and implemented other designs and configurations with a reasonable expectation of success that such configurations would have operated as intended and in accordance with design parameters for a given application. (*Id.*)

266. In my opinion, a person of ordinary skill in the art would have appreciated that implementing the above-discussed modification would have involved applying known technologies (e.g., known planar, spiral, thin coils and related circuitry (e.g., *Odendaal* and a person of ordinary skill in the art's state of art knowledge as I discussed above)) with wireless inductive power transfer/charging systems (*Nakamura, Berghegger, and Odendaal*) according to known methods and techniques (e.g., using planar-type coils to transfer power/data similar to known coil designs (*Nakamura, Berghegger, and Odendaal*)) that would have led to a foreseeable result of providing a thin form factor / "compact and lower-profile shape" (Ex. 1005, ¶¶0070, 0075) "**base unit**" (having embedded planar primary coils arranged behind and parallel to its surface) and device 2/3 that provide the power/charging operations like that discussed above for the *Nakamura-Berghegger* system in Ground 1. (*Id.*; see also my discussions in Section IX.A.)

D. Ground 4: *Nakamura* in view of *Berghegger*, *Odendaal*, and *Hsu* Discloses and/or Suggests the Features of Claims 1 and 18

267. In my opinion, *Nakamura* in view of *Berghegger*, *Odendaal*, and *Hsu* discloses and/or suggests all of the features of claims 1 and 18 of the '208 patent. (See my discussions below in this section; see also my discussions in Sections IX.A-IX.C.)

268. The *Nakamura-Berghegger-Odendaal* combination discloses and/or suggests the limitations of claims 1 and 18 for reasons I explained in Grounds 1 and 3. (See my analysis and discussions in Sections IX.A, IX.C.) My analyses and discussions for Ground 2 also explain how and why a person of ordinary skill in the art would have been motivated to modify the *Nakamura-Berghegger* combined system in view of *Hsu* in a manner that discloses and/or suggests the limitations of claims 1 and 18 (e.g., implementing a base unit including an array or matrix of primary coils where one or more of those coils would have been selectively activated via switching circuit(s) using polling or sensor features like that recited in limitations 1(c), 1(g)-1(h), among others). (See my analysis and discussions in Section IX.B.)

269. Thus, for the same/similar reasons, rationale, and teachings and suggestions that I discussed and explained above for Grounds 1-3, it is my opinion that a person of ordinary skill in the art would have been motivated to configure and modify the above-discussed *Nakamura-Berghegger-Odendaal* system with features

similar to those taught/suggested by *Hsu* in a manner that discloses and/or suggests claims 1 and 18. (See my discussions in Sections IX.A-IX.C.)

270. In my opinion, a person of ordinary skill in the art would have had similar reasons and motivations to consider the teachings of *Hsu* along with those of *Odendaal* and *Berghegger* when contemplating the design and configuration of the *Nakamura* system, and would have done so with a reasonable expectation of success that the modifications would have performed functionalities as intended, which such a person would have appreciated would have been consistent with the goals and operations of *Nakamura* and with the functionalities and features provided in the above-discussed *Nakamura-Berghegger-Odendaal* and *Nakamura-Berghegger-Hsu* systems as I discussed and explained above for Grounds 1-3. (*Id.*)

E. Ground 5: *Nakamura* in view of *Berghegger* and *WangII* Discloses and/or Suggests the Features of Claims 1 and 18

271. In my opinion, *Nakamura* in view of *Berghegger* and *WangII* discloses and/or suggests all of the features of claims 1 and 18 of the '208 patent. (See my discussions below in this section; *see also* my discussions in Section IX.A.)

272. *Nakamura* (alone or as modified in view of *Berghegger*) discloses and/or suggests limitations 1(a)-1(c), 1(e)-1(k) and claim 18 for the reasons I explained in Ground 1. (See my analysis and discussions in Sections IX.A.1(a)-(c), IX.A.1(e)-1(k), IX.A.2.) As I discussed and explained in Ground 1, *Nakamura* in view of *Berghegger* discloses and/or suggests limitation 1(d). (See my analysis and discussions in Section IX.A.1(d).) In my opinion, in addition to the teachings/suggestions of *Berghegger*, a person of ordinary skill in the art would have been further motivated to configure the “**base unit**” in the above-discussed modified *Nakamura* system to include a capacitive or other component that decreases harmonics in an activated primary coil of the system based on the teachings/suggestions of *WangII*.¹³

¹³ I referenced *WangII* in Ground 1 to support my opinions concerning a person of ordinary skill in the art’s state of art knowledge at the time. (See Section IX.A.1(d).)

273. In my opinion, in addition to the teachings/suggestions of *Berghegger* discussed above, a person of ordinary skill in the art would have had reason to consider the teachings/suggestions of *WangII* for reasons similar to those I explained above regarding such a skilled person's reason for considering *Berghegger* for limitation 1(d) in Ground 1. (See my analysis and discussions in Section IX.A.1(d).) For example, *WangII* discloses contactless inductive power transfer system for powering a remote device via magnetic coupling. For example, *WangII* explains:

An improved transcutaneous energy transmission device (50) is disclosed for **charging rechargeable batteries (13) in an implanted medical device (14)**. A current with a sinusoidal waveform is applied to a resonant circuit comprising a **primary coil (9) and a capacitor (25)**. **Current is induced in a secondary coil (10) attached to the implanted medical device.**

(Ex. 1013, Abstract.) *WangII* also explains:

The inductor forms a primary coil of a transformer in which current is induced in a secondary coil attached to an implanted medical device. The medical device

Here, I rely on *WangII* in Ground 5 as prior art disclosures and suggestions consistent with that provided by *Berghegger*.

receives the induced current for charging rechargeable batteries.

(*Id.*, 4:34-5:2; *see also id.*, FIGS. 1-3, 6, 4:29-5:13.)

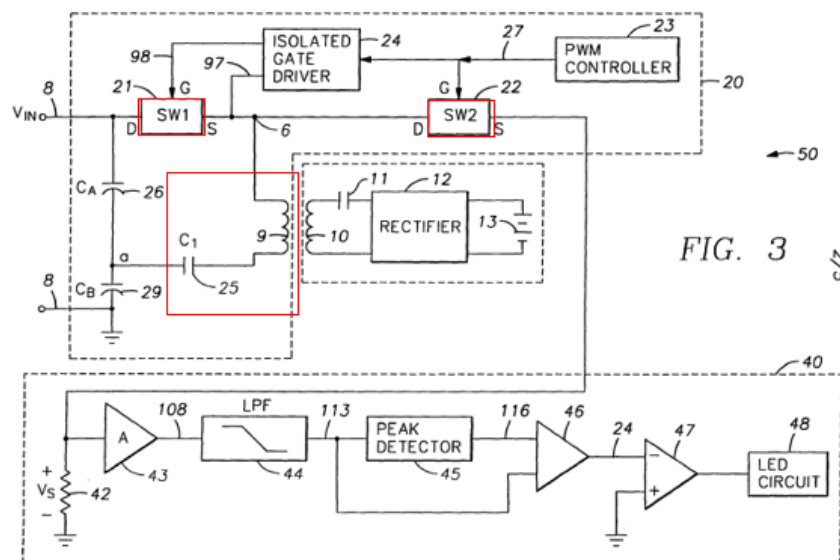
274. As I explained above for limitation 1(d) in Ground 1, *WangII* also describes configurations that use switch(es) loaded by a capacitor coupled to a primary coil providing wireless power to secondary coil that reduces harmonics in the signals generated by the primary coil, consistent with that known in the art.

275. For one example, *WangII* explains:

The present invention solves the shortcomings and deficiencies of the prior art by constructing a transcutaneous energy transmission device with **two solid state switches facilitating the production of a substantially sinusoidal power waveform. The generation of the full sinusoidal wave reduces harmonics and eddy currents which otherwise are generated in the housing (or can) of the implanted device. As a result, heating of the can is minimized. The solid state switches connect a regulated DC voltage across an inductor and capacitor resonant circuit.** The inductor forms a primary coil of a transformer in which current is induced in a secondary coil attached to an implanted medical device. The medical device receives the induced current for charging rechargeable batteries.

The present invention can be implemented in a circuit in which a 5 KHz gate signal turns a first MOSFET switch on and off. The gate signal also turns on and off a second MOSFET switch at opposite times than the first MOSFET switch. **In addition to minimizing harmonics, the use of the optimum switching frequency reduces the eddy current in the housing (or can) of the implanted device, without causing excessive energy loss.**

(Ex. 1013, 4:29-5:7; *see also id.*, Abstract (“ . . . A current with a sinusoidal waveform is applied to a **resonant circuit comprising a primary coil (9) and a capacitor (25)**. Current is induced in a secondary coil (10) attached to the implanted medical device. . . .”), FIGS. 1-3, 6, 3:29-4:5, 7:24-8:14, 8:17-23 (“little high order frequency content”), 8:24-31, 9:26-12:27; *see also* discussions regarding Ex. 1013 in Section IX.A.1(d).)



(Ex. 1013, FIG. 3 (annotated).)

276. In my opinion, such additional teachings and suggestions of *WangII* are consistent with a person of ordinary skill in the art's knowledge at the time, including those demonstrated by *Berghegger*. (See my discussions regarding *WangII* and *Berghegger* in this section and in Section IX.A.1(d).) Thus, in my opinion, a person of ordinary skill in the art would have been further motivated by such teachings/suggestions in *WangII* to configure apparatus 1 ("**base unit**") in the *Nakamura* system to include a capacitive or other component that decreases harmonics in the activated primary coil to improve efficiencies in power transfer between the primary and secondary coils in *Nakamura*'s system, and/or promote efficient processing of the information signal provided by apparatus 1 to mobile/electronic device 2/3 that are used to initiate the generation and transmission of the information signals used by apparatus 1 to control the powering/charging of the mobile/electronic device 2/3 or its battery, as explained above for claim 1. (See my discussions in Sections IX.A.1(a)-(k).)

277. In my opinion, a person of ordinary skill in the art would have had similar motivation, rationale, and expectation of success in considering, designing, and implementing such features as those explained for the modification based on *Berghegger*, coupled with the additional express teachings/suggestions by *WangII*

as discussed above, which are applicable here. (*Id.*; *see* my discussions in Section IX.A.1(d).)

F. Ground 6: *Nakamura* in view of *Berghegger*, *WangII*, *Odendaal*, and *Hsu* Discloses and/or Suggests the Features of Claims 1 and 18

278. In my opinion, *Nakamura* in view of *Berghegger*, *WangII*, *Odendaal*, and *Hsu* discloses and/or suggests all of the features of claims 1 and 18 of the '208 patent. (*See* my discussions below in this section; *see also* my discussions in Sections IX.A- IX.E.)

279. As I explained above in Ground 4, *Nakamura*, as modified in view of *Berghegger*, *Odendaal*, and *Hsu*, discloses and/or suggests the limitations of claims 1 and 18. (*See* my discussions in Section IX.D; *see also* my discussions in Sections IX.A-IX.C.) Also, my discussions in Ground 5 explain how and why the *Nakamura-Berghegger-WangII* combination discloses and/or suggests the limitations of claims 1 and 18, in particular with respect to limitation 1(d). (*See* my discussions in Section IX.E.)

280. Thus, in my opinion, for the same/similar reasons, rationale, and teachings/suggestions that I discussed and explained in Grounds 1-5 (including those explained for limitation 1(d) in Sections IX.A.1(d) and IX.A.E), it is my opinion that a person of ordinary skill in the art would have been further motivated to configure and modify the above-discussed *Nakamura-Berghegger-Odendaal-Hsu* system,

such that the apparatus 1 (“**base unit**”) in the above-discussed modified *Nakamura* system includes a capacitive or other component that decreases harmonics in an activated primary coil of the system, in view of the additional teachings of *WangII*. (See my discussions in Sections IX.A-IX.E.)

281. In my opinion, a person of ordinary skill in the art would have had the same motivation, rationale, skills, knowledge, and reasonable expectation of success to consider and modify *Nakamura*’s modified system (in view of *Berghegger*, *Odendaal*, and *Hsu* (as explained for Grounds 1-4)) based on the additional teachings/suggestions in *WangII* (consistent with *Berghegger* and the state of art knowledge discussed above) to implement features like those recited in limitation 1(d) as those I explained above in Sections IX.A.1(d) and IX.E. (*Id.*; see Sections IX.A.1(d) and IX.E.) Therefore, in my opinion, for similar reasons explained here and above, the combined teachings/suggestions of *Nakamura*, *Berghegger*, *WangII*, *Odendaal*, and *Hsu* disclose and/or suggest all of the recited features of claims 1 and 18. (*Id.*)

X. CONCLUSION

282. In summary, it is my opinion that all of the features recited in claims 1 and 18 of the '208 patent are disclosed and/or suggested by the prior art.

283. 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 16, 2023

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