

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. 9,577,440

**DECLARATION OF R. JACOB BAKER, PH.D., P.E.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,577,440**

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	BACKGROUND AND QUALIFICATIONS	1
III.	MATERIALS REVIEWED	5
IV.	PERSON OF ORDINARY SKILL IN THE ART AND THE TIME OF THE ALLEGED INVENTION	9
V.	TECHNICAL BACKGROUND	11
A.	Electronic Circuits and Components	12
B.	Contactless Power/Data Transfer	19
1.	Inductance and Inductive Coupling	20
2.	Applications of Contactless Power/Data Transfer	24
3.	Use of Planar Coils	31
4.	Controlling and Regulating Contactless Power/Data Transfer	35
VI.	OVERVIEW OF THE '440 PATENT	39
VII.	CLAIM CONSTRUCTION	40
VIII.	OVERVIEW OF THE PRIOR ART	42
A.	<i>Nakamura</i> (Ex. 1005)	42
B.	<i>Odendaal</i> (Ex. 1008)	63
C.	<i>Calhoon</i> (Ex. 1006)	66
IX.	THE PRIOR ART DISCLOSES OR SUGGESTS ALL RECITED FEATURES OF CLAIMS 3 AND 13 OF THE '440 PATENT	76
A.	Ground 1: <i>Nakamura</i> in view of <i>Odendaal</i> and <i>Calhoon</i> Discloses and/or Suggests the Features of Claims 3 and 13	76
1.	Claim 3	76

- a) A system for use with a mobile device for charging or powering the mobile device inductively by a universal base unit for charging of different mobile devices and/or batteries of different charging characteristics associated therewith, comprising: 76
- b) a universal base unit including one or more primary coils therein, each primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil;.....95
- c) wherein the perpendicular magnetic field inductively generates a current in a matching secondary coil or coils within a mobile device placed close to and aligned with the base unit, to charge or power the mobile device;.....131
- d) wherein one or both of the mobile device and a battery have a receiver and particular charging characteristics associated therewith,.....141
- e) an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to the base unit, ...160
- f) a means for avoiding overcharging one or both of the mobile device and battery inductively, and.....181
 - (1) Plain Meaning and Means-Plus-Function Interpretation 181
 - (2) Other Scenarios 201
- g) a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery; 209

h)	wherein different mobile devices and batteries can have different charging characteristics associated therewith; and	222
i)	wherein the receiver communicates with the base unit to	223
j)	detect, identify and authenticate the receiver with the base unit, as provided by the identification component,.....	227
k)	determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil, ...	234
l)	verify the continued presence of the receiver near the base unit, and	242
m)	communicate information describing the characteristics of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.	249
2.	Claim 13	252
a)	The system of claim 3, further comprising a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.....	252
X.	CONCLUSION.....	275

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. 9,577,440 (“the ’440 patent”) (Ex. 1001).¹ I have been asked to consider whether the prior art discloses or suggests the features recited in claims 3 and 13 (“the challenged claims”) of the ’440 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 ’440 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. 9,577,440
Ex. 1004	Prosecution History of U.S. Patent No. 9,577,440
Ex. 1005	U.S. Patent Application Publication No. 2005/0068019 (“ <i>Nakamura</i> ”)
Ex. 1006	U.S. Patent Application Publication No. 2005/0127868 (“ <i>Calhoon</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. 1013	International Patent Application Publication No. WO1996040367 (“ <i>WangII</i> ”)
Ex. 1015	U.S. Patent No. 4,942,352 (“ <i>Sano</i> ”)

Ex. 1019	U.S. Patent No. 5,733,313 (“ <i>Barreras</i> ”)
Ex. 1024	U.S. Patent No. 7,378,817 (“ <i>CalhoonII</i> ”)
Ex. 1025	International Patent Application Publication No. WO2003/096361 (“ <i>Cheng</i> ”)
Ex. 1026	International Patent Application Publication No. WO2004/038888 (“ <i>ChengII</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. 1031	U.S. Patent Application Publication No. 2009/0072784A1 (“ <i>Erickson</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. 1039	Watson, J., Mastering Electronics, Third Ed., McGraw-Hill, Inc. (1990) (“ <i>Watson</i> ”)
Ex. 1040	Sedra, A., <i>et al.</i> , Microelectronic Circuits, Fourth Ed., Oxford University Press (1998) (“ <i>Sedra</i> ”)
Ex. 1041	U.S. Patent Application Publication No. 2006/0145660A1 (“ <i>Black</i> ”)
Ex. 1042	U.S. Patent No. 5,780,992 (“ <i>Beard</i> ”)

Ex. 1043	U.S. Patent No. 6,912,137 (" <i>Berghegger</i> ")
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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 '440 patent at the time of the alleged invention.

18. I understand that the '440 patent issued from Application No. 13/115,811, which is a continuation of Application No. 11/669,113, and claims priority to four provisional applications: U.S. Provisional Application Nos. 60/763,816 (filed January 31, 2006), 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, 2.) For purposes of rendering my opinions, I have been asked to initially consider that the time of the alleged invention of the '440 patent is around March 1, 2006 to June 1, 2006. My opinions reflect how one of ordinary skill in the art (which I described below) would have understood the '440 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 3 and 13 of the '440 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 March 1, 2006 to June 1, 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 '440 patent, a person of ordinary skill in the art at the time of the alleged invention of the '440 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 March 1, 2006 to June 1, 2006. My opinions in this declaration are also applicable from the perspective of such a skilled person at other related timeframes (e.g., late 2005 to early 2007 timeframes),

Declaration of R. Jacob Baker, Ph.D., P.E.
U.S. Patent No. 9,577,440

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

V. TECHNICAL BACKGROUND

22. As I discuss further below in Sections VIII and IX, it is my opinion that the features recited in the '440 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 '440 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 '440 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 '440 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 '440 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. 1039, 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).)

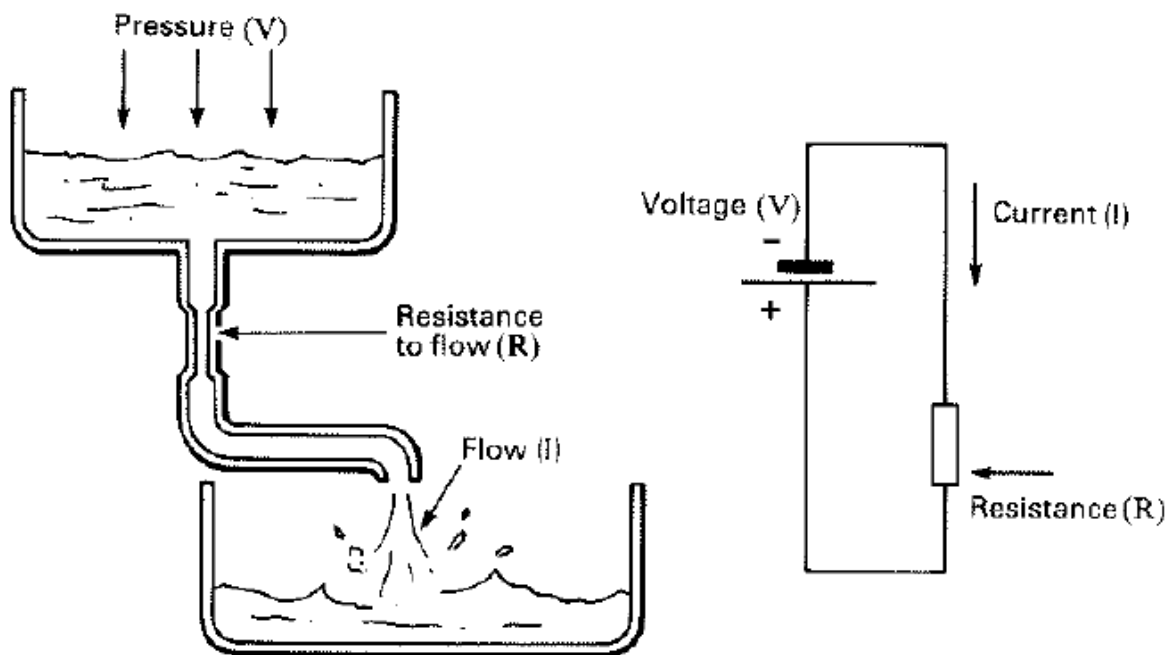
26. A person of ordinary skill would have known that “[i]n addition to measuring the current flow, we also need to measure another factor, the potential difference between two points,” which “is the energy difference between” the two points. (*Id.*, 10 (emphasis in original).) The potential difference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

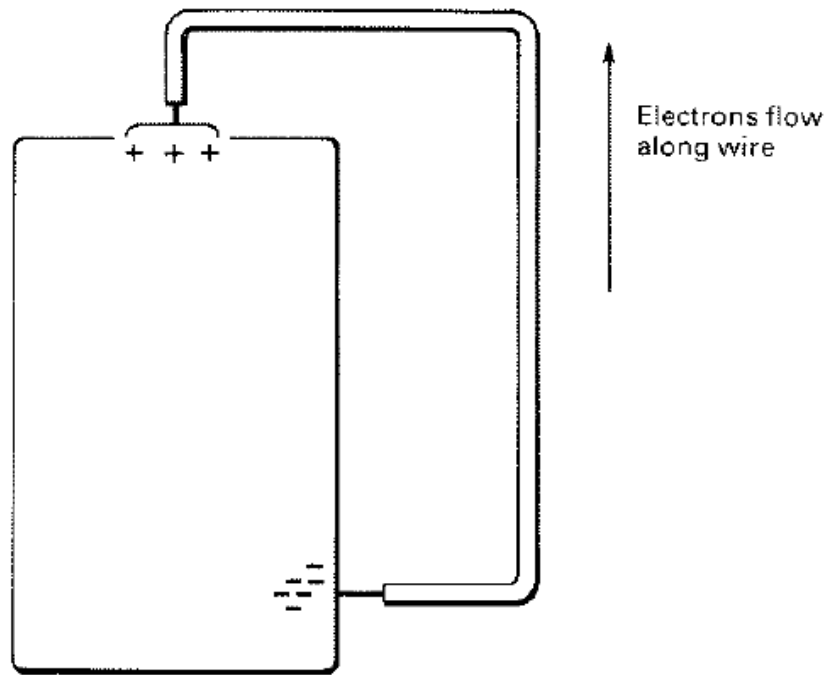


(*Id.*, FIG. 2.5.)

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*



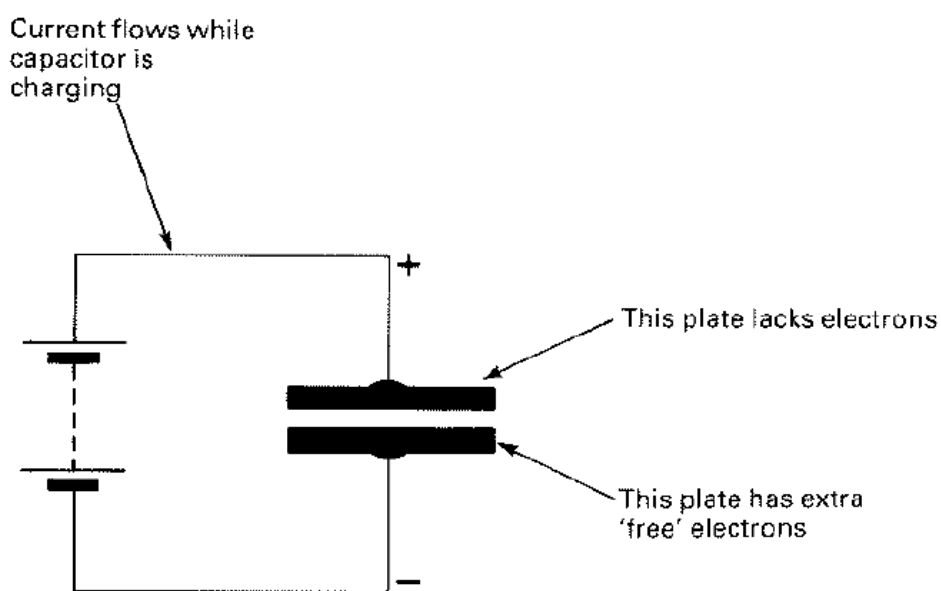
(*Id.*, FIG. 2.3.) A person of ordinary skill would have known that without such a closed path (e.g., as shown above in Figure 2.3), current cannot flow. (*Id.*, 8-11, FIGS. 2.3-2.5.)

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*

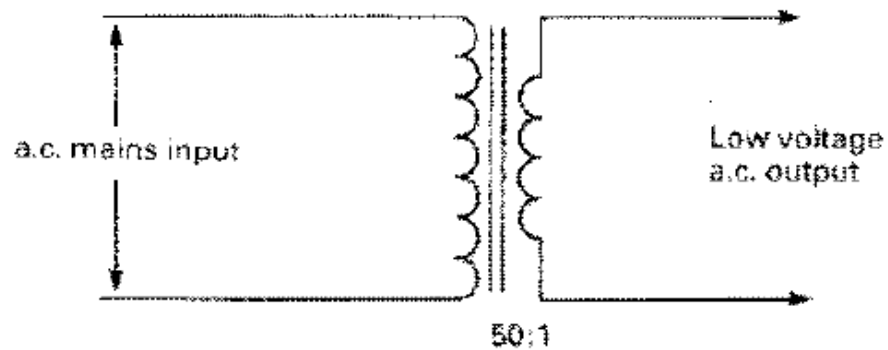


(*Id.*, FIG. 3.8.) A person of ordinary skill would have known that “[i]n this state the capacitor is said to be *charged*,” and [i]f the charged capacitor is connected in a circuit, it will, for a short time, act as a voltage source, just like a battery.” (*Id.*, 27 (emphasis in original).) It was known 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. 1040, 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).)

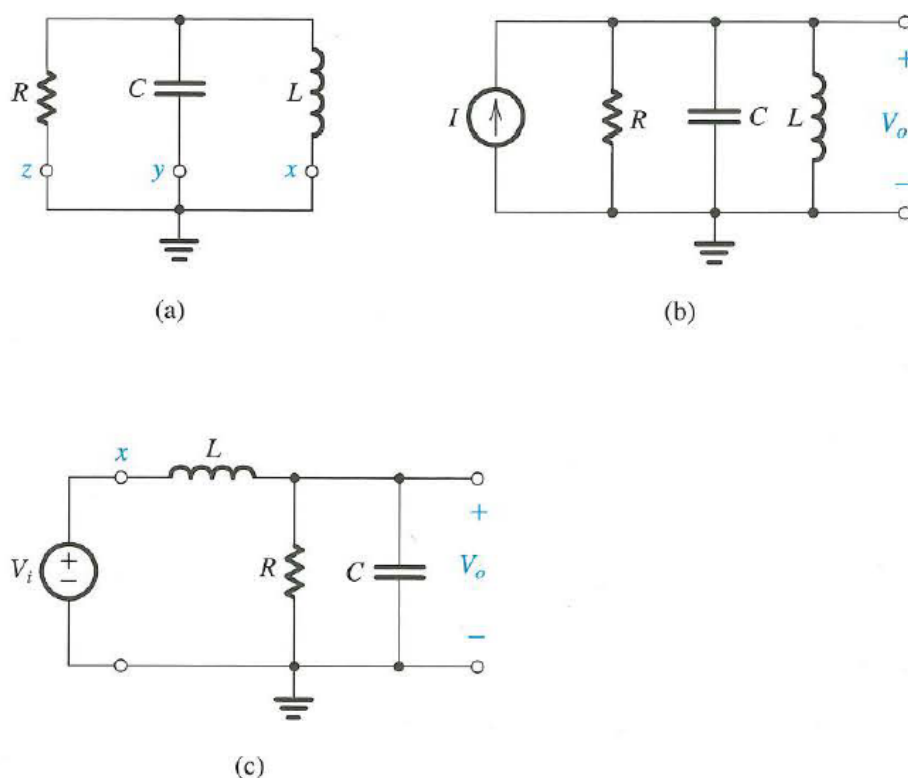


Fig. 11.17 (a) The second-order parallel LCR resonator. (b) and (c) Two ways for exciting the resonator of (a) without changing its *natural structure*. The resonator poles are the poles of V_o/I and V_o/V_i .

(*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.)

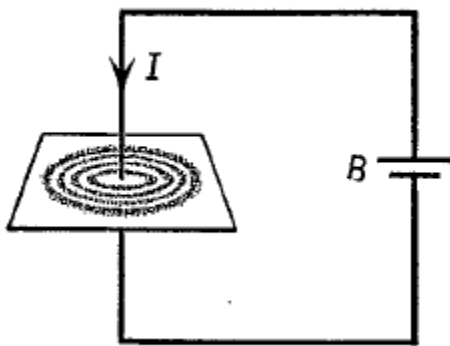
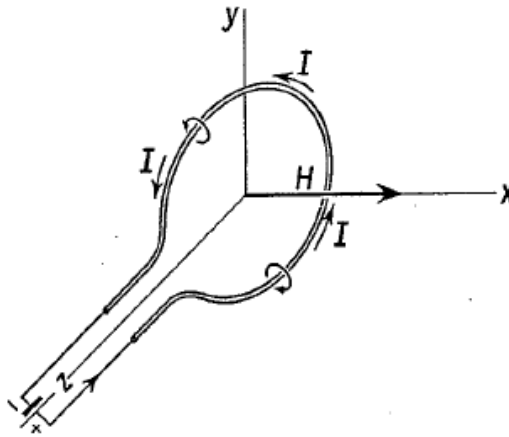


Fig. 30-2 Pattern formed by iron filings showing the circular magnetic field around a wire carrying current.

(*Id.*, 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.)

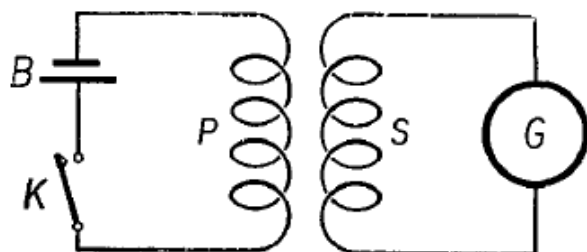


Fig. 32-3 Faraday's experiment on electromagnetic induction.

(*Id.*, 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.*, 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.*)

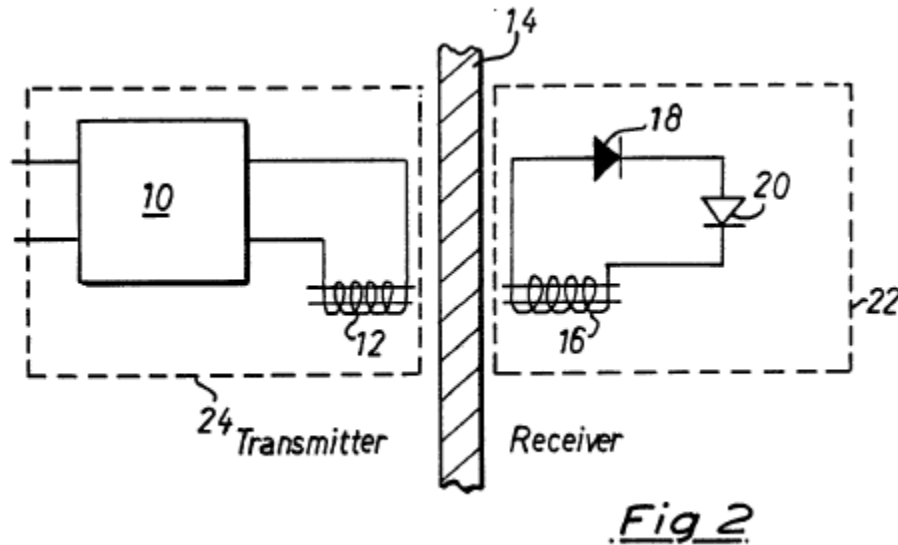
43. Therefore, in order to maintain current in the secondary circuit, the current in the first circuit can be continuously varied. By varying the current in the first circuit, the magnetic field (and therefore, magnetic flux) generated by the primary coil P is continuously varied, thereby inducing a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

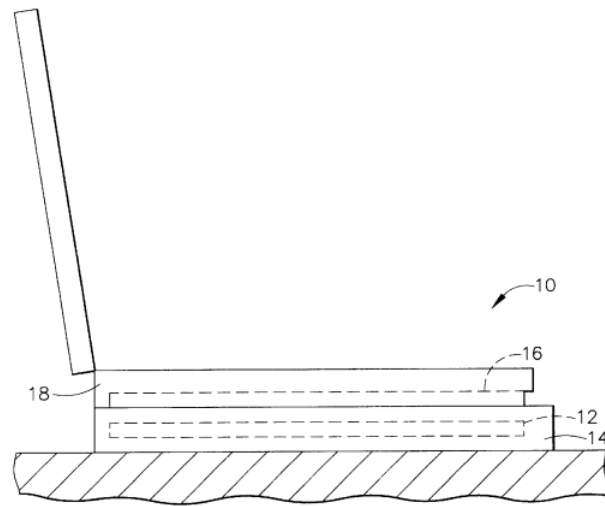


FIG. 1

(*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. 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.

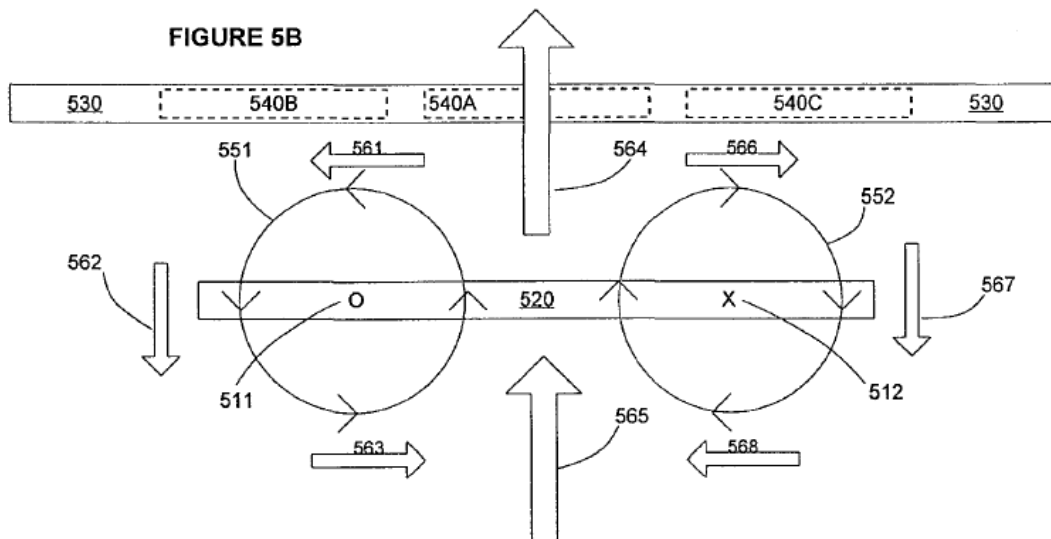
(Ex. 1010, Abstract.)

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.)

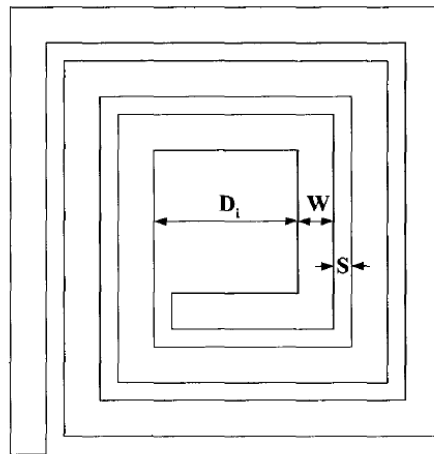


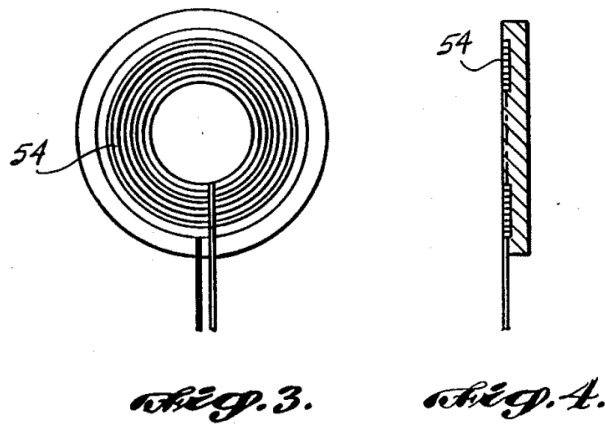
Fig. 1. A planar square spiral inductor structure.

(*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.)



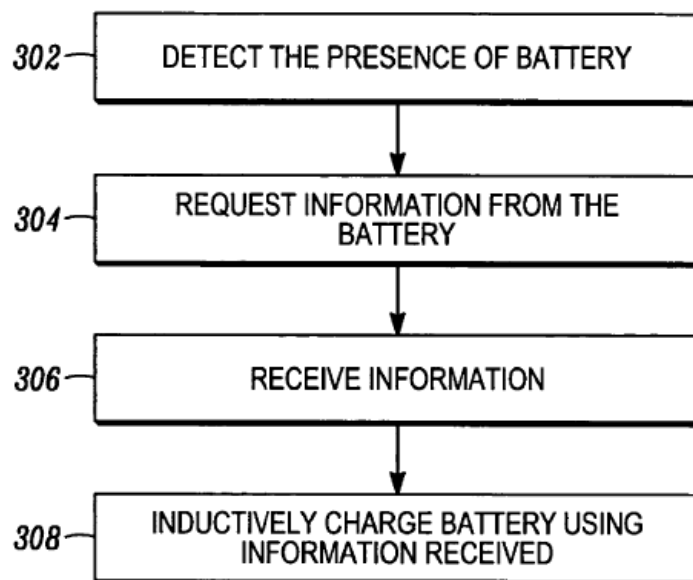
(*Id.*, FIGS. 3-4.)

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. 1041, ¶0020.)



(Ex. 1041, 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. 1042, 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. 1042, 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* 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. 1043, 5:65-6:37.)

VI. OVERVIEW OF THE '440 PATENT

57. The '440 patent relates to power supplies and other power sources, such as a portable inductive power source. (*See* Ex. 1001, 1:35-38.) For example, the patent describes a power source, device, or unit for powering/charging a device (e.g., mobile or other devices), where a system includes a base unit with a primary coil and a device with a secondary coil that receives energy by a magnetic field created by the primary coil to power/charge the device according to information associated with the device. (*See id.*, Abstract, 3:35-67, 4:58-5:56.) These features, in my opinion, were conventional at the time. Likewise, these and other features recited in claims 3 and 13, 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

58. 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 3 and 13, I have been asked to apply the plain and ordinary meaning of the terms in those claims, where applicable (although I may address other interpretations that I have been asked to consider below in my analysis of those claims in Section IX). For example, I have been asked to consider interpretations for the term “means for avoiding overcharging” that is recited in claim limitation 3(f). I discuss that below and also in Section IX.1(f). My opinions concerning the interpretation of the claim terms are based on the time of the alleged invention I have been asked to consider as I noted above (e.g., March 1, 2006 to June 1, 2006). I understand that in considering the meaning of the claims, one must consider the language of the claims, the specification, and the prosecution history of record. I have done so to support my opinions in this Declaration where appropriate.

59. Limitation 3(f) in claim 3 recites a “**means for avoiding overcharging one or both of the mobile device and battery inductively.**”² (Ex. 1001, 28:7-8.)

I have been asked to consider that term as a means-plus-function term. I understand that where a claim term is a means-plus-function term (such as I have been asked to assume here), the specification must clearly link or associate structure to the identified function for the claim term. I have been asked to provide my opinions under the following construction for the above “means for avoiding overcharging...” term:

- a. The identified function is: avoiding overcharging one or both of the mobile device and battery inductively as recited in the claim term.
- b. The corresponding structure is: the structure identified in the ’440 patent’s specification that includes a battery regulator chip and/or a circuit that measures parameters of a battery (e.g., voltage, degree of charging, temperature, etc.) and uses an internal program to regulate the power drawn from a circuit to ensure overcharging does not occur (where “[t]he circuit could also include LEDs to show the receiver being in the presence of

² I have added any emphasis herein unless indicated otherwise.

a magnetic field from the charger, complete charge LEDs and/or audible signals”) and/or equivalents thereof. (*See* Ex. 1001, 11:8-16; *see also* the file history (Ex. 1004, 171), which cites to ¶0064 of the specification (found at Ex. 1004, 1669) filed with the application for the ’440 patent that corresponds to the text found in the ’440 patent at column 11, lines 8-16.)

In my opinions below for limitation 3(f) in Section IX.A.1(f), I applied both the plain meaning and the above-discussed means-plus-function construction for the “means for avoiding overcharging...” term. As explained, in either case, it is my opinion that the prior art discloses and/or suggests the features recited in limitation 3(f). (*See* my analysis and discussions below in Section IX.A.1(f).)

VIII. OVERVIEW OF THE PRIOR ART

60. 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 ’440 patent below in Section IX. Accordingly, the following discussions are incorporated into my analysis below in Section IX.

A. *Nakamura* (Ex. 1005)

61. 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 '440 patent below in Section IX.

62. *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.)

63. *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

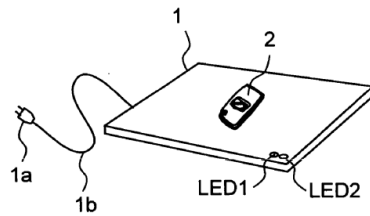
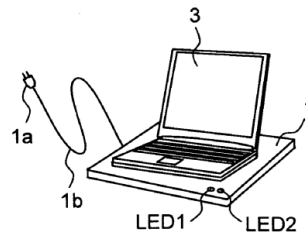


FIG. 1B



(*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

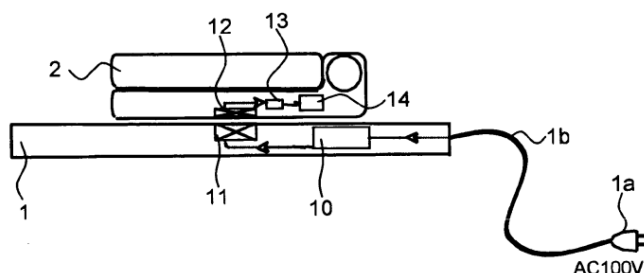
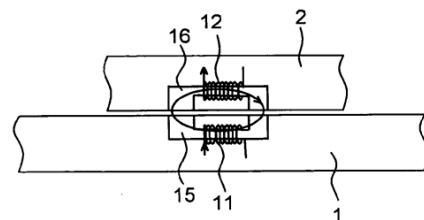


FIG. 2B



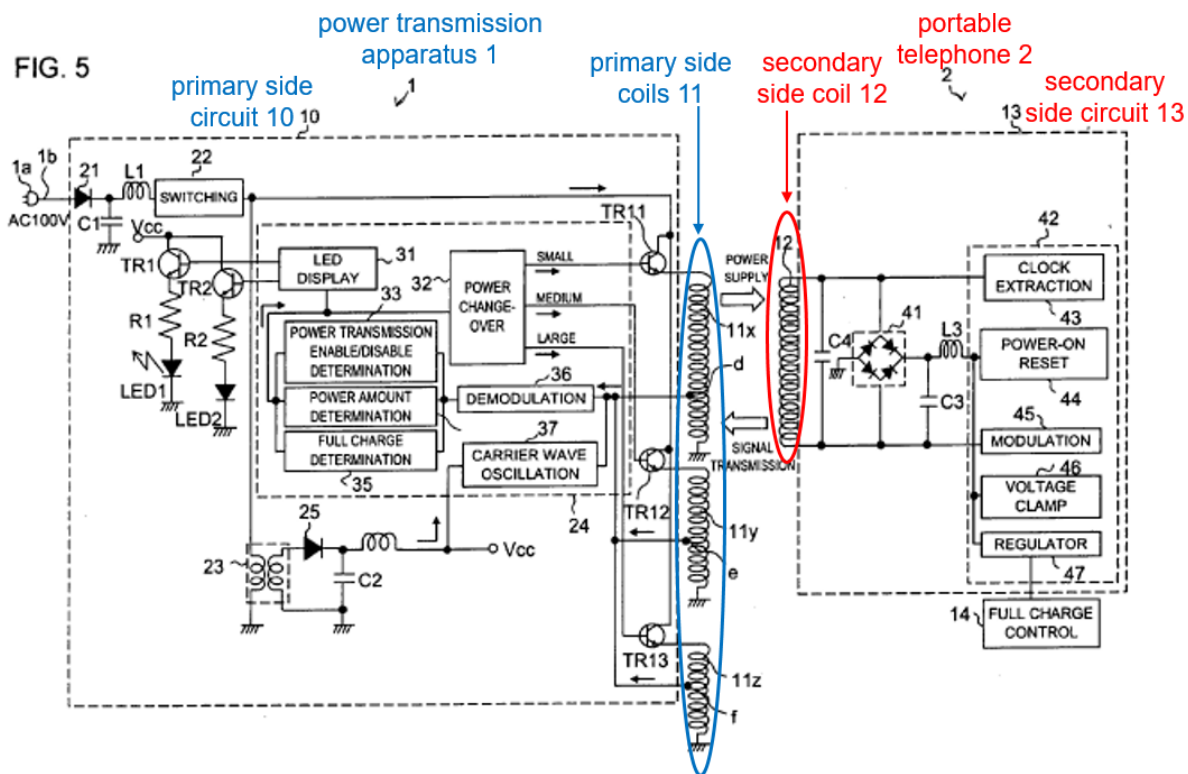
(*Id.*, FIGS. 2A-2B.)

64. *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.)

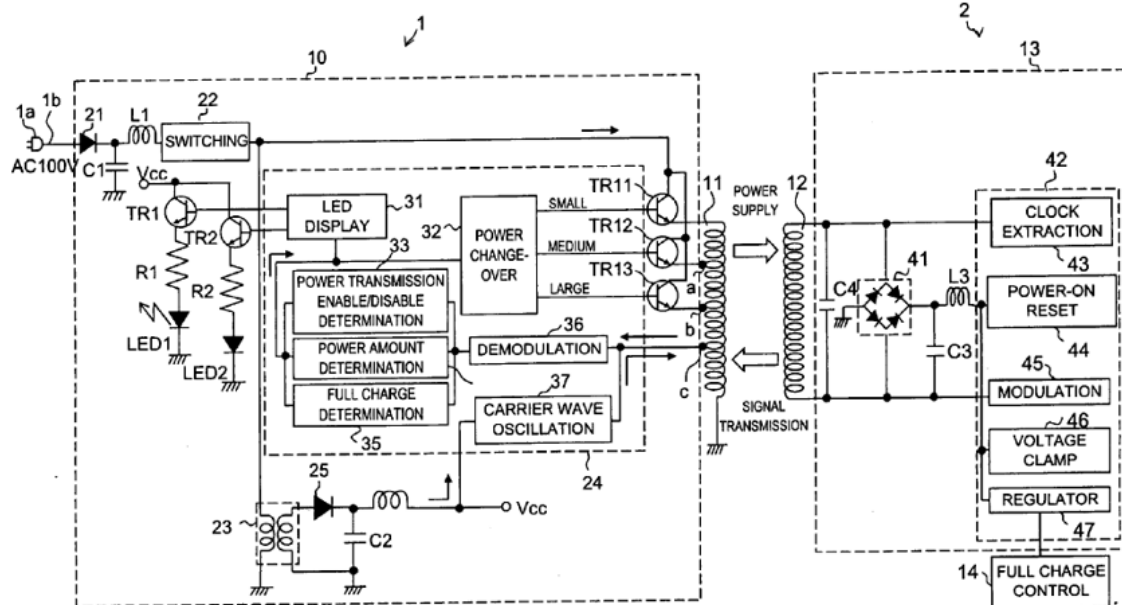


(*Id.*, FIG. 5 (annotated); ¶¶0090-0091.)

65. 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).

66. *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

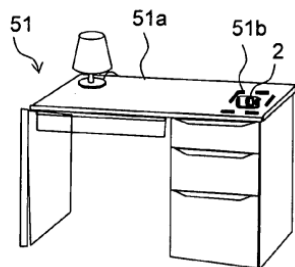


FIG. 13B

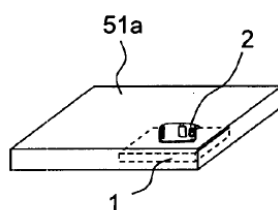


FIG. 13E

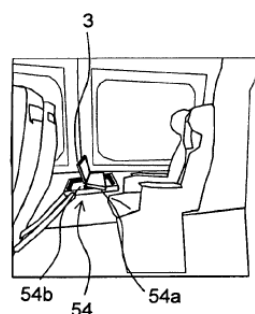


FIG. 14

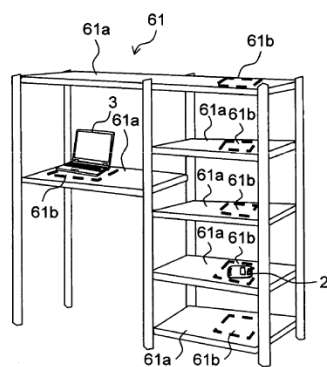


FIG. 15B

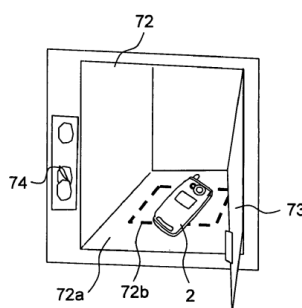
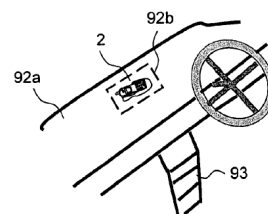


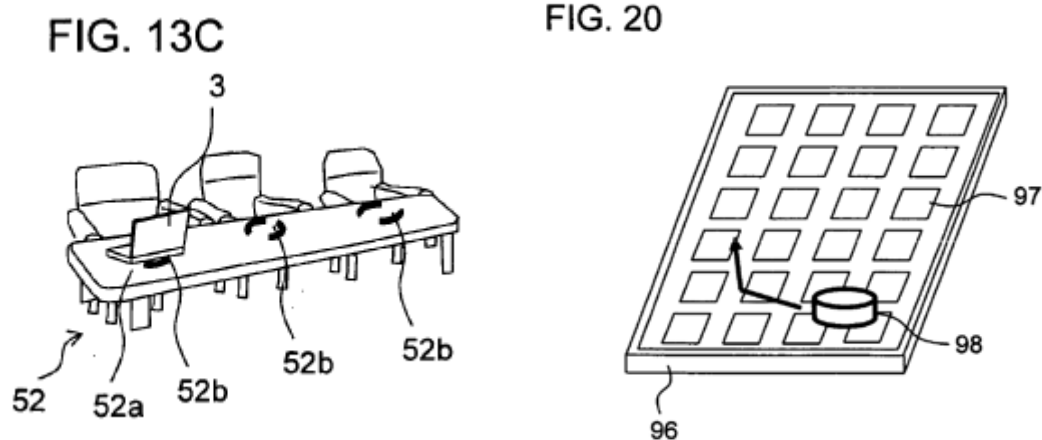
FIG. 18



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

67. *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.)



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

68. *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”**).)

69. 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, 0090-0091.)

70. 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.)

71. *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))³ that is detected and closely positioned/aligned with the secondary side coil (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”**) 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

³ 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.)

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.)

72. 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.”.)

73. *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

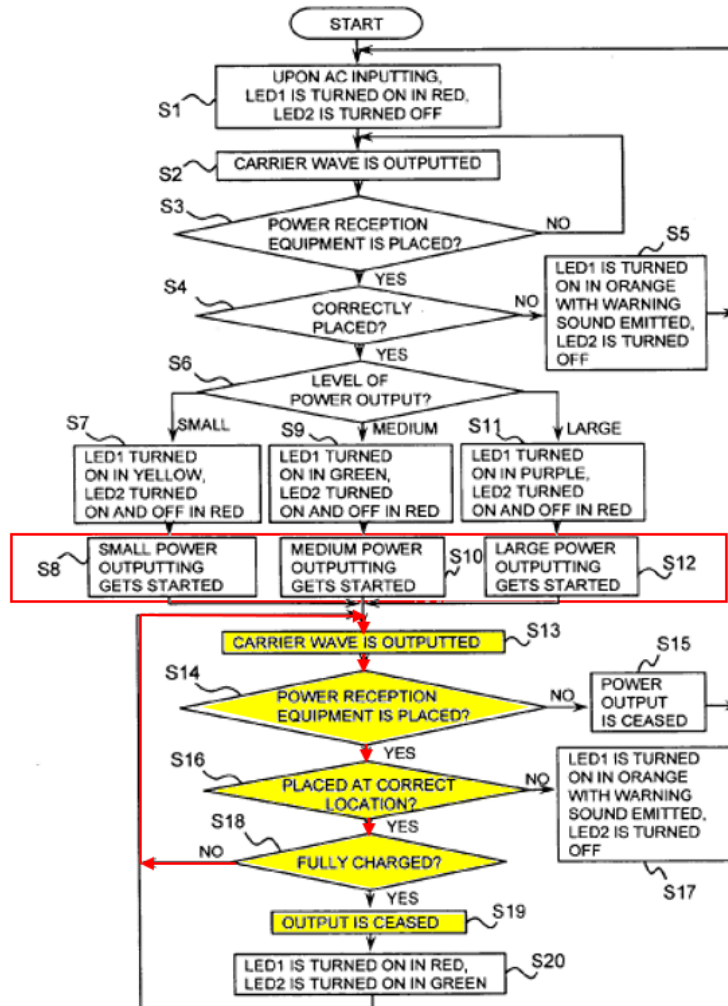
not a deviation of the portable telephone 2 from the power transmission apparatus 1 exceeds a predetermined value. If the positional deviation exceeds the predetermined value, no power transmission is performed from the power transmission apparatus 1. Then, in a similar manner to that in step 5, the 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).)

74. *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. *Odendaal* (Ex. 1008)

75. 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.*) I rely on the disclosures and analysis thereof of *Odendaal* discussed in this section VIII for my opinions regarding *Odendaal*'s teachings and suggestions as applied to the challenged claims of the '440 patent below in Section IX.

76. *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.)

77. *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).)

C. Calhoon (Ex. 1006)

78. I understand that *Calhoon* is a published United States patent application. (Ex. 1006, Cover.) My understanding is that *Calhoon* was filed December 12, 2003 and published June 16, 2005. (*Id.*) I rely on the disclosures and analysis thereof of *Calhoon* discussed in this section VIII for my opinions regarding *Calhoon*’s teachings and suggestions as applied to the challenged claims of the ’440 patent below in Section IX.

79. *Calhoon* discloses an inductive charging system that transfers energy/power by inductively coupling a source coil on an inductive power source to a “receiver coil” for a battery charger/battery pack of a mobile device (inductive power receiver), and other features relating to such an inductive charging system (e.g., detection / identification / verification / authentication of an inductive power receiver, and ensuring proper inductive power transmission). (Ex. 1006, Abstract, ¶¶0002, 0008-0010, 0022-0027, 0029, 0033-0038, 0040-0049, 0050-0052, 0056, 0065, FIGS. 2-4, 5A-5B, 6.) For example, *Calhoon* explains:

Aspects of the present invention provide **inductive charging arrangements** enabling user convenience in wireless power environments for **mobile computing and communications devices**. An **inductive charging system** transfers energy by **inductively coupling a source coil on a power source to a receiver coil for a battery charger portion**. Current flows through the source coil and the resulting magnetic flux induces an alternating current through the magnetic field and across the receiver coil, completing an energy transfer circuit. ... Aspects of the present invention may provide for **wirelessly communicating operating parameters and protocol between an inductive power source and an inductive battery charger**. A **wireless communication arrangement** may also provide for authentication of devices that are allowed by the power source or trusted entity to be powered or otherwise charged.

(Ex. 1006, ¶0022.)

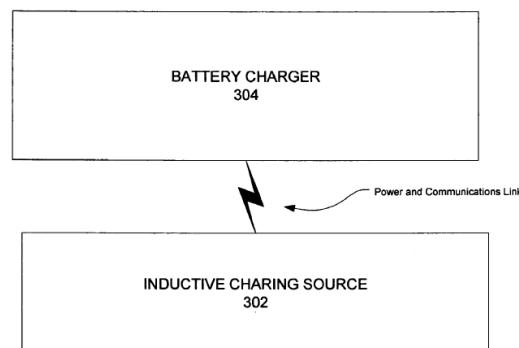


FIGURE 2

(*Id.*, FIG. 2.)

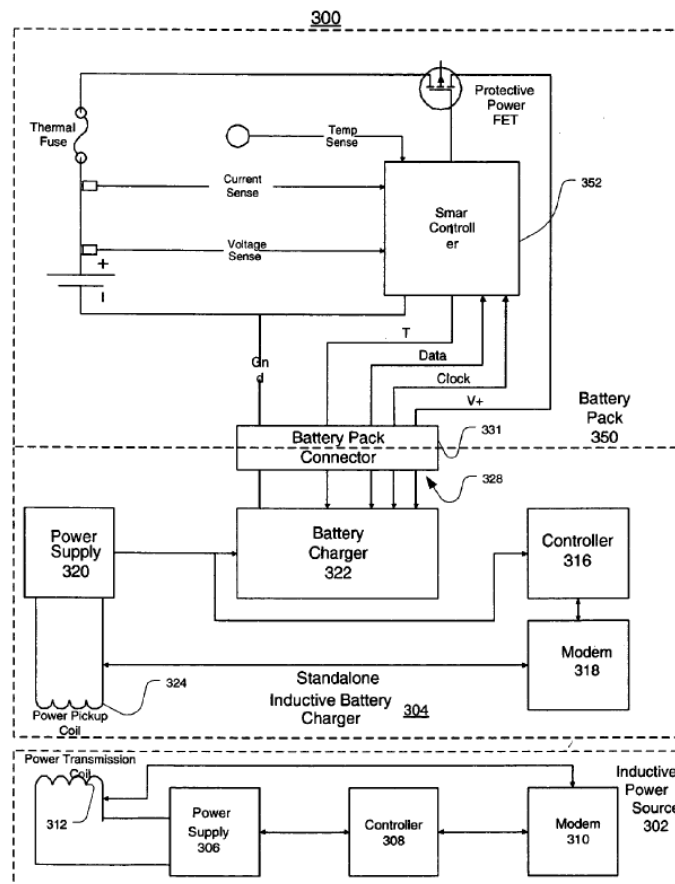


FIGURE 3

(*Id.*, FIG. 3.)

80. *Calhoon* explains that “multiple battery packs may have different power requirements which can be handled by the Source 302. For example, a cellular phone power requirement is less than that of a laptop computer.” (*Id.*, Ex. 1006, ¶¶0045.) *Calhoon*’s inductive power source is capable of powering/charging different mobile devices/batteries with different power/charge requirements or characteristics. (See, e.g., Ex. 1006, ¶¶0033, 0037, 0044-0045, 0047-0049, 0056, 0065.)

81. *Calhoon* explains that various information regarding a battery charger/battery pack (inductive power receiver) (e.g., power/charging requirements, charging parameters, ID/serial numbers, manufacturer's names, security certificates, digital signatures, etc.) can be obtained, stored, transmitted/communicated (e.g., between inductive power receiver and inductive power source), and/or used for *Calhoon's* inductive power transfer operations. (*Id.*; see also Ex. 1006, Abstract, ¶¶0022, 0034, 0036-0038, 0040-0049, 0050-0052, 0056, 0065-0066, FIGS. 2-3, 4, 5A-5B, 6.)

82. For example, *Calhoon* explains:

In one arrangement, **controller 316 may contain computer readable data programmed by the manufacturer or other entity, such as a battery charger ID number, serial number, manufacturer's name and date of manufacture. This data can be used by the inductive power source 302 for novel power operations** according to aspects of the present invention, such as shown in FIGS. 5A, 5B, and 6.

(*Id.*, ¶0042.) *Calhoon* also explains:

[B]attery charger assembly 304 is enabled to determine **the power requirements or other data of a battery pack 350** when inserted into communication bus 328. **Requirements data are obtained from the smart**

controller 352 of battery pack 350. In one implementation, the requirements data may include those as specified in the smart battery data specification revision 1.1 available from the SBS Implementer Forum. For example, **values for the charging current and the charging voltage may be determined from the battery pack 350.** The requirements data, once obtained from the battery pack 350, may be stored in the computer readable storage 415 of controller 316 for use during charging operations or for later transmission to the inductive power source 302. Nevertheless, the controller 316 of battery charger assembly 350 may be configured to read, via the bus 328, **other functions, alarms, and signals from the battery pack 350.** For example, values can be obtained from the battery pack 350 for battery pack voltage, relative state of charge, absolute state of charge, remaining capacity, full charge capacity, alarm warning, average time to full, battery chemistry.

(*Id.*, ¶0044; *see also id.*, ¶0049 (“[C]ontroller 316 of the battery charger assembly 304 may determine or otherwise access the battery pack 350 **charging requirements and charge parameters** as discussed with respect to block 500 shown in FIG. 5A. The **requirements data and parameters can be stored** in the non-volatile computer readable memory 415 for later use. . . . [T]he **battery pack ID of each battery pack may be stored along with the charging requirements.**

Battery charger assembly 304 may then have a plurality of different charging requirements stored therein.”); *see also id.*, ¶¶0037 (“[B]us 328 can be used to inform controller 316 as to a wide range of information about the legacy battery pack 350, e.g., **current, voltage, power requirements, and rated capacity.**”), 0043 (“[C]ontroller 316 may have computer-readable media 415, which provides nonvolatile storage of computer-readable instructions, data structures, program modules and other data relevant for charging operations.”).)

83. *Calhoon* also explains that various information regarding a battery charger/battery pack (e.g., inductive power receiver) that has been obtained (e.g. power requirements, charging parameters, ID/serial numbers, security certificates, digital signatures, etc.) can be transmitted/communicated wirelessly from an inductive power receiver to an inductive power source to be used for *Calhoon*’s inductive powering/charging processes (e.g., for ensuring proper power transmission with appropriate voltage/power, “security, data integrity, or other purposes,” or authenticating an inductive power receiver with an inductive power source). (Ex. 1006, Abstract, ¶¶0022, 0034, 0036, 0042, 0046-0048, 0050-0052, 0056, 0065, FIGS. 2-3, 4, 5A-5B, 6; *see also* citations to *Calhoon* in this section.)

84. For example, *Calhoon* explains:

[T]he source 302 may request information or charging parameters from the battery charger assembly 304,

such as the required charging voltage and maximum power requirement. Nevertheless, the inductive charging source 302 can request other information relevant to the battery charger assembly 304, such as a battery charger identification (ID) number, battery type chemistry of the battery pack, or serial number of the battery charger or the serial number of the battery pack. This information can be used for security, data integrity, or other purposes. In process block 508, the battery charger assembly 304 transmits the requested information. In process block 510, the source 302, via controller 308, determines if it can supply the requested voltage and power to battery charger assembly 304. In process block 512, if the source 302 cannot supply the requested voltage and/or power, then the source 302 can change to the polling mode. Alternatively, if the source 302 can provide the voltage and/or power, then the process flows to process block 514 for the charging mode.

After the negotiation process, in process block 514, when the battery charger assembly 304 begins to receive its requested voltage and power, the controller 316 may turn on the battery charger 322 in order to charge the battery pack 350.

(Ex. 1006, ¶¶0047-0048; *see also id.*, ¶¶0034 (“[M]odem 310, 318 may be adapted to modulate and demodulate signals appropriate to the frequency supplied by the power supply 306, 320 to **receive and transmit data**. Thus, **the power transmission coil 312 of the charging source 302 and the power pickup coil 324 of battery charger assembly 304 are used to provide inductive data communications over an inductive pathway.**”), 0050 (“[I]nductive charging source 302 and battery charger assembly 304 may be configured for **wireless data communications.**”).)

85. *Calhoon* also explains that information such as a digital certificate or digital signature is used to authenticate an inductive power receiver:

In process block 606, upon receiving the battery pack’s request for power, **the inductive charging source 302 may request for a security certificate or digital signature from the battery charger assembly 304 to authenticate it**. The security certification or digital signature may be stored in the computer readable storage of the controller 308. In process block 608, **if battery charger assembly 304 has a digital certificate or digital signature stored, the battery charger assembly 304 transmits it to the source 302**. In process block 610, **if the battery charger assembly 304 is authenticated in view of the certification or signature, the source 302 supplies the**

requested voltage and power the battery charger as shown in process block 612.

(Ex. 1006, ¶0052; *see also id.*, Abstract, ¶¶0022, 0036, 0042, 0050, 0065, FIGS. 2-3, 5A-5B, 6.) *Calhoon* explains that such inductive “energy transfer based on authentication information [] form[s] a trusted energy transfer arrangement [which] is useful to prevent authorized [sic - unauthorized] use of an inductive charging source [and] may prevent a computer virus from infecting the controller 316 or the host device 100.” (*Id.*, ¶0050; *see also id.*, ¶¶0022, 0065, FIGS. 3, 6.)

86. *Calhoon* also teaches mechanism (e.g., in an inductive power receiver/mobile device) for avoiding overcharging of a mobile device battery. For example, *Calhoon* explains:

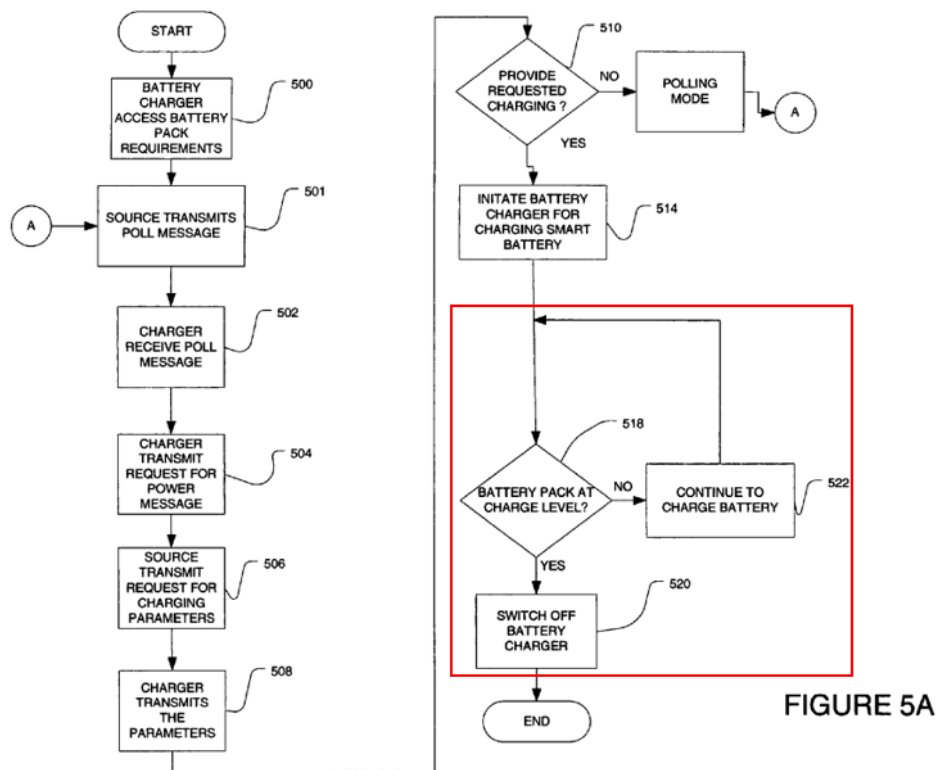
In another alternative arrangement, a thermistor or “T” line between the charger 322 of battery charger assembly 304 and the battery pack 350 can be used as a **safety control to disrupt charging in the event the battery pack 350 experiences an overcharge or over-temperature condition.**

(Ex. 1006, ¶0038; *see also id.*, FIG. 3.) *Calhoon* also explains:

After the negotiation process, in process block 514, when the battery charger assembly 304 begins to receive its requested voltage and power, the **controller 316 may turn on the battery charger 322 in order to charge the**

battery pack 350. In process block 520, **if the battery is charged to the desired level, the battery charger 322 can be switched off-line.** When power from the source is lost, the battery pack returns to its listening mode. In process block 522, if the battery 314 is not at the desired level of charge, then the charging process is continued.

(*Id.*, ¶¶0048; *see also id.*, ¶¶0038, 0040, 0043, 0044, 0048, 0066, FIGS. 3-4, 5A.)



(*Id.*, FIG. 5A (showing that a battery charger is switched off if a battery pack is at a desired charge level) (annotated); *see also id.*, ¶¶0038, 0048, FIG. 3.)

IX. THE PRIOR ART DISCLOSES OR SUGGESTS ALL RECITED FEATURES OF CLAIMS 3 AND 13 OF THE '440 PATENT⁴

A. Ground 1: *Nakamura* in view of *Odendaal* and *Calhoon* Discloses and/or Suggests the Features of Claims 3 and 13

87. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests all of the features of claims 3 and 13 of the '440 patent.

1. Claim 3

a) A system for use with a mobile device for charging or powering the mobile device inductively by a universal base unit for charging of different mobile devices and/or batteries of different charging characteristics associated therewith, comprising:

88. I understand that this phrase is the preamble of claim 3, 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 analysis*

⁴ 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.)

and discussions below for this section; *see also* my analysis and discussions below for Sections IX.A.1(b)-(m)⁵.)

89. As I explain below, *Nakamura* discloses a “**mobile device**” (e.g., power reception equipment such as portable phone 2 or notebook PC 3 (which I will also refer to as “device 2/3” in my discussions)) in a power charging/supply system (“**system**,” e.g., the power charging/supply system including device 2/3 and power transmission apparatus 1 (“apparatus 1”) (among other components)) that is “**for use with a mobile device [e.g., device 2/3] for charging or powering the mobile device inductively by a universal base unit [e.g., apparatus 1] for charging of different mobile devices and/or batteries [e.g., device 2/3 and/or its battery] of different charging characteristics associated therewith.**”

90. For example, *Nakamura* explains that the power charging/supply system (“**system**”) includes apparatus (“**base unit**”) with primary side circuit and coil(s) and power reception equipment (“**mobile device**”) with a secondary side coil “magnetically coupled to the primary side coil,” such that “a single power

⁵ My analysis/discussions of *Nakamura* and supporting citations to *Nakamura* in this section are applicable to the analysis/discussions for all limitations of claims 3 and 13, and are incorporated by reference fully below in each of those sections even where not expressly cited or referenced.

transmission apparatus [**“universal base unit”**] can supply power [inductively] to *different types of power reception equipment* (**“mobile devices”**) and batteries (**“batteries”**) with different power/charging requirements (**“charging characteristics”**):

According to another aspect of the invention, **a power supply system comprises: a primary side coil**; a power transmission apparatus having a primary side circuit for feeding a pulse voltage to the primary side coil, the pulse voltage resulted from switching a DC voltage which is obtained by rectifying and smoothing a commercial power supply; **a secondary side coil magnetically coupled to the primary side coil**; and power reception equipment having a secondary side circuit for rectifying and smoothing an induced voltage induced across the secondary side coil, wherein there is provided **a power adjusting section for adjusting a level of power to be transmitted according to power required by the power reception equipment. With this configuration, a single power transmission apparatus can supply power to different types of power reception equipment.**

(Ex. 1005, ¶0018; *see also id.*, Abstract, ¶¶0003, 0016 (system is capable of “supplying power to **different** types of electronic equipment”), 0017, FIGS. 1A-2B, ¶0062 (FIG. 1A—portable telephone 2 (**“mobile device”/“battery”**), FIG. 1B—

notebook PC 3 (different “**mobile device**”/“**battery**”)), FIGS. 2A-2B, ¶0064
(discussing FIGS. 2A and 2B).)

91. *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.** 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.

(*Id.*, ¶0062; *see also id.*, ¶¶0063 (“Since the power transmission apparatus 1 . . . transmit[s] power necessary for the power reception equipment thereto depending on the type, **a single power transmission apparatus 1 can charge even batteries of electronic equipment different in power required for charging, such as the portable telephone 2 and the notebook PC 3.**”), 0064, 0065, 0110 (“apparatus 1 can **charge various types of equipment . . . having a battery such as PDAs, digital cameras, camcorders, or the like**”); *see also* my analysis and discussions in Sections IX.A.1(b)-1(c), 1(d), 1(h), 1(m) (charging characteristics) below; *see also* my analysis and discussions in Section VIII.A above.)

FIG. 1A

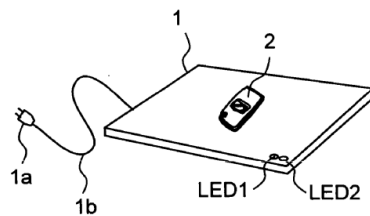
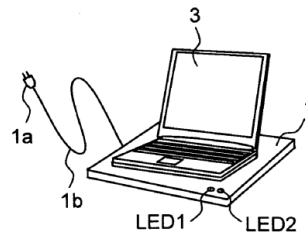
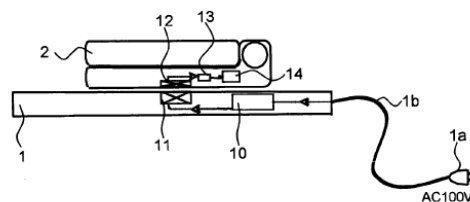


FIG. 1B



(Ex. 1005, FIGS. 1A-1B.)

FIG. 2A



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

92. Nakamura also explains:

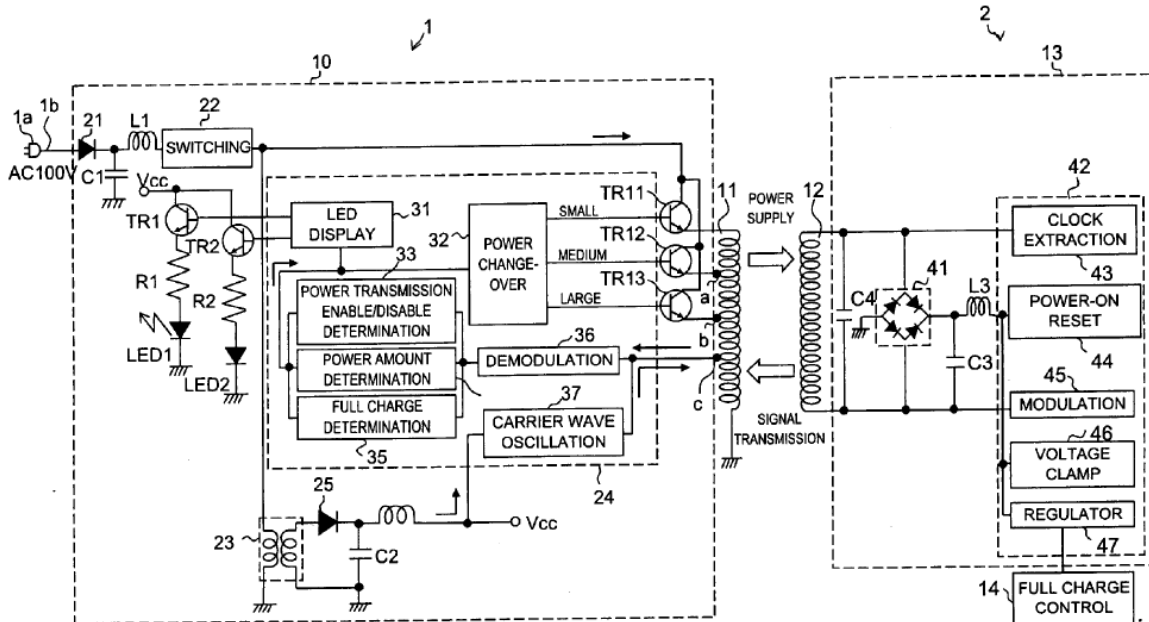
The primary side circuit 10 full-wave rectifies and smoothes AC 100 V supplied through the AC plug 1a and the cord 1b to convert the AC 100 V once to a DC voltage, and thereafter the DC voltage is subjected to switching to obtain a pulse voltage which is then supplied to the primary side coil 11. *The 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.*, ¶0062, FIGS. 3-5.)

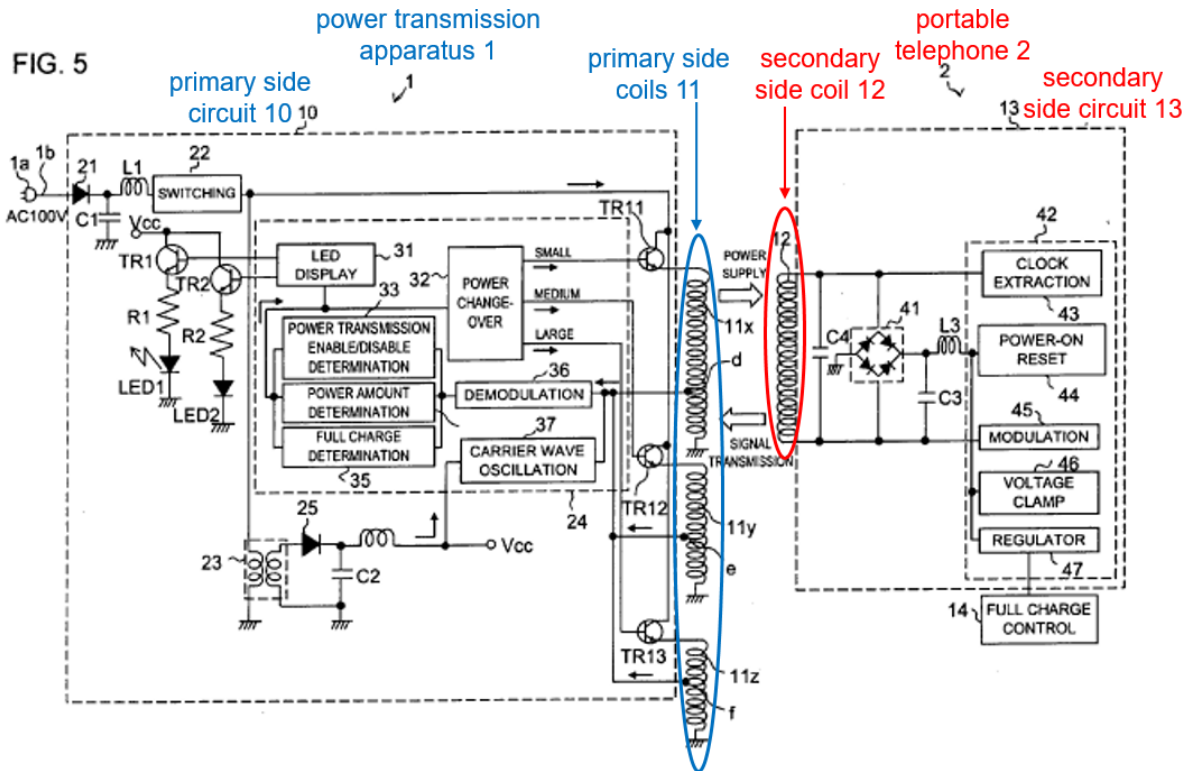
93. *Nakamura* explains that the primary side coil in apparatus 1 can have multiple taps at different turns or can be configured with a “plurality of coils each having a different number of turns,” which allows the apparatus (“**universal base**

unit”) to select and provide different levels of power from the apparatus (“**universal base unit**”) depending on the power requirements (“**charging characteristics**”) of device 2/3 (“**mobile device**”) via inductive power transfer. (Ex. 1005, ¶0019; *see also* citations above.) FIG. 3 (below) shows an exemplary a multi-tap primary coil configuration and FIG. 5 (below) shows an exemplary multi-primary coil configuration that perform the power/charge operations/functions disclosed by Nakamura.

FIG. 3



(*Id.*, FIG. 3.)



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

94. Nakamura explains that information signals (e.g., modulated wave containing information such as “information on consumed power” regarding device 2/3) transmitted from device 2/3 to apparatus 1 provides charging characteristic information that is used to determine the proper power level to transmit to a detected and properly aligned device for powering/charging the device/battery. (Ex. 1005, ¶¶0077-0085, 0090, 0091 (“one of the transistors is selected . . . 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,” which allows “a coil for transmitting power [to] be selected, and power required for the

power reception equipment [to] be transmitted” (e.g., small, medium, large)), FIGS.

3-5.) 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).

(Id., ¶¶0083-0084, FIGS. 3-5.)

95. *Nakamura* also explains (e.g., with respect to the FIG. 5 configuration):

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.

(*Id.*, ¶0091; *see also id.*, FIGS. 3-5.)

96. Therefore, for the reasons discussed above, *Nakamura* discloses a “**universal base unit**” (apparatus 1) capable of inductively charging different mobile devices or their respective batteries that each have “**different charging characteristics.**” (*Id.*; *see also* citations to *Nakamura* above; *see also* my analysis and discussions in Sections IX.A.1(b)-(m); *see also* my analysis and discussions in Section VIII.A.) In my opinion, *Nakamura*’s teachings are consistent with a person of ordinary skill in the art’s knowledge that different devices and their batteries can have different charging characteristics. (*Id.*; *see, e.g.*, Ex. 1005, ¶¶0005-0015; Ex. 1006, ¶¶0033, 0037, 0040 (“different battery packs can have different charging requirements”), 0044, 0049.)⁶

⁶ I reference Exhibit 1006 here to support my opinions regarding the state of art knowledge of a person of ordinary skill in the art at the relevant time. While I reference Ex. 1006 (*Calhoon*) here to demonstrate state of art knowledge, I rely on

97. In my opinion, a person of ordinary skill in the art would have understood that *Nakamura*'s discussions of similar components, features, and functionalities relating to various configurations (exemplified by the figures) are applicable to others. (*See, e.g.*, Ex. 1005, FIG. 3, ¶0067 ("same constituents as in FIGS. 1A, 2A, 2B are attached with the same symbols and descriptions thereof will not be given herein"), ¶¶0068-0075, ¶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" where the "difference" is use of "primary side coils 11x, 11y, and 11z"), ¶¶0091-0092, 0096-0155); my analysis and discussions above in Section VIII.A.) For example, features/functionalities relating to FIGS. 1A-1B, 2A-2B, and 3 are applicable to each other and the FIG. 5 configuration. (*See, e.g.*, Ex. 1005, ¶¶0063, 0067, 0063, 0090.)

98. For example, *Nakamura* describes various configurations that while arranged slightly different, operate and perform similar features to transfer power and data between the apparatus (e.g., apparatus 1) and the device (e.g., device 2/3) and are applicable to the many different applications *Nakamura* contemplates in the disclosure. For example, as discussed above, in certain configurations, the primary

Calhoon below to address particular claim limitations. (*See, e.g.*, Section IX.A.1(e).)

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 (“**mobile device**”) or its battery (“**batter[y]**”) 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 (“**universal base unit**”) depending on the power required by the power reception equipment (“**mobile device**”) or its battery (“**batter[y]**”) (“**for charging or powering the mobile device inductively by a universal base unit for charging of different mobile devices and/or batteries of different charging characteristics associated therewith**”). (*Id.*, ¶¶0019, 0084; *see also* my analysis and discussions above.)

99. As discussed above, an example of a multi-tap single primary coil configuration is shown in FIG. 3 and an example of multi-primary coil configuration is shown in FIG. 5 (*see* figures above). *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.) A person of ordinary skill in the art would have also understood that *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

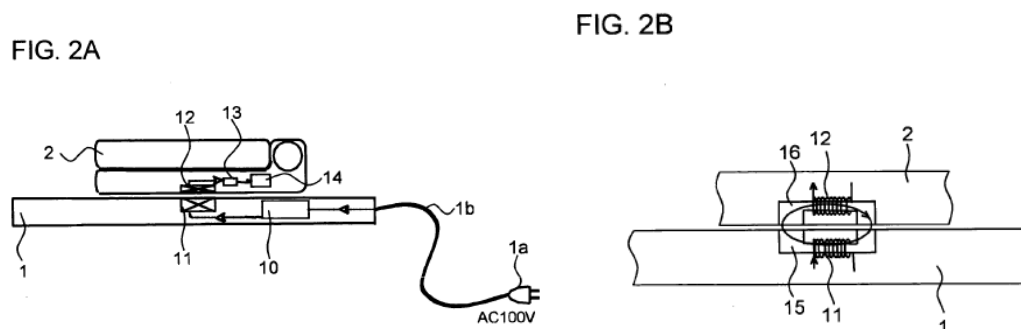
primary side coil 11 of the power transmission apparatus 1,” and that “[i]n this embodiment [relating to FIG. 5], the power transmission apparatus 1 has the configuration in which **three coils for power transmission and respective transistors are provided** [and i]t is also possible to transmit power 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.*, ¶¶0090-0091; *see also id.*, ¶¶0092, 0096-0101, FIGS. 3, 5.) *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.)

100. Thus, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura*’s discussions of similar components, features, and functionalities 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, 21-25, 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”), 0067-0075, 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.”), 0090-0092, 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.”), 0096-0155.)

101. In my opinion, 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 3 of the ’440 patent. (*See, e.g., id.*, ¶¶0063, 0067, 0090.) For example, *Nakamura* explains how apparatus 1 (“**universal base unit**”) includes primary side coil 11 and has functionalities to recognize when device 2/3 (“**mobile device**”) is placed on apparatus 1 (“**universal base unit**”) “so as to transmit power necessary for the power reception equipment thereto depending on the type” (Ex. 1005, ¶0063), and how the power transmission apparatus 1 (“**universal base unit**”) can “charge even batteries [**batteries**] of electronic equipment different in power required for charging, such as the portable telephone 2 and the notebook PC 3” (“**mobile device**”) (*id.*). *Nakamura* also explains, “Though not shown, any type of electronic equipment [**mobile 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 apparatus 1 (“**universal base unit**”) and a portable telephone 2 (“**mobile device**”) and their respective coils.



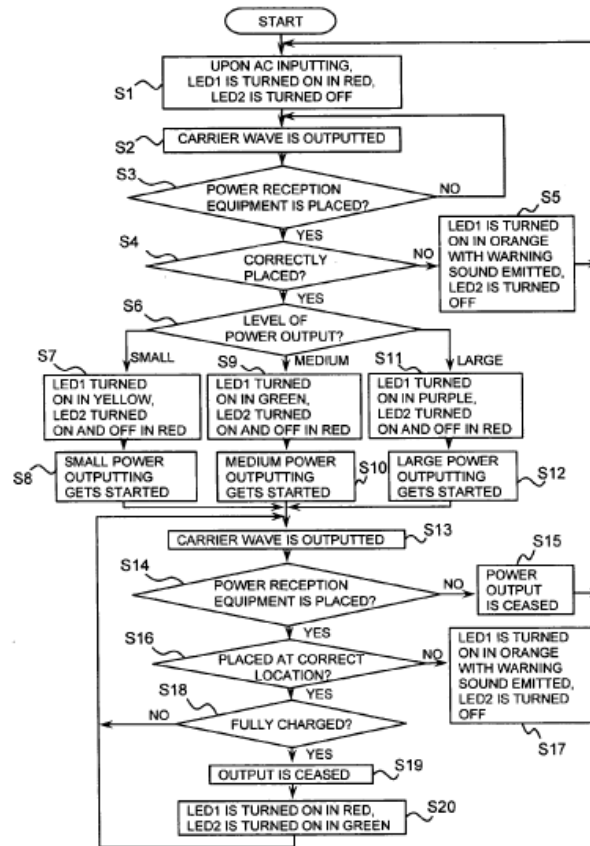
(*Id.*, FIGS. 2A-2B.) (See also *id.*, ¶0065 (describing primary side circuit 10 of apparatus 1 as full wave rectifying and smoothing AC 100V through plug 1a, to provide a DC voltage that is subjected to switching to provide a pulse voltage to the primary side coil 11, and how primary side coil 11 and secondary side coil 12 (in the “**mobile device**” 2) “form a transformer through magnetic coupling”).)

102. With respect to FIG. 3, *Nakamura* describes components and associated features in apparatus 1 (“**universal base unit**”) 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, rectifier, and switching circuits (L1, C1, 21, 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, 0090-0092.)

Similarly, *Nakamura* describes components and features associated with the receiving device side (device 2/3 (“**mobile device**”)) (e.g., rectifier 41, C4, L3-C3, IC 42, clock extraction 43, power-on reset circuit 44, modulation 45, 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.)

103. *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 “**system**” (and “**universal base unit**” and “**mobile device**”) including those of FIG. 3 and FIG. 5. (Ex. 1005, FIG. 4, ¶¶0076-0089.)

FIG. 4



(*Id.*, FIG. 4.)

104. Likewise, in my opinion, a person of ordinary skill in the art would have understood that the alternate configuration of using 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.) 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 (“**system**”) described in *Nakamura*, including those of FIGS. 3 and 5. (*Id.*, FIGS. 11A-11B, FIG. 12, ¶¶0080-0081, 0089.)

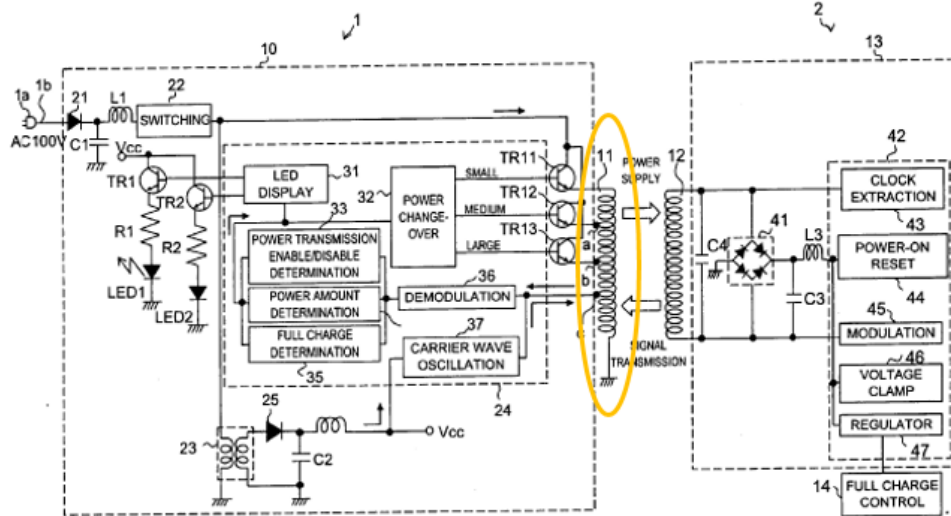
105. Additionally, in my opinion, a person of ordinary skill in the art would have understood the exemplary applications and configurations associated with respect to e.g., FIGS. 8-9, 11A-11B, 12, 13A-13E, 14, 15A-15B, 16-20, 21-25 (among others), are applicable to the various power supply system configurations and operations 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 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.”); see also *id.*, ¶¶0080-0081, 0089, 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]”), ¶¶0126-0155.) (See also my analysis and discussions in Sections IX.A.1(b)-(m); see also my analysis and discussions in Section VIII.A.)

- b) **a universal base unit including one or more primary coils therein, each primary coil having a generally planar shape so that when a current is passed through the primary coil a magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil;**

106. In my opinion, *Nakamura* in view of *Odendaal* 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), IX.A.1(c)-(m); see also my analysis and discussions in Sections VIII.A, VIII.B.)

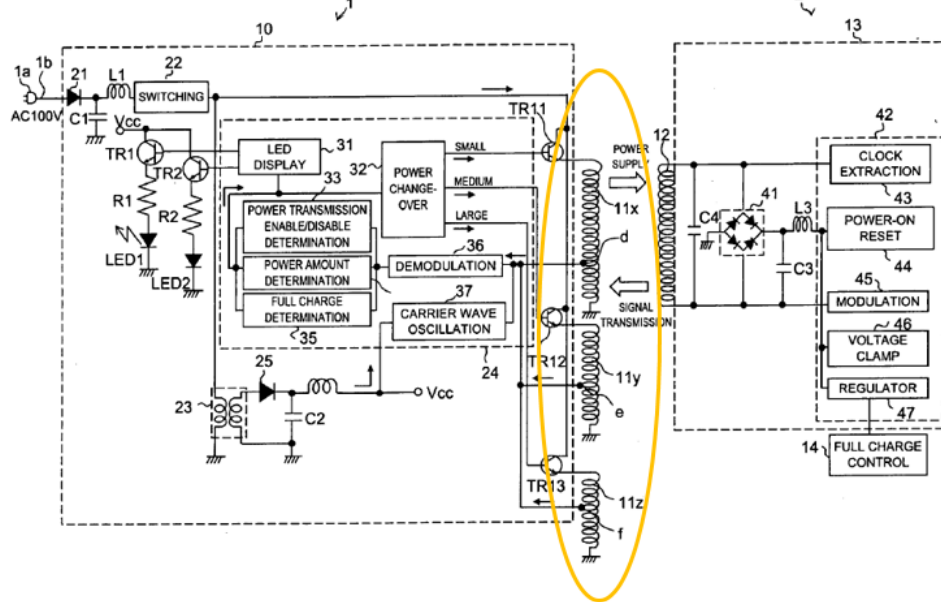
107. As I explained above, apparatus 1 is a “**universal base unit.**” (See my analysis and discussions in Section IX.A.1(a).) Also, as I explained above, apparatus 1 includes “**one or more primary coils.**” (*Id.*) For example, *Nakamura* discloses one or more primary coils that are arranged behind and parallel to the surface of apparatus 1 and can be positioned within the base unit. (*Id.*; see, e.g., Ex. 1005, ¶¶0017-0019, 0064-0065.) As I explained above for limitation 3(a), FIG. 3 shows an exemplary configuration with one multi-tap primary coil 11, and FIG. 5 shows a configuration with three primary coils (11x-11z). (*Id.*; Ex. 1005, ¶¶0090-0091, FIGS. 3, 5 (annotated below); see also my analysis and discussions in Section IX.A.1(a); see also my analysis and discussions in Section VIII.A.)

FIG. 3



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

FIG. 5

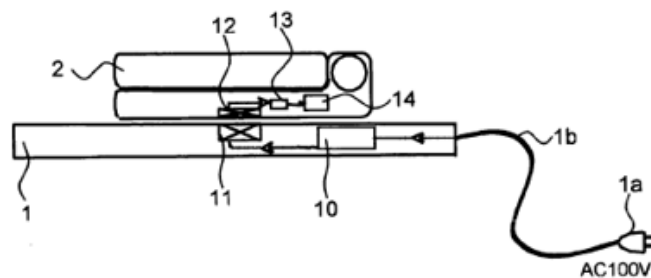


(Id., FIG. 5 (annotated).)

108. In my opinion, a person of ordinary skill in the art would have understood that *Nakamura* explains (e.g., with respect to FIGS. 2A-2B (shown

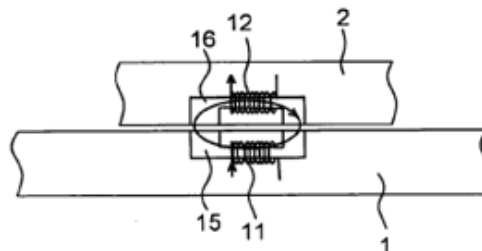
below)) how primary coil 11 can be positioned within apparatus 1, and arranged behind and parallel to a surface thereof (*id.*, ¶0064), which (as with other described configurations of *Nakamura*) provides power through magnetic coupling (e.g., with secondary coil 12) for device 2/3. (Ex. 1005, ¶¶0065, 0068-0073, 0076-0088, 0090-0091; *see also* my analysis and discussions in Section IX.A.1(a); *see also* my analysis and discussions in Section VIII.A.)

FIG. 2A



(Ex. 1005, FIG. 2A.)

FIG. 2B



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

109. *Nakamura* also discloses applications/setups/configurations where apparatus 1 is embedded in a top plate of a desk, shelves, locker, holder, dashboard, mat, wall, floor, floor covering fabric, etc. (*See, e.g.*, Ex. 1005, FIGS. 13A-20, ¶¶0107-0124, 0153, 159; *see also* my analysis and discussions in Section VIII.A.) A person of ordinary skill in the art would have understood that in such configurations, apparatus 1 and its primary circuit 10 with primary coil(s) 11 are embedded, positioned, arranged, behind a surface of apparatus 1 or its host component (e.g., desk, shelf, mat, floor, etc.) to allow a present and properly positioned device 2/3 and its battery to be inductively powered/charged. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a), (j)-(l).) In my opinion, 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*. (*Id.*; *see* Ex. 1005, ¶0008 (discussing JP 2001-16789 as having primary coil “installed below a body placement section of the charger”).)

110. In my opinion, a person of ordinary skill in the art would have understood that the one or more primary coil(s) each generates a “**magnetic field**” “**when a current is passed through the primary coil**” such that the “**magnetic field is generated in a direction substantially perpendicular to the plane of the primary coil,**” including as the system is modified in view of *Odendall* below. (*See* my analysis and discussions above and below in this section.) For example, as I

explained, *Nakamura* explains that the power/voltage inductively transmitted between the primary side and secondary side coils involves a magnetic field. (*Id.*; Ex 1005, ¶¶0018 (“secondary side coil magnetically coupled to the primary side coil”), 0062, 0065, 0077-0080, 0090-0091, FIGS. 2A-2B, 3-5, Abstract, Claim 2; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a).)

111. Apparatus 1 includes components (e.g., transistors TR11/TR12/TR13, components 32-35, etc.) that activate the coil(s) (via tap(s) (FIG. 3) or coils 11x/11y/11z (FIG. 5)) to transfer appropriate voltage/power (determined from “consumed power” information of device 2/3). (Ex. 1005, ¶¶0069-0071, 0077, 0083-0085, 0090-0091, FIGS. 3-5.) For example, as I explained above, apparatus 1 can be configured with transistors TR11/TR12/TR13 that are each associated with a particular tap(s) (FIG. 3) or separate coil (FIG. 5) in the one or more primary coil(s). (Ex. 1005, ¶¶0068-0069 (TR11 connected to end of primary coil 11, TR12-TR13 connected to taps a, b, respectively); *see also id.*, ¶0090 (“coil 11[x, y, z] is connected to the emitter of the transistor TR[11, 12, 13]”); *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a).) As I also explained above, *Nakamura* explains that “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.*; Ex. 1005, ¶0090; *see also id.*, ¶¶0069-0071, 0077, 0083-0085, 0091.) *Nakamura*

explains, for example, where power for device 2/3 “is small, a coil with a large number of turns is used” and where power for the device “is large, a coil with a small number of turns is used.” (Ex. 1005, ¶¶0090; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a).)

112. As I explained above, in operation, a pulsed voltage obtained from switching circuit 22 is connected to transistors TR11-TR13, which allows the pulsed voltage to be applied across a selected tap/coil in coil 11 or coils 11x/11y/11z, thereby allowing power to be transmitted from a selected/activated primary tap/coil to the secondary coil 12 of a correctly placed device 2/3 via magnetic coupling. (*Id.*; Ex. 1005, FIGS. 3-5, ¶¶0065, 0079-0083, 0084 (“when transistor TR11 is turned on, a pulse voltage . . . is applied across the total length of primary side coil 11 to start power transmission . . .”), 0090-0091; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a).)

113. In my opinion, a person of ordinary skill in the art would have understood that by applying the pulsed voltage to an activated primary coil, a **current** necessarily passes through the primary coil, because voltage and current is necessarily included in the pulsed voltage signal provided to the activated coil, consistent with inductive-based power transfer techniques/technologies known by such a skilled person at the time. (Ex. 1005, ¶¶0065, 0076-0087, 0090-0091; *see also* my analysis and discussions in Sections V, VIII.A, IX.A.1(a).) For example, in

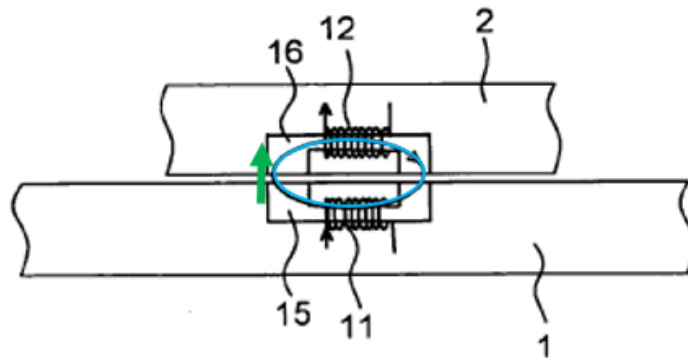
my opinion, a person of ordinary skill in the art would have understood that by applying a voltage across a primary side coil and inducing a voltage across a secondary side coil by magnetic coupling, a voltage/current is inductively passed through the primary side coil and a generated magnetic field to the secondary side coil, consistent with known contactless inductive-based power transfer techniques/technologies. (Ex. 1005, ¶¶0065 (“**when the pulse voltage obtained by switching is applied across the primary side coil 11, a voltage [and thus current] is induced across the secondary side coil 12 by magnetic coupling . . .**”), 0076-0087, 0090-0091; Ex. 1006, ¶¶0022 (“**Current flows through the source coil and the resulting magnetic flux induces an alternating current through the magnetic field and across the receiver coil, completing an energy transfer circuit.**”), 0031; Ex. 1009, 2:62-3:8, 1:54-2:18, 3:20-4:11, FIGS. 1-3; 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**”), FIGS. 6A-10, 7:21-8:54, 9:53-10:22, 11:27-14:67; Ex. 1029, 3-4, 27-50; *see also* Section V.)⁷

⁷ I reference Exhibits 1006, 1009, and 1010 here to support my opinions regarding the state of art knowledge of a person of ordinary skill in the art at the relevant time (like other extraneous references I may refer to throughout this Declaration when

114. Also, in my opinion, a person of ordinary skill in the art would have understood that the activated primary coil, due to the current flow, generates a **magnetic field** in a direction **substantially perpendicular** to the surface (and plane) of the apparatus 1 (or host of apparatus 1 (e.g., desk/table, shelf, mat, floor, etc.)) and the plane of the activated primary coil for powering/charging device 2/3 or its battery as described by *Nakamura* and consistent with such a skilled person's knowledge at the time. (*Id.*; see also my analysis and discussions below and in Sections V, VIII.A, IX.A.1(a).) For example, in my opinion, a person of ordinary skill in the art would have understood that FIG. 2B of *Nakamura* (annotated below) discloses a magnetic field (**blue** below) that is generated by the inductive/magnetic coupling between coils 11 and 12 that is perpendicular (**green**) to a plane of the surface of apparatus 1 and device 2/3 and their coils, consistent with inductive power/data transfer configurations known to such a skilled person. (*Id.*)

discussing what such a skilled person would have understood/appreciated, etc.). While I reference Ex. 1006 (*Calhoon*) here to demonstrate state of art knowledge, I rely on *Calhoon* below to address particular claim limitations. (See, e.g., Section IX.A.1(e).)

FIG. 2B



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

115. As I mentioned previously, *Nakamura* discloses:

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, 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, 0080-0082, FIGS. 11A-11B, ¶¶0090-0091; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a), (k).)

116. In fact, *Nakamura* 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 (“FIGS. 11A and 11B are graphs showing relationships between a relative position of the portable telephone 2 to the power transmission apparatus 1 (a positional deviation of the portable telephone 2 from the power transmission apparatus 1) and a transmission efficiency of power and the information signal.”).)

FIG. 11A

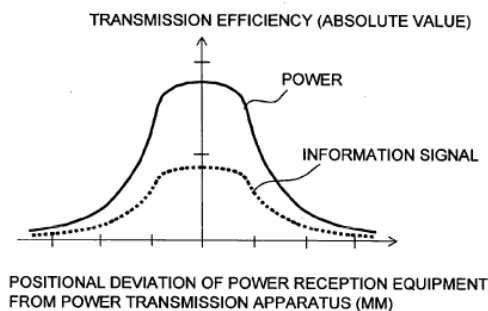
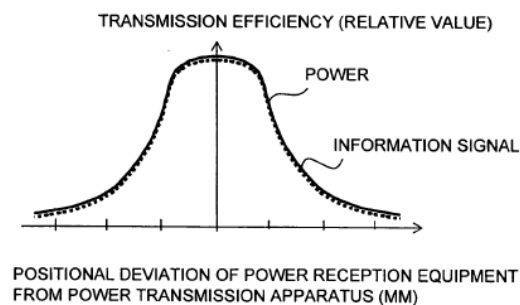


FIG. 11B



(*Id.*, FIGS. 11A-11B.) *Nakamura* discusses how,

When the power transmission apparatus 1 and the portable telephone 2 are located at positions where the highest 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, the deviation is given 0,

deviations in a left-to-right direction or a forward-to-rearward direction of the portable telephone 2 from the position with the deviation of 0 are measured in units of mm.

(*Id.*, ¶0080.) Further,

As shown in FIG. 11A, the **larger the deviation** of the portable telephone 2 from the power transmission apparatus 1 becomes, **the lower the transmission efficiencies** of both power and information signal drop. Since the transmission efficiencies of power and information signal are, as shown in FIG. 11B, reduced at the same rate with an increase in deviation of the portable telephone 2 from the power transmission apparatus 1, **a deviation of the portable telephone 2 from the power transmission apparatus 1 can be recognized by measuring a signal intensity of the information signal** even in a state where the power transmission apparatus 1 transmits no power.

(*Id.*, ¶0081.) *Nakamura* also explains,

Since the **larger the positional deviation of the portable telephone 2 from the power transmission apparatus 1** becomes, **the lower the transmission efficiencies of power and information signal drop**, there will be no meaning to transmit the power, because the portable

telephone 2 is not capable of receiving it in a case where the power transmission efficiency is extremely low.

Therefore, 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.

(*Id.*, ¶0082). “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, the process moves to a process for determining a level of power to be transmitted (step S6).” (*Id.*, ¶0083.) (*See also id.*, ¶¶0090-0091, 0096-0098.)

117. As I explained above, the understanding of a person of ordinary skill in the art—that the above-discussed activated primary 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 (and plane) of the apparatus 1 (or host of apparatus 1) (e.g., inductive power source) and the plane of the activated primary coil—is consistent with knowledge of such a person of ordinary skill in the

art. For example, *Koreis* (Ex. 1009) and other references I reference below⁸ 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 comprises a two-part transformer, wherein the transformer has a flat configuration so as to fit within,**

⁸ I reference *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.

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.)

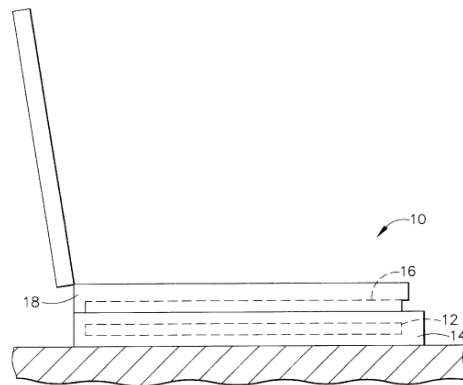


FIG. 1

(*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 substantially perpendicular to the plane of the activated inductive coil 12 (e.g., activated primary coil) and a surface of an inductive power source such as charging unit 14. (*Id.*; *id.*, 2:46-3:8.) Such teachings are consistent with the

above-discussed knowledge of a person of ordinary skill in the art regarding an activated primary coil of an inductive/contactless power supply system generating a **magnetic field** in a direction **substantially perpendicular** to the plane of the activated primary coil (similar to the activated primary coil of *Nakamura*) and the surface of an inductive power source (similar to apparatus 1 of *Nakamura*), which are also consistent with the above-discussed disclosures 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; Ex. 1004, 1311-1386, 1363-1365; *see also* Section V.) In my opinion, a person of ordinary skill in the art would have understood that such features are also disclosed/suggested in the modified *Nakamura* device/system discussed below. (*Id.*)

118. In my opinion, while *Nakamura* does not expressly disclose that each of the one or more of the primary coil(s) (11 or 11x/11y/11z) has “a **generally planar shape** so that when a current is passed through the primary coil a **magnetic field** is generated in a direction **substantially perpendicular to the plane of the primary coil**,” a person of ordinary skill in the art would have been motivated

to configure the *Nakamura* system to implement and use planar coils for one or more primary coil(s) 11 of apparatus 1 (and also for secondary/receiver coil 12 of device 2/3) in view of the teachings/suggestions of *Odendaal*, complemented by such a skilled person's knowledge in the art. In my opinion, 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 form factor, compact, and/or planar type designs/arrangements (e.g., apparatus 1 embedded in the surface of a desk/table, locker, shelf, automobile dashboard, mat, floor, rug, etc., thin/compact cellphone/laptop 2/3, etc.). (*See* my analysis and discussions above and below in this section; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a).)

119. In my opinion, a person of ordinary skill in the art would have appreciated that inductive power/data transfer (consistent with that disclosed by *Nakamura*) uses inductive coils to wirelessly transfer power/data to another electronic device. (*See* my analysis and discussions in this section and in Sections IX.A.1(a), (b)-(m); *see also* my analysis and discussions in Sections V, VIII.) In my opinion, a person of ordinary skill in the art was aware of and appreciated that different types of coil designs were available to achieve desired applications of inductive power/data transfer. (*Id.*) For example, planar coils were known by such a skilled person, as were their characteristics and design techniques for

implementing circuits/systems/devices that use them to achieve desired contactless/inductive power/data transfer. (*Id.*) In my opinion, several state of the art references known by a person of ordinary skill in the art demonstrate/exemplify such knowledge, which describe features consistent with such a skilled person's knowledge at the time. (*Id.*)

120. For one 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.)

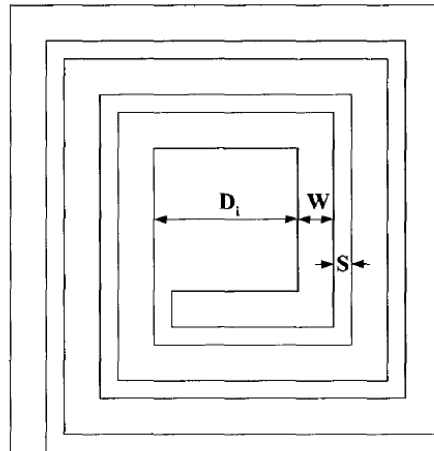


Fig. 1. A planar square spiral inductor structure.

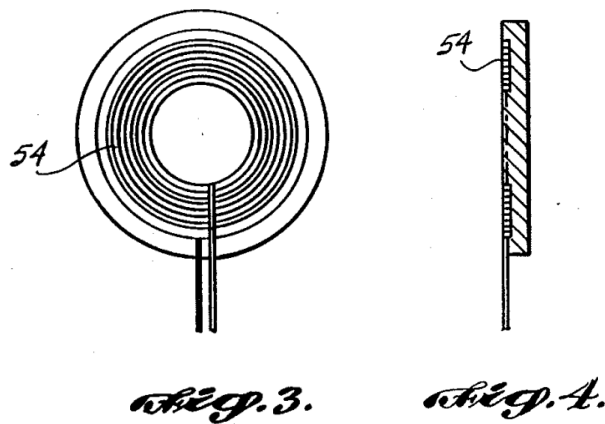
(*Id.*, FIG. 1 (showing a “**planar square spiral inductor** structure”).)

121. Also, references such as *Sano* (Ex. 1015) (which also disclose features consistent with the state of art knowledge of a person of ordinary skill in the art at the time) discuss 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.)

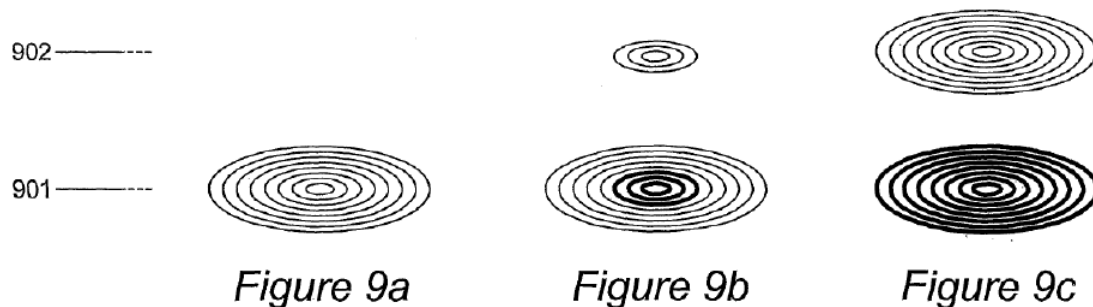
122. References such as *ChengII* (Ex. 1026) (which also disclose features consistent with the state of art knowledge of a person of ordinary skill in the art at the time) also show the known use of thin, planar-type coils in an inductive power source/charger and an inductive power receiver (device).

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.)

123. There are other state of art references that demonstrate and exemplify the above-discussed knowledge of a person of ordinary skill in the art. (*See, e.g.*, 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. 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, 870-928, 1010-1045, 1071-1104, 1311-1386, 1387-1454; *see also* Section V.)

124. Therefore, in my opinion, a person of ordinary skill in the art would have been aware of available designs and options for implementing inductor coils to facilitate contactless power/data transfer, including the related circuitry, and the tradeoffs, benefits, advantages, etc. associated with their use. (*Id.*; *see also* my analysis, discussions, and citations in this section; *see also* Section V.) In my opinion, a person of ordinary skill in the art would have relied on such knowledge when considering design and implementation options for the *Nakamura* system/device, and would have appreciated how various coil designs (including planar coils) would have improved the system/device based on given applications taking into account factors, such as size, weight, cost, efficiencies, performance, design constraints, etc. (*Id.*; *see e.g.*, Ex. 1007, ¶0033 (describing size/shape

attributes of coils and known characteristics in a contactless inductive power/charge system).) In my opinion, a person of ordinary skill in the art would have considered the tradeoffs and potential benefits provided by planar coils when contemplating ways to design and implement apparatus 1 / device 2/3 in a charging/power system as disclosed by *Nakamura*. (*Id.*) In my opinion, one source of such relevant guidance and knowledge is *Odendaal*.

125. In my opinion, a person of ordinary skill in the art would have had reasons to consider the teachings/suggestions of *Odendaal* in context of *Nakamura* since *Odendaal* describes a contactless inductive power/charging system including techniques/technologies similar and related to those of *Nakamura*. (*See* my analysis and discussions in Section IX.A.1(a); *see, e.g.*, Ex. 1008, Title, Abstract, Figs. 1A-4, 11-12, 1:5-3:57, 4:50-5:8, 5:24-28, 6:59-64; *see also* my analysis and discussions in Sections VIII.A-B, IX.A.1(c)-(m).) For example, *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.) 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* my analysis, discussions, and citations regarding *Nakamura* above in this section and in Section IX.A.1(a); *see also* my analysis and discussions in Sections VIII.A-B.)

126. Thus, in my opinion, a person of ordinary skill in the art would have understood that *Odendaal* is in the same technical field as the '440 patent and *Nakamura* because *Odendaal* also describes a system and processes for powering/charging a mobile device/battery using inductive contactless power transfer techniques/technologies. In my opinion, a person of ordinary skill in the art would have appreciated that *Odendaal* (like *Nakamura*) also discloses features that were reasonably pertinent to one or more particular problems the '440 patent

discusses. (*See, e.g.*, Ex. 1001, 3:35-3:67; 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.) As I discussed above and below, *Odendaal* also discloses techniques and technologies for addressing the need to power mobile devices using contactless inductive coupling. In my opinion, a person of ordinary skill in the art would have understood that such teachings address similar problems identified in the '440 patent, and thus would have consulted such teachings while looking to address and solve such issues/problems and others relating to the design and implementation of a contactless inductive charging system, including those described by *Nakamura*. (*Id.*) Therefore, in my opinion, a person of ordinary skill in the art contemplating designing and configuring a system like that described by *Nakamura* would have considered teachings/suggestions like those provided in *Odendaal* and thus would have been motivated to modify apparatus 1 (and device 2/3) to include planar (primary/secondary) coils to provide features like those discussed herein and claimed. (*Id.*)

127. For example, *Odendaal* discloses the known use of planar-type inductor coils in a contactless/inductive power transfer system that transfers power via magnetic coupling, for, e.g., charging a battery of a cellphone, computer, wearable items, etc. (Ex. 1008, FIGS. 1A-1B, 2A, 2C, 8E, 1:5-3:57.)

128. 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; *see also id.*, 2:1-15, 2:44-3:5, 4:44-5:8, 6:1-18.)

129. *Odendaal* explains that it would be advantageous to provide a planar resonator for wireless power transfer that exhibits characteristics of an integrated inductor-capacitor transformer. (*Id.*, 1:53-57.) The planar resonator includes a coil arrangement where spirals arranged on opposite sides of each other can be used for

energy transfer “so that a battery of a cellphone could be charged without physical wires connecting the cellphone to a charger.” (*Id.*, 1:60-67.) Depending on the physical arrangement and/or material used, the planar resonator “transfer[s] power across the ‘interface-of-energy-transfer’ (IOET) *in either an electric or magnetic form, or both.*” (*Id.*, 2:1-7.) Thus, while *Odendaal* discusses capacitive-type energy transfer, “[t]he physical arrangement and/or material can *permit transformer action with or without* [such] capacitive energy transfer.” (*Id.*, 2:7-10; *see also id.*, 2:65-3:5 (signal transfer between spiral coils “*by coupling of magnetic flux*”), 4:44-5:8, 6:1-18 (air coil transformer).)

130. Moreover, *Odendaal* explains that the planar coils 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.” (Ex. 1008, 2:44-54.) Also, as discussed above, *Odendaal* explains that “[t]he 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.)

131. Therefore, in my opinion, *Odendaal* discloses inductive contactless power system designs/configurations that use primary planar coil(s) in a power transmitting unit and planar coil(s) in a power receiving unit (*e.g.*, cellphone, computer, etc.) for charging the receiving unit's battery (Ex. 1008, 1:60-67, 2:29-44, 2:55-3:5), consistent with that known in the art. (*Id.*, 1:23-31 (conventional road embedded coils), 2:29-44 (coils embedded in fabric or pads), 3:65-67 (spirals arranged within substrate material); *see also* my analysis and discussions regarding state of art knowledge of a person of ordinary skill in the art above in this section; *see also* my analysis and discussions in Section VIII.B.)

132. In my opinion, upon considering *Odendaal* in context of the disclosures of *Nakamura*, in context of the knowledge in the art, a person of ordinary skill in the art would have been motivated to modify the *Nakamura* system to use planar “**primary coil(s)**” in apparatus 1 (“**universal base unit**”) (and also to consider/implement and complement such a design with corresponding planar secondary/receiver coil(s) in device 2/3) to increase the versatility in the designs/arrangements compatible with the thin/planar-type applications contemplated by *Nakamura* (some illustrated below) that use compact device designs (*e.g.*, charging pad, cellphone, laptop, etc.). (Ex. 1005, FIGS. 1A-2B, 8-9, 13A-15B, 18-20, ¶¶0062-0075, 0090-0094, 0096-0156; *see also* my analysis and

discussions above in this section; *see also* my analysis and discussions in Sections VIII.A-B, IX.A.1(a).)

FIG. 1A

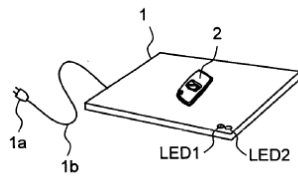


FIG. 1B

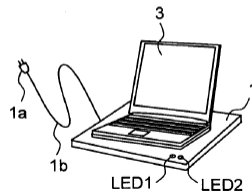


FIG. 8

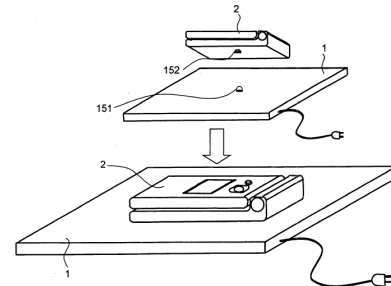


FIG. 13B

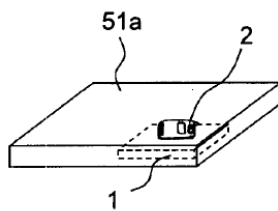


FIG. 13C

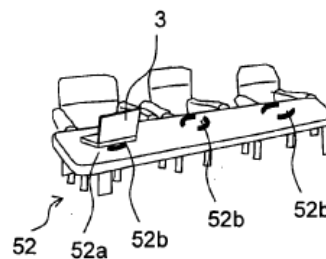


FIG. 13E

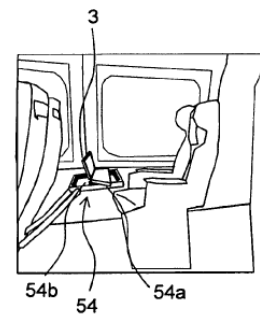


FIG. 14

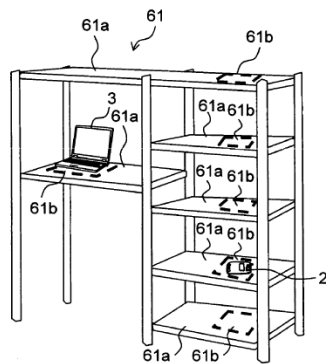


FIG. 15B

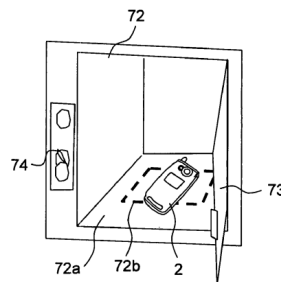


FIG. 18

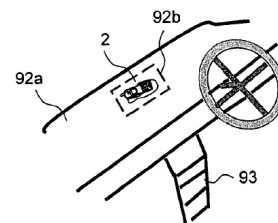
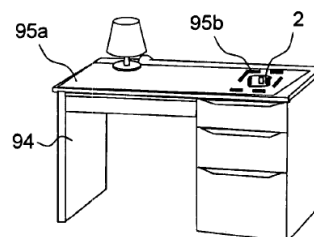


FIG. 19



(Ex. 1005, FIGS. 1A, 1B, 8, 13B, 13C, 13E, 14, 15B, 18, 19.)

133. In my opinion, as I have explained above, a person of ordinary skill in the art would have recognized *Nakamura*'s system configurations were versatile and applicable to many different applications and modifications to accommodate multiple types of charging units and devices, including those that would have benefited from the use of known planar coil(s) designs. (*Id.*; *see also* my analysis and discussions in Section IX.A.1(a); *see also* my analysis and discussions in Section VIII.A.) Therefore, such a skilled person would have been motivated to contemplate, design, and implement other variations that expand the applications and versatility of *Nakamura*'s configurations implementing different types of power transmission apparatus arrangements and power reception equipment (e.g., device 2/3). (*Id.*; *see also* Ex. 1005, FIGS. 1A-2B, 8-9, 13A-15B, 18-20, ¶¶0062-0075, 0090-0094, 0096-0156.)

134. Therefore, in my opinion, a person of ordinary skill in the art would have been motivated by *Odendaal*'s teachings/suggestions (in context with their state of art knowledge) to configure each of the one or more primary coil(s) (11 or 11x/11y/11z) (and secondary/receiver coil 12) as a planar coil to expand the applications and features of *Nakamura*'s contactless inductive power/charge transfer system/device. (*Id.*; Ex. 1008, 2:16-28 (“... a planar configuration for transferring power with isolation properties . . . [with] two separable structures on either side of

the IOET, such as, for example, a cellphone and its charger” where “no electrical contacts necessary at the IOET” and “[t]he physical structure may include a set of spiral coils on each side of the IOET, typically with each spiral being a conductor trace on a separate substrate, such as flex or printed circuit board (FR-4)”, 2:29-44 (applications with wearable electronics such as radio, cellphone, and computer), 3:65-67 (spirals arranged within substrate material).)

135. For example, as I explained above, *Nakamura*’s exemplary applications (e.g., FIGS. 1A-2B, 8-9, 13A-20) depict apparatus 1 embedded in thin planar type host units. (*See* my analysis and discussions above in this section; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a).) In my opinion, a person of ordinary skill in the art would have understood that, in these configurations, a reduced thickness of the primary coil(s) would have benefited the corresponding thickness/profile of apparatus 1, and in turn, its integration with such host units (e.g., such as those I discussed above). (*Id.*) In my opinion, a person of ordinary skill in the art would have thus been motivated to modify *Nakamura*’s configurations with a planar primary coil(s) to provide options with a thin and/or more compact power transmission apparatus (e.g., apparatus 1) (and host objects/units), consistent with that contemplated by *Nakamura*. (*Id.*; *see also* Ex. 1005, ¶0070 (“power transmission control 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*”).)

Also, *Nakamura's* FIG. 2A shows a receiver/secondary coil 12 in a portable telephone (device 2) being placed near its back panel (*see also* FIG. 9). In such a configuration (and other similar configurations), thickness of the receiver/secondary coil affects the thickness of the portable phone. (Ex. 1005, FIGS. 2A, 9.) A person of ordinary skill in the art would have thus been motivated to modify *Nakamura's* configurations with a planar receiver/secondary coil(s) to provide for thin and more compact power reception equipment (e.g., device 2/3), which would have been consistent with features contemplated by *Nakamura*. (Ex. 1005, ¶0075 (“Note that the power receiving control IC 42 [in *Nakamura's* portable telephone] is in the shape of an IC chip so that ***a compact and lower-profile shape of the portable telephone 2 is achieved.***”).)

136. Furthermore, 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 and effectiveness of inductive power transfer. (*Id.*; Ex. 1005, ¶¶0079-0082; *see also* my analysis and discussions regarding *Nakamura* above in this section and in Sections VIII.A, IX.A.1(a), V.B.) A person of ordinary skill in the art would have appreciated and recognized that this would have been particularly beneficial in configurations contemplated by *Nakamura* where apparatus 1 transmission apparatus is embedded in host objects with larger surfaces, such as

desks, tables, shelves, floors, carpets, etc., where a user would wish to place the mobile device in different parts of such surfaces for inductive powering/charging. (*Id.*; *see, e.g.*, Ex. 1005, ¶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 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). 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 (“universal 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.

137. In my opinion, implementing planar coils in apparatus 1 (and device 2/3) as discussed above would have predictably resulted in the *Nakamura-Odendaal* system/device to include features and perform functionalities like those described by *Nakamura* and discussed above, consistent with known planar coil inductive power transfer configurations, including e.g., where the primary coil(s) each would generate “a magnetic field” when “a current is passed through the primary coil” that would have been in “a direction substantially perpendicular to the plane of the primary coil,” for similar reasons that I explained above. (*See* my analysis and discussions above in this section; *see also* my analysis and discussions above regarding state of art disclosures such as those in Exs. 1006-1007, 1009-1011, 1015, 1024-1030.) 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, ¶¶79-83), 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 plane of the primary coil(s)) would be generated by the planar primary coil(s) and received by the planar secondary coil. Similarly, in my opinion, other disclosed features would have been included in the *Nakamura-Odendaal* system (including as further modified below) for reasons explained in this ground. (See my analysis and discussions in Sections IX.A.1(a)-(m).) In my opinion, a person of ordinary skill in the art would have sought to implement the above-modification in various ways (different planar coil designs, configurations, etc.) depending on given applications while still maintaining the power/data transfer functionalities discussed above (and below) as contemplated by *Nakamura*. (*Id.*)

138. In my opinion, a person of ordinary skill in the art would have had the skills, knowledge, and rationale in light of the teachings/suggestions of *Nakamura*, *Odendaal*, and such a skilled person's state of art knowledge, to implement the above-modification while taking into account design tradeoffs and techniques/technologies with a reasonable expectation of success. (*Id.*) For example, such a skilled person would have known how to configure the modification such that the modified system/device operated as intended and in accordance with design parameters for a given application consistent with the teachings of *Nakamura*. (*Id.*; see also my analysis and discussions above in this section; see also my analysis and discussions in Sections VIII.A-B, IX.A.1(a).) In my opinion, implementing the above-modification would have involved applying known technologies (e.g., known

planar 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* and *Odendaal*) according to known methods and techniques (e.g., using planar-type coils to transfer power/data similar to known coil designs (*Nakamura* and *Odendaal*)) to yield the predictable result of providing a thin form factor / "compact and lower-profile shape" (Ex. 1005, ¶¶0070, 0075) apparatus 1 / host objects / device 2/3, which would have been consistent with features contemplated by *Nakamura*. (*Id.*; *see also* my analysis and discussions above in this section; *see also* my analysis and discussions in Sections VIII.A-B, IX.A.1(a).)

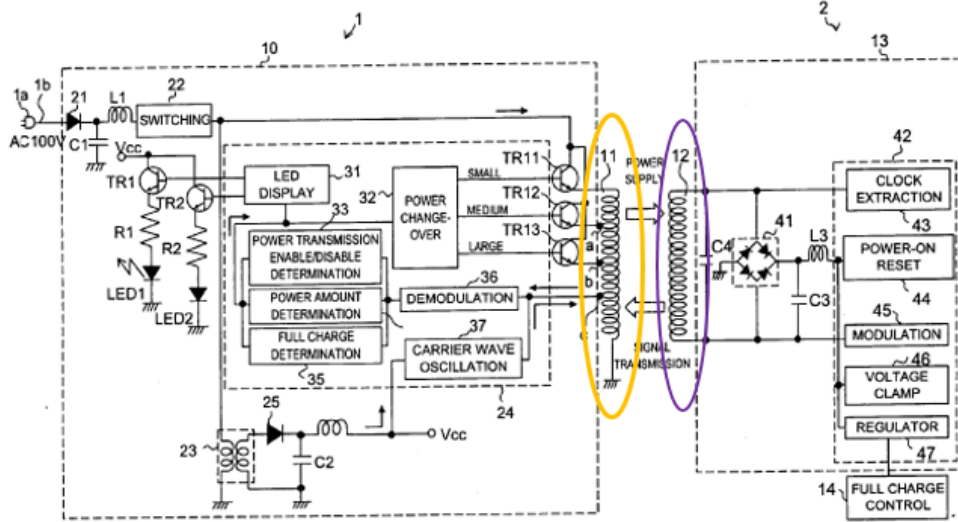
- c) **wherein the perpendicular magnetic field inductively generates a current in a matching secondary coil or coils within a mobile device placed close to and aligned with the base unit, to charge or power the mobile device;**

139. In my opinion, *Nakamura* in view of *Odendaal* 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)-(b), IX.A.1(d)-(m); *see also* my analysis and discussions in Sections VIII.A, VIII.B.)

140. As I explained, *Nakamura*'s device 2/3 ("**mobile device**") contains a secondary coil 12 ("**matching secondary coil**"), which I exemplified in purple in annotated figures below. (*See* my analysis and discussions in Sections IX.A.1(a)-

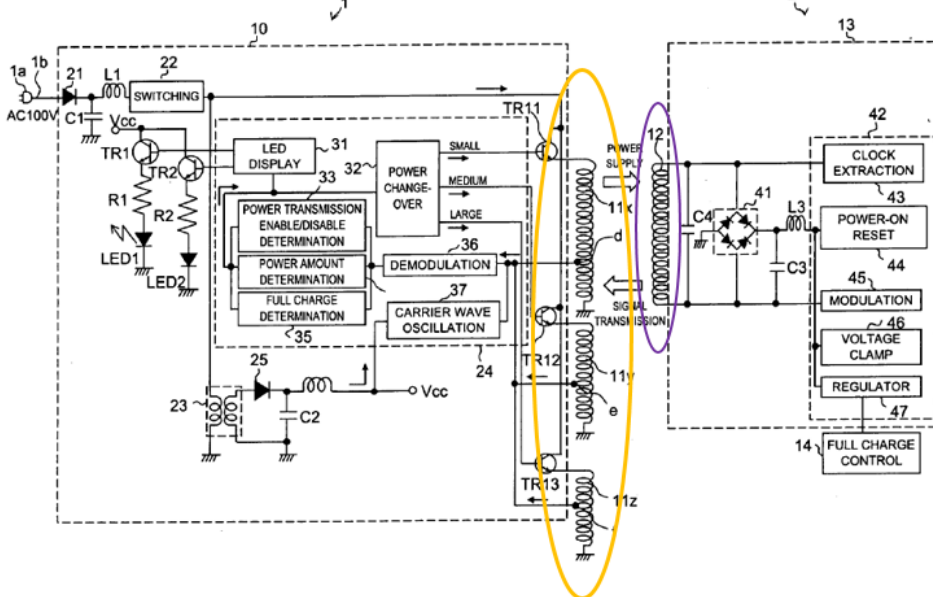
(b), IX.A.1(k)-(l); *see, e.g.*, Ex. 1005, FIGS. 1A-2B, 3 and 5 (annotated below), 6, ¶¶0016-0022, 0062-0067, 0074-0075, 0076-0089, 0090-0092; *see also* my analysis and discussions in Section VIII.A.)

FIG. 3



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

FIG. 5



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

141. As I explained above for limitations 3(a) and 3(b), the “**perpendicular magnetic field**” generated by the primary coil(s) (11 or 11x/11y/11z) “**inductively generates a current**” in the secondary coil 12 (“**matching secondary coil or coils within a mobile device**”) when device 2/3 (and thus coil 12) is placed close to and aligned with apparatus 1 (“**base unit**”), “**to charge or power the mobile device**” (device 2/3). (*See* my analysis and discussions in Sections IX.A.1(a)-(b); *see also* my analysis and discussions in Sections VIII.A, IX.A.1(d)-(m).) For example, as I explained above, *Nakamura* discloses that

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.*, Abstract, ¶¶0018-0019, 0062-0064, 0074 (“an induced voltage across the secondary side coil 12 is . . . rectified in the rectification circuit 41 and, thereafter, smoothed by a smoothing circuit constituted of a coil L3 and a capacitor C3 and converted to a DC voltage”), 0082-0091, FIGS. 2A, 2B, 3-5.)

142. As I explained above, a person of ordinary skill in the art would have understood that the power/voltage inductively transmitted between the primary side and secondary side coils involves a magnetic field (e.g., *Nakamura-Odendaal*’s “magnetic field [that] is generated in a direction substantially perpendicular to the plane of the primary coil” that I explained above for limitation 3(b) / “**perpendicular magnetic field**” of limitation 3(c)). (*See* my analysis and discussions in this section and in Sections IX.A.1(a)-(b); *see also* Ex 1005, ¶¶0018, 0062, 0065, 0077-0080, 0090-0091, FIGS. 3-5, Abstract, Claim 2; *see also* my analysis and discussions in Section VIII.A.) Also, for the reasons I discussed above, in my opinion, a person of ordinary skill in the art would have understood that by receiving power/voltage via the magnetic coupling/field, a current is inductively generated in secondary coil 12 (by the perpendicular magnetic field), consistent with known contactless inductive-based power transfer techniques/technologies. (*Id.*; *see also* Ex. 1005, ¶¶0065 (“**when the pulse voltage obtained by switching is applied across the primary**

side coil 11, a voltage [and thus current] is induced across the secondary side coil 12 by magnetic coupling...”), 0076-0087, 0090-0091; Ex. 1006, ¶¶0022 (“**Current flows through the source coil and the resulting magnetic flux induces an alternating current through the magnetic field and across the receiver coil, completing an energy transfer circuit.**”), 0031; Ex. 1009, 2:62-3:8, 1:54-2:18, 3:20-4:11, FIGS. 1-3; 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**”), FIGS. 6A-10, 7:21-8:54, 9:53-10:22, 11:27-14:67; Ex. 1029, 3-4, 27-50; *see also* Section V.)⁹

143. In my opinion, a person of ordinary skill in the art would have also understood that the magnetic field induces such current in secondary coil 12 when device 2/3 (“**mobile device**”) is “**placed close to and aligned with**” apparatus 1

⁹ I reference Exhibits 1006, 1009, and 1010 here to support my opinions regarding the state of art knowledge of a person of ordinary skill in the art at the relevant time (like other extraneous references I may refer to throughout this Declaration when discussing what such a skilled person would have understood/appreciated, etc.). While I reference Ex. 1006 (*Calhoon*) here to demonstrate state of art knowledge, I rely on *Calhoon* below to address particular claim limitations. (*See, e.g.,* Section IX.A.1(e).)

(“**base unit**”), consistent with that known in the art. (*See, e.g.*, Ex. 1005, Abstract, ¶¶0018, 0062, 0065, 0079 (power transmission efficiencies relating to the presence/position of device 2/3 to apparatus 1 where “a high coupling degree in magnetic coupling is established”), 0080-0082 (“highest coupling degree in magnetic coupling” occurs with 0 mm positional/alignment deviations in left-right and forward-rearward directions), FIGS. 11A-11B, 0090-0091; Ex. 1011, 557-562, 593-594, 601; Ex. 1009, 2:62-3:8 (“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 inducted into the computing device 18”), 1:54-2:18, 3:20-4:11, FIGS. 1-3; Ex. 1010, FIGS. 1-5B, 8:55-9:52, FIGS. 6A-10, 7:21-8:54, 9:53-10:22, 11:27-14:67; Ex. 1029, 3-4, 27-50, Ex. 1004, 1311-1386, 1363-1365.)

144. In fact, *Nakamura* explains how its inductive power transfer operations are performed only when device 2/3 (and its respective coil) is detected and placed close to and properly aligned with apparatus 1 (and their respective coils) so that sufficient “magnetic coupling is established.” (Ex. 1005, ¶0079; *see also id.*, ¶¶0080-0083, 0086-0089, 0102-0103, 0118, 0156, Claims 19-20, 33, 37, FIGS. 4, 8-9, 11A-12, 17.)

145. For example, *Nakamura* explains that “**code indicating being power reception equipment,**” which is code transmitted from a power reception equipment (e.g., device 2/3) to a power transmission apparatus (e.g., apparatus 1), is

used to detect/determine/verify 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) (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 (“FIGS. 11A and 11B are graphs showing relationships between a relative position of the portable telephone 2 to the power transmission apparatus 1 (a positional deviation of the portable telephone 2 from the power transmission apparatus 1) and a transmission efficiency of power and the information signal.”).)

FIG. 11A

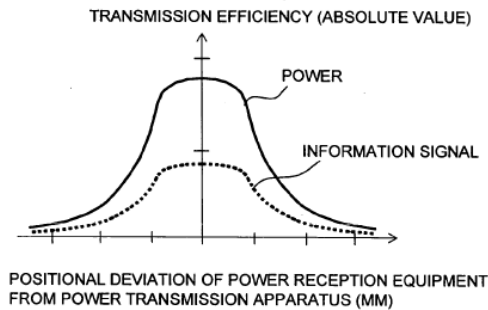
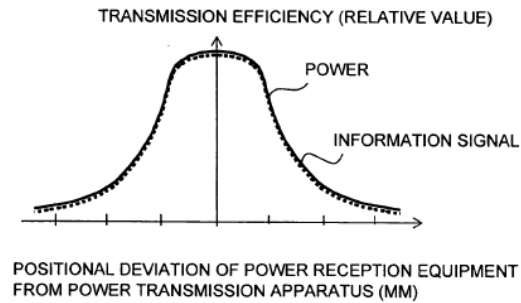


FIG. 11B



(*Id.*, FIGS. 11A-11B.)

146. Also, *Nakamura* discusses how,

When the power transmission apparatus 1 and the portable telephone 2 are located at positions where the highest 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, the deviation is given 0, deviations in a left-to-right direction or a forward-to-rearward direction of the portable telephone 2 from the position with the deviation of 0 are measured in units of mm.

(*Id.*, ¶0080.) Further,

As shown in FIG. 11A, the **larger the deviation** of the portable telephone 2 from the power transmission apparatus 1 becomes, **the lower the transmission efficiencies** of both power and information signal drop. Since the transmission efficiencies of power and

information signal are, as shown in FIG. 11B, reduced at the same rate with an increase in deviation of the portable telephone 2 from the power transmission apparatus 1, **a deviation of the portable telephone 2 from the power transmission apparatus 1 can be recognized by measuring a signal intensity of the information signal even in a state where the power transmission apparatus 1 transmits no power.**

(*Id.*, ¶0081.) *Nakamura* also explains,

Since the **larger the positional deviation of the portable telephone 2 from the power transmission apparatus 1 becomes, the lower the transmission efficiencies of power and information signal drop, there will be no meaning to transmit the power, because the portable telephone 2 is not capable of receiving it in a case where the power transmission efficiency is extremely low.** Therefore, 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.

(*Id.*, ¶0082). “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, the process moves to a process for determining a level of power to be transmitted (step S6).**” (*Id.*, ¶0083.) (*See also id.*, ¶¶0086-0087, 0090-0091, 0096-0098, 0109, FIGS. 3-5, 11A-11B; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a)-(b).)

147. In my opinion, such features are also disclosed/suggested in the modified *Nakamura* device/system discussed for this ground. (*See also* my analysis and discussions in Sections IX.A.1(a)-(m); *see also* my analysis and discussions in Section VIII.)

d) wherein one or both of the mobile device and a battery have a receiver and particular charging characteristics associated therewith,¹⁰

148. In my opinion, *Nakamura* in view of *Odendaal* discloses and/or suggests this limitation. (*See* my analysis and discussions below in this section; *see*

¹⁰ For purposes of rendering my opinions, I have been asked to assume that the “charging characteristics” are associated with the “receiver,” “mobile device,” and/or “battery.” For the reasons I discuss in this section, it is my opinion that the charging characteristics of the battery/device in *Nakamura* are necessarily associated

also my analysis and discussions in Sections IX.A.1(a)-(c), IX.A.1(e)-(m); *see also* my analysis and discussions in Sections VIII.A, VIII.B.)

149. I first point out that the '440 patent describes the “**receiver**” in various exemplary ways. (*See, e.g.*, Ex. 1001, FIGS. 2, 6-7, 9, 3:43-67, 4:15-18, 5:4-35, 7:8-26, 8:47-59, 10:22-39 (“a receiver for a mobile phone . . . **can be** a coil . . .”), 10:44-11:4, 11:5-6 (“receiver **can also** contain rectifier(s) and capacitor(s) to produce a cleaner DC voltage”), 11:34-44, 12:20-26, 12:48-49 (“the receiver (**i.e., circuitry**)”), 13:1-3 (“**regulator in the receiver** can then regulate the current and the load . . .”), 13:44-54, 13:55-14:7 (“receiver **may be** a component (such as a shell) . . . the receiver (shell) . . .”), 14:37-45.) In my opinion, a person of ordinary skill in the art would have understood that *Nakamura*’s teachings are consistent with the plain language of the claim, and in particular limitation 3(d) in context of the '440 patent. (*Id.*; *see also* my discussions below.)

150. For example, *Nakamura* discloses the claimed “**a receiver**” in different ways, and that device 2/3 includes “**a receiver**” in different ways. As I discussed above, *Nakamura*’s “**mobile device**” 2/3 contains components that are examples of the claimed “**receiver**” that I discuss below. (*See* my analysis and discussions in

with the device’s “receiver” (which is part of device 2/3 and attached/coupled/connected to its battery) as discussed below.

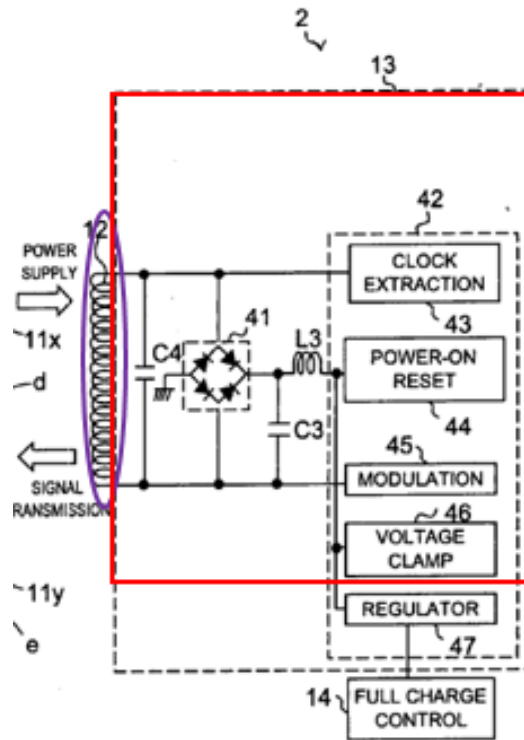
Sections IX.A.1(a)-(c); *see, e.g.*, Ex. 1005, FIGS. 1A-2B, 3-6, ¶¶0016-0022, 0062-0067, 0074-0075, 0090-0092; 0076-0089.)

151. For example, as exemplified in the annotated figures below, *Nakamura*'s mobile device 2/3 with its secondary coil 12 (identified in **purple** in the non-limiting annotated figures below) includes a “**receiver**” in various ways.¹¹ These include:

¹¹ The annotated figures I provide here (and below) are exemplary and not intended to describe or define precise boundaries, schematics or limit/constrain the mappings/analysis that I provide of the prior art to the claim language (alone or as modified as applicable below). A person of ordinary skill in the art would have understood that other components/circuitry, etc. that are not shown but are included in device 2/3 as described or suggested by *Nakamura* (alone or as modified as applicable below) are or would have been contemplated portions of such mappings. For one example, *Nakamura* does not explicitly illustrate a battery in its figures, but as I explained above, a battery is a disclosed part of device 2/3. (*See* my analysis and discussions in Sections IX.A.1(a)-(c).) Also, other figures in *Nakamura* are equally applicable with such mappings, such as FIGS. 1A-2B, 3, 6, 8-9, and 13A-25. (*See* my analysis and discussions in Section IX.A.1(a).)

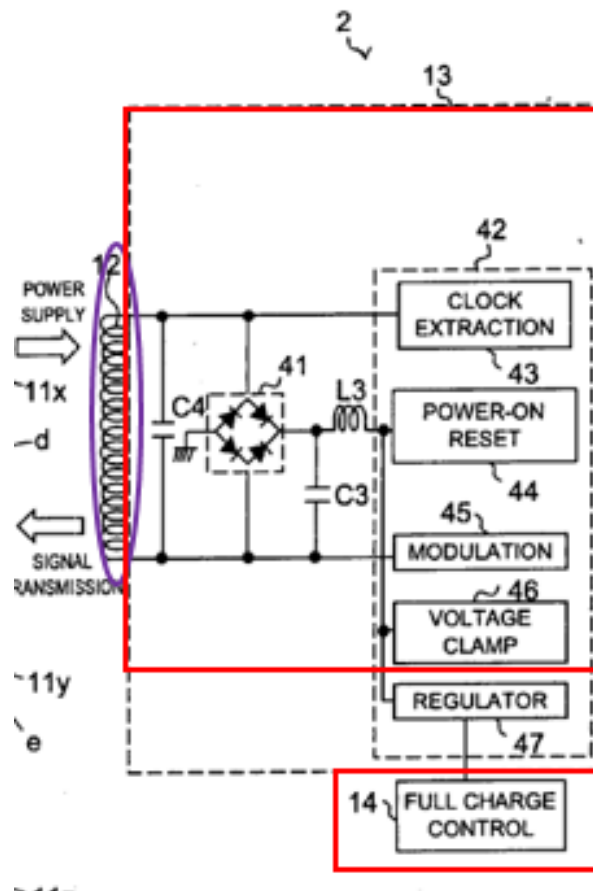
- a. **(1)** Secondary side circuit 13 (that may or may not include regulator 47).¹² One example is shown below in **red** (e.g., shown without regulator 47).

¹² A person of ordinary skill in the art would have understood that the '440 patent describes embodiments where a “regulator” is “in the receiver” (*see, e.g.*, Ex. 1001, 13:1-3). Therefore, in my opinion, the alternate *Nakamura* mappings that I discuss herein that encompass a “**receiver**” with regulator 47 and those including regulator 47 for the claimed “**regulator**” (*see, e.g.*, limitation 3(g)) and others are consistent with the '440 patent's descriptions. (*Id.*; *see also* my analysis and discussions in Section IX.A.1(g) and other limitations below.)



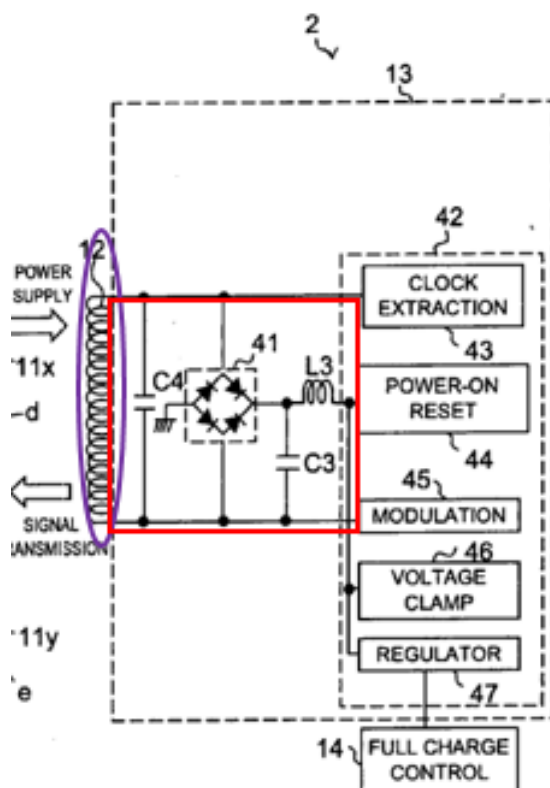
(Ex. 1005, FIG. 5 (annotated).)

- b. **(2)** Secondary side circuit 13 (that may or may not include regulator 47) together with full charge control 14. One example is shown below in **red** (e.g., shown without regulator 47).

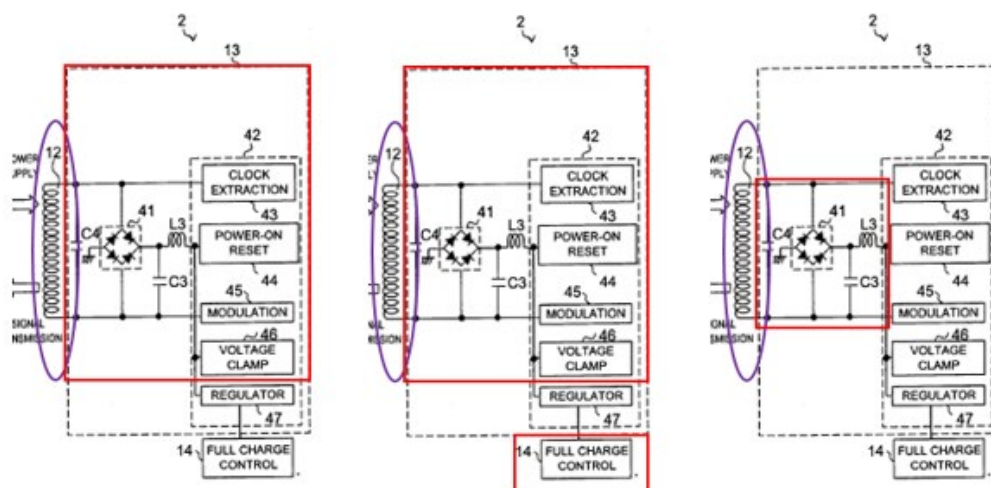


(Ex. 1005, FIG. 5 (annotated).)

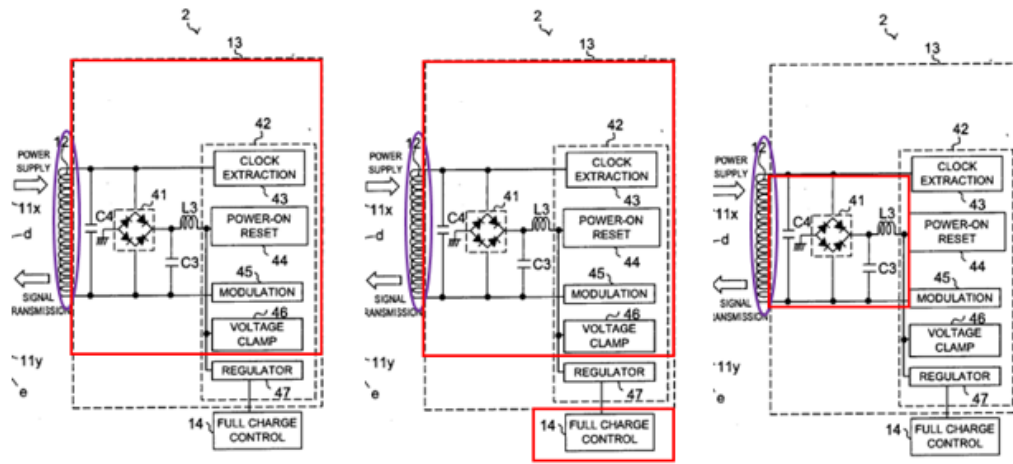
- c. **(3)** Other circuitry/components in secondary side circuit 13 (e.g., one or more of capacitor C4, rectifier 41, inductor L3, and/or capacitor C3). One example is shown below in **red**.



(Ex. 1005, FIG. 5 (annotated).) I recreate the three above exemplary mappings below together for visual aid purposes.



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



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

152. Additionally, as I discussed above for limitations 3(a)-(c), the above-identified “**receiver**” is attached/coupled/connected to device 2/3’s components including its battery, and is used for inductively powering/charging device 2/3 or its battery. (See my analysis and discussions in Sections IX.A.1(a)-(c); *see also* my analysis and discussions in Sections VIII.A, IX.A.1(e)-(m).) For example, *Nakamura* explains:

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.**

(Ex. 1005, ¶0065; *see also id.*, Abstract, ¶¶0018-0019, 0062-0064, 0074 (“an induced voltage across the secondary side coil 12 is . . . rectified in the rectification circuit 41 and, thereafter, smoothed by a smoothing circuit constituted of a coil L3 and a capacitor C3 and converted to a DC voltage”), 0082-0091, FIGS. 2A, 2B, 3-5.) Thus, a person of ordinary skill in the art would have readily understood that the “receiver” discussed above is attached/coupled/connected to device 2/3’s components including its battery. (*Id.*)

153. *Nakamura* also discloses that device 2/3 and/or its battery (and thus necessarily the above-identified “receiver” included in device 2/3) have “**particular charging characteristics associated therewith.**”¹³ (*See* my discussions and

¹³ *See* footnote n.10, above.

analysis regarding *Nakamura* above and below in this section; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a).) As I explained above for limitation 3(a) and in this section, a person of ordinary skill in the art would have understood that device 2/3 includes a battery, consistent with that known in the art. (*See* my analysis and discussions in Section IX.A.1(a); Ex. 1005, FIGS. 1A-5, 13A-13E, ¶¶0005-0008, 0062-0065, 0110, 0151, Claims 15, 29-30, 35; *see also* my analysis and discussions in Section VIII.A.)

154. Also, I discussed above for limitation 3(a) how *Nakamura*'s device 2/3 contains a battery ("**battery**"), where one or both of which have "**particular charging characteristics associated therewith.**" (*See* my analysis and discussions in Section IX.A.1(a); *see also* my analysis and discussions in Section VIII.A.) For example, while not illustrated in the figures, *Nakamura* makes clear in the disclosures that mobile device 2/3 includes a battery that can be charged via the contactless inductive power features disclosed by *Nakamura* (*see, e.g.*, Ex. 1005, FIGS. 1A-5, 13A-13E, ¶¶0062 ("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."), 0063-0065, 0110),

consistent with that known in the art (*id.*, ¶¶0005-0015). (*See also* my analysis and discussions in Sections IX.A.1(a), VIII.A.)

155. Moreover, as I explained above, apparatus 1 is configured to determine and provide a different power level appropriate for the type of device 2/3 (and battery) inductively coupled to the apparatus. (*See* my analysis and discussions in Section IX.A.1(a); *see e.g.*, Ex. 1005, Abstract, ¶¶0017-0019, 0062, 0063 (apparatus 1 transmits necessary power “**depending on the type**” of device 2/3 so that it “can charge even batteries of electronic equipment different in power required for charging, such as the portable telephone 2 and the notebook PC 3.”), 0065, FIG. 4, ¶¶0076-0091, ¶¶0110, Claims 15, 29-30, 35; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(h), IX.A.1(m).)

156. Moreover, because apparatus 1 is configured to determine and provide a different power level appropriate for the type of device 2/3 inductively coupled to the apparatus, a person of ordinary skill in the art would have understood that device 2/3 and its battery have particular charging characteristics (e.g., a notebook PC (laptop) 3 (and battery) has different power/charging characteristics than a portable telephone (mobile phone/cellphone) 2 (and battery)). For example, *Nakamura* explains:

Since the power transmission apparatus 1 has **functions of recognizing power reception equipment placed on the**

power transmission apparatus 1 so as to transmit power necessary for the power reception equipment thereto *depending on the type*, a single power transmission apparatus 1 can charge even batteries of electronic equipment different in power required for charging, such as the portable telephone 2 and the notebook PC 3. Though not shown, any type of electronic equipment equipped with a battery, such as a digital camera, a camcorder, a PDA, or the like, can be charged similarly.

(Ex. 1005, ¶0063; *see also id.*, Abstract, ¶¶0005-0015 (conventional devices with particular charging characteristics), 0017-0019, 0062, 0063, 0065, FIG. 4, ¶¶0076-0091, 0110, Claims 15, 29-30, 35; *see also* my analysis, discussions, and citations in Sections IX.A.1(a), VIII.A; *see also* my analysis and discussions in Sections IX.A.1(h), IX.A.1 (m).) In my opinion, *Nakamura*'s teachings are consistent with the common understanding by a person of ordinary skill in the art that such portable/mobile devices contain batteries and that such devices/batteries have different power/charging characteristics. (*See, e.g.*, Ex. 1005, ¶¶0005-0008 (describing conventional portable devices with a battery); Ex. 1006, ¶0045 (describing "multiple battery packs [that] may have different power requirements"

and confirming “a cellular phone power requirement is less than that of a laptop computer”).¹⁴

157. A person of ordinary skill in the art would have understood that the above disclosures of *Nakamura* (regarding different mobile devices and batteries having different power requirements (e.g., power levels)) also relate to such devices/batteries having different voltage requirements, because *Nakamura* (as discussed above) discloses transmitting different levels of **power** based on different **power** requirements and because *Nakamura* also discloses that **voltage** is induced between the primary side coils (of apparatus 1) and the secondary side coil of the mobile device (device 2/3) (e.g., the term “power” in *Nakamura* encompasses voltage). (*Id.*; Ex. 1005, ¶0065 (“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**

¹⁴ I reference Exhibit 1006 here to support my opinions regarding the state of art knowledge of a person of ordinary skill in the art at the relevant time. While I reference Ex. 1006 (*Calhoon*) here to demonstrate state of art knowledge, I rely on *Calhoon* below to address particular claim limitations. (See, e.g., Section IX.A.1(e).)

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.”); *see also* my analysis, discussions, and citations regarding *Nakamura* and state of art knowledge of a person of ordinary skill in the art in this section and in Sections IX.A.1(a)-(c); *see also* my analysis and discussions in Section VIII.A; *see also* Section V.)

158. In my opinion, the teachings of *Nakamura* (regarding different mobile devices and batteries having different power/voltage requirements) (“**charging characteristics**”) are consistent with the disclosures of the ’440 patent. (*See, e.g.*, Ex. 1005, ¶¶0065, 0076-0085, 0091; Ex. 1001, 8:38-42 (“Each **mobile device and its battery has particular characteristics (voltage, capacity, etc.)**. In order to facilitate these different devices with a single universal mobile device charger, several circuit architectures are possible, some of which are described in further detail below.”), 8:66-9:9 (“The mobile device charger, after exchanging information with the mobile device, determines the appropriate **charging/powering conditions to the mobile device**. It then proceeds to **power the mobile device with the appropriate**

parameters required. For example, to set the **mobile device voltage to the right value required**, the value of the **voltage** to the mobile device charger can be set. Alternatively, the duty cycle of the charger switching circuit or its frequency can be changed to modify the voltage in the mobile device.”), 9:40-45 (“In accordance with an embodiment, to **power mobile devices with power requirements** that exceed maximum powers attainable by typical coils in a surface, the mobile device, during its hand shake and verification process can indicate its **power/voltage requirements** to the mobile device charger.”), 10:7-12 (“If a **device with higher power requirements** is placed on the mobile device charger, the mobile device charger can detect its **power requirements** and activate a larger coil or wire pattern with **higher power capabilities** or a coil or wire pattern that is connected to **higher power circuitry**.”), 20:58-64.)

159. Therefore, in my opinion, a person of ordinary skill in the art would have understood that device 2/3 and its battery have particular charging characteristics (and thus the device’s “receiver” (which is attached/coupled/connected with the battery) would also have particular charging characteristics) (e.g., a laptop 3 (and its receiver/battery) has different power/charging characteristics than a mobile phone 2 (and its receiver/battery)). (See my analysis and discussions above in this section and in Sections IX.A.1(a)-(c); *see also* Ex. 1005, Abstract, ¶¶0017-0019, 0062, 0063, 0065, FIG. 4, ¶¶0076-0091,

¶¶0110, Claims 15, 29-30, 35; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(h), IX.A.1(m).) For example, as I discussed above, a person of ordinary skill in the art would have understood that device 2/3's "receiver" (such as the exemplary ones I identified above), which is attached/coupled/connected to the device's battery, is part of, associated with, and/or works with the device's circuitry/components that receive power/voltage/current (e.g., wirelessly/inductively from apparatus 1) and prepare, process, convert, control, manage, carry, etc. such power/voltage/current within device 2/3 for powering the device and/or charging its battery. (*Id.*; *see also* my analysis, discussions, and citations in this section and in Sections VIII.A, IX.A.1(a)-(c), IX.A.1(h), IX.A.1(m).) For example, *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 (“[T]he 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.”), FIGS. 3-5.)

160. *Nakamura* also explains:

Next, description will be given of the portable telephone 2 side. **A smoothing capacitor C4 and a rectification circuit 41 are connected to both ends of the secondary side coil 12, and an induced voltage across the secondary side coil 12 is full-wave rectified in the rectification circuit 41 and, thereafter, smoothed by a**

smoothing circuit constituted of a coil L3 and a capacitor C3 and converted to a DC voltage. The DC voltage is supplied to a power-on reset circuit (carrier wave detection circuit) 44, a power clamp circuit 46, and a regulator 47 in a power receiving side control IC (power adjusting section) 42 that performs power receiving control of the secondary side circuit 13.

The power-on reset circuit 44 is a circuit that detects a DC voltage obtained by converting a carrier wave transmitted from the primary side circuit 10 described later and thereby, determines that a request for an information signal has been issued from the power transmission apparatus 1 so as to reset the power receiving control IC 42 to cause transmission of the information signal to be started. **The voltage clamp circuit 46 is a circuit in which the DC voltage obtained by the conversion is clamped at a predetermined voltage to thereby prevent circuits from being subjected to voltage breakdown, and the regulator 47 converts the DC voltage obtained by the conversion to a predetermined voltage used for charging and supplies the predetermined voltage to the charge control circuit 14.** The power receiving control IC 42 is further provided with a clock extraction circuit 43 connected to the secondary side coil 12 and a modulation circuit 45, and performs a signal processing for a signal transmitted through the primary side coil 11 and the

secondary side coil 12. Note that the power receiving control 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.

(*Id.*, ¶¶0074-0075; *see also id.*, ¶0077 (“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.”), FIGS. 3-5.)

161. In my opinion, *Nakamura*’s teachings are consistent with a person of ordinary skill in the art’s knowledge that different devices (and their components, such as receiver circuitry, battery, etc.) can have different charging characteristics. (Ex. 1005, ¶¶0005-0015; Ex. 1006, ¶¶0033, 0037, 0040 (“different battery packs can have different charging requirements”), 0044, 0049; *see* my analysis and discussions above in this section; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a), IX.A.1(h), IX.A.1(m).)

- e) **an identification component associated with the mobile device or battery, which is configured to provide wireless identification of the receiver to the base unit,**

162. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* 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)-(d), IX.A.1(f)-(m); *see also* my analysis and discussions in Sections VIII.A, VIII.C.)

163. For example, *Nakamura* discloses identifying a mobile device (including its “**receiver**” (which I discussed in Section IX.A.1(d)) as “power reception equipment” that is capable of receiving power from apparatus 1 (“**base unit**”) based on information communicated from the device, which is used by apparatus 1 to determine/recognize whether the device is present (e.g., on or near apparatus 1 and its primary side coil) and properly aligned/positioned for high degree of magnetic coupling for efficient power transfer. (See my analysis and discussions in this section and in Sections IX.A.1(a)-(d); Ex. 1005, FIGS. 3-5, ¶¶0077-0083, e.g., 0078 (“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*’”), 0090-0091, FIG. 4.) 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 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.*, FIGS. 4-5, ¶¶0079-0089, 0090, 0091.)

164. *Nakamura* also discloses applications where “equipment ID of the portable telephone 2” recorded (stored) in the portable telephone can be used to identify/verify/authenticate the device 2 to facilitate mobile payment processes. (Ex. 1005, ¶0149; *id.*, ¶¶0148-0151; *see also id.*, FIGS. 21-22, 25-26, ¶¶0125-0141, 0147-0153.) For example, *Nakamura* explains:

[T]he user who has reached the arrival station at the destination places the portable telephone 2 on a power

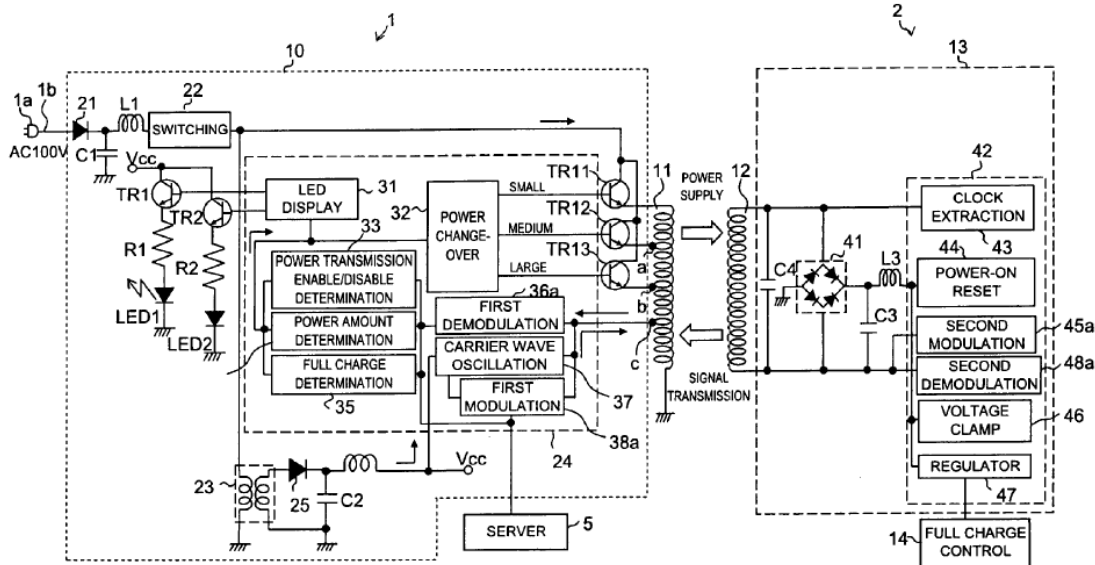
transmission apparatus 1 embedded in an automatic ticket examining machine installed at ticket gate of the arrival station (step S74). Then, the fare is paid by means of the mobile banking according to the departing station information and the **personal information (equipment ID of the portable telephone 2) recorded in the portable telephone 2**. Here, the departing station information and the personal information recorded in the computer of the railway company are also accessed through a server 5 of the arrival station (step S75). In this way, the user is relieved from troublesome work that includes finding a fare to the destination and buying a ticket.

(Ex. 1005, ¶0149.)

165. A person of ordinary skill in the art would have understood such features to include the device wirelessly providing the equipment ID information to facilitate the verification of payment processes. (*Id.*; Ex. 1005, ¶0149 (personal information [equipment ID] “*are also* accessed through a server 5 . . .”), 0150 (“power transmission **apparatus 1 is embedded in a ticket dispenser** installed at a ticket vending corner in the station” and the “**ticket dispenser is connected to the server 5** of the station, and the **power transmission apparatus is connected to the server 5** of the station through the network 6 of the station”), 0151 (equipment ID of device 2 is recorded into computer of the railway company connected to server 5

after device 2 is “placed at a predetermined po[r]tion of the ticket dispenser in which power transmission apparatus 1 is embedded” (when rapid charging starts) and a button is selected on the dispenser).) (*See also id.*, FIGS. 22 (below showing server 5 connected to apparatus 1), 21, 25-26.)

FIG. 22



166. Accordingly, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura's* device 2/3 (e.g., power reception equipment) contains mechanisms (e.g., component(s)) that are configured to store and wirelessly provide identification of the device and/or information associated with the device (and thus its components, including its “**receiver**”-related circuitry and/or battery), such as ID information and/or e.g., certain “codes” (“code indicating being power reception equipment”). (*See my analysis, discussions, and citations regarding Nakamura* above in this section; *see also my analysis and discussions in Sections*

IX.A.1(a)-(d), IX.A.1(f)-(m); *see also* my analysis and discussions in Section VIII.A.)

167. While *Nakamura* discloses configurations where device (e.g., device 2/3) can provide device-related information (e.g., device ID, code information signals), *Nakamura* does not expressly disclose “**an *identification component* associated with the mobile device or battery, which is configured to provide wireless *identification of the receiver to the base unit.*”** (*Id.*) However, in my opinion, a person of ordinary skill in the art would have been motivated to configure the *Nakamura-Odendaal* system to implement such features in view of the teachings/suggestions of *Calhoon* and the disclosures in *Nakamura*. (*Id.*; *see also* discussions below.)

168. *Calhoon* discloses an inductive charging system that transfers energy/power by inductively coupling a source coil on a power source to a “receiver coil” (secondary coil) for a battery charger/battery pack of a mobile device (inductive power receiver), and other features relating to such an inductive charging system (e.g., detection / identification / verification / authentication of an inductive power receiver). (Ex. 1006, Abstract, FIGS. 2-3 (below), ¶¶ 0002, 0008-0010, 0022-0027, 0029, 0042, 0045-0048, 0052, 0065, FIGS. 4-6.) For example, *Calhoon* explains:

Aspects of the present invention provide **inductive charging arrangements** enabling user convenience in wireless power environments for **mobile computing and communications devices**. An **inductive charging system** transfers energy by **inductively coupling a source coil on a power source to a receiver coil for a battery charger portion**. **Current flows through the source coil and the resulting magnetic flux induces an alternating current through the magnetic field and across the receiver coil, completing an energy transfer circuit.** ... Aspects of the present invention may provide for wirelessly communicating operating parameters and protocol between an inductive power source and an inductive battery charger. A wireless communication arrangement may also provide for **authentication** of devices that are allowed by the power source or trusted entity to be powered or otherwise charged.

(Ex. 1006, ¶0022.)

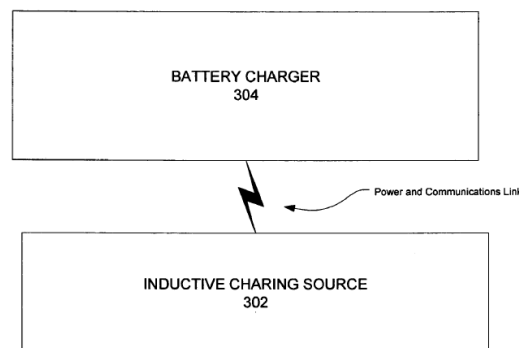


FIGURE 2

“universal base unit” similar to *Nakamura’s* in that it is capable of powering/charging different mobile devices/batteries. (Ex. 1006, ¶¶0033, 0045, 0049, 0056, 0065.) For example, *Calhoon* explains:

The multiple battery packs may have different power requirements which can be handled by the Source 302. For example, a **cellular phone** power requirement is less than that of a **laptop computer**.

(Ex. 1006, ¶0045.) *Calhoon* also explains:

Inductive charging arrangements provide user convenience by providing wireless power to mobile devices and communications devices. . . . Thus, computer users do not need to carry power cables and AC power adapters with them. There is no need to search for an electrical plug location that may be in inconvenient places. The hazards related to power cords are eliminated.

(*Id.*, ¶0065.)

170. *Calhoon* explains that controller 316 in battery charger 304 may include data, “such as a battery charger ID number, serial number, manufacturer’s name and date of manufacture,” which can be used “for novel power operations according to aspects of the present invention, such as shown in FIGS. 5A, 5B, and 6.” (Ex. 1006, ¶0042; *id.*, FIGS. 2-3, 4-6, ¶¶0034, 0043-0044 (charger 304 enabled to determine

power requirements or other data of battery pack 350 (e.g., current and charging voltage, charge state, capacity, full charge, alarm warning, etc.), 0045-0048, 0049 (“battery pack ID of each battery pack may be stored with the charging requirements”), 0050-0052, 0056.) For example, *Calhoon* explains:

[T]he **source 302** may request information or charging parameters from the **battery charger assembly 304**, such as the required charging voltage and maximum power requirement. Nevertheless, the **inductive charging source 302** can request other information relevant to the **battery charger assembly 304**, such as a **battery charger identification (ID) number**, battery type chemistry of the battery pack, or **serial number of the battery charger** or the **serial number of the battery pack**. *This information can be used for security, data integrity, or other purposes.* In process block 508, the **battery charger assembly 304** **transmits the requested information.**

(Ex. 1006, ¶0047.) *Calhoon* also explains:

In process block 606, upon receiving the battery pack’s request for power, **the inductive charging source 302** may request for a **security certificate or digital signature from the battery charger assembly 304 to authenticate it**. The security certification or digital signature may be stored in the computer readable storage of the controller 308. In process block 608, **if battery charger assembly**

304 has a digital certificate or digital signature stored, the battery charger assembly 304 transmits it to the source 302. In process block 610, if the battery charger assembly 304 is authenticated in view of the certification or signature, the source 302 supplies the requested voltage and power the battery charger as shown in process block 612.

(Ex. 1006, ¶0052.)

171. A person of ordinary skill in the art would have understood that such transmission of information (e.g., including ID/serial numbers, power requirements, security certificates, or digital signatures, etc.) between an inductive power receiver (e.g., battery charger assembly 304 and battery pack 350) and an inductive power source (e.g., inductive charging source 302) in *Calhoon* took place wirelessly. (*Id.*; *see also id.*, ¶¶0034 (“[T]he power transmission coil 312 of the charging source 302 and the power pickup coil 324 of battery charger assembly 304 are used to provide **inductive data communications** over an inductive pathway.”), 0050 (“[I]nductive charging source 302 and battery charger assembly 304 may be configured for **wireless data communications.**”))

172. In my opinion, a person of ordinary skill in the art would have thus understood that *Calhoon*’s inductive power receiver includes an “**identification component**” that is associated with the mobile device/battery “**configured to**

provide wireless identification of the receiver [e.g., power receiver ID/serial number, etc.] **to [a] [universal] base unit**” (e.g., power source 302). (*Id.*; *see also* discussions and citations regarding *Calhoon* above.) In my opinion, such a skilled person would have understood that components configured to store, obtain, and transmit such information in inductive power receiver (e.g., assembly 304 component(s), such as one or more of modem 318, controller 316, nonvolatile storage, connector 328, etc.) function as an “**identification component**” given the information can be wirelessly transmitted “for security, data integrity, or other purposes.” (Ex. 1006, ¶¶0047; *see also id.*, FIGS. 3-5A, ¶¶0034, 0036-0037, 0040-0044, 0050, 0052.)

173. In my opinion, a person of ordinary skill in the art would have had reasons to review and consider the teachings of *Calhoon* as explained above, given such a skilled person would have understood *Calhoon* to be in the same field of endeavor as *Nakamura* and *Odendaal* (and the '440 patent) and their teachings to be compatible. For example, *Nakamura*, *Odendaal*, and *Calhoon* all concern wireless/inductive powering/charging (by a base unit) of a mobile/portable device. (*See* my analysis, discussions, and citations above regarding *Nakamura*, *Odendaal*, and *Calhoon*; *see also* my analysis and discussions in Sections VIII, IX.A.1(a)-(d); Ex. 1008, Title, Abstract, 1:5-3:57; Ex. 1006, Abstract, ¶¶0002, 0008-0010, 0022-0027, 0029, 0045-0048, 0065, FIGS. 2-6.) As discussed above, *Nakamura* and

Calhoon both describe transmitting information used by a base unit to control and manage power transfer to a mobile device (based on, for example, power requirements/charging parameters, identification information, etc.). (See my analysis and discussions regarding *Nakamura* above in this section and in Sections IX.A.1(a)-(d); Ex. 1006, ¶¶0034, 0047-0048, 0050, FIGS. 3, 5A, 6.) For example, *Calhoon* explains:

[T]he source 302 may request information or charging parameters from the battery charger assembly 304, such as the required charging voltage and maximum power requirement. Nevertheless, the inductive charging source 302 can request other information relevant to the battery charger assembly 304, such as a battery charger identification (ID) number, battery type chemistry of the battery pack, or serial number of the battery charger or the serial number of the battery pack. This information can be used for security, data integrity, or other purposes. In process block 508, the battery charger assembly 304 transmits the requested information. In process block 510, the source 302, via controller 308, determines if it can supply the requested voltage and power to battery charger assembly 304. In process block 512, if the source 302 cannot supply the requested voltage and/or power, then the source 302 can change to the polling mode. Alternatively,

if the source 302 can provide the voltage and/or power, then the process flows to process block 514 for the charging mode.

After the negotiation process, in process block 514, when the **battery charger assembly 304 begins to receive its requested voltage and power**, the controller 316 may turn on the battery charger 322 in order to charge the battery pack 350.

(Ex. 1006, ¶¶0047-0048.)

174. Furthermore, in my opinion, a person of ordinary skill in the art would have understood that *Calhoon* (like *Nakamura*) also discloses features reasonably pertinent to one or more particular problems the '440 patent discusses. For example, the '440 patent explains that there was a “need” for powering portable/mobile devices for use in different “applications” (Ex. 1001, 1:42-64; *see also id.*, 1:35-3:67). A person of ordinary skill in the art would have understood that *Calhoon* and *Nakamura* also contemplate commercial applications like that considered in the '440 patent. (*Id.*, 1:42-43; Ex. 1006, ¶¶0003-0010, 0050; Ex. 1005, ¶¶0110, 0147-0151.) Accordingly, in my opinion, *Calhoon* would have been consulted by a person of ordinary skill in the art, looking to address and solve similar issues/problems and others relating to the design and implementation of a contactless inductive charging system. (*Id.*)

175. Therefore, in my opinion, when considering, designing, configuring, and implementing a system like the *Nakamura-Odendaal* system, a person of ordinary skill in the art would have consulted teachings/suggestions like that found in *Calhoon* and consequently would have been motivated to modify the above-discussed charger system (of *Nakamura-Odendaal*) to include features like those discussed here and recited in claim 3. (*Id.*)

176. In my opinion, a person of ordinary skill in the art would have recognized the benefits of such identification features and thus would have been motivated to configure device 2/3 in the *Nakamura-Odendaal* combined system to include an identification component that performs similar features, such as providing wireless identification of the “**receiver**” (as I discussed in Section IX.A.1(d)) to apparatus 1 (“**base unit**”), and store such identifier information in device 2/3 in a memory/storage device for such subsequent transmission. (*Id.*) For example, because of the similar features provided by both *Nakamura* and *Calhoon* (e.g., inductively charging/powering different types of devices, modulation/transmission of information/codes used to control power to particular identified/verified devices, etc.), a person of ordinary skill in the art would have had reasons to configure and modify *Nakamura*’s device 2/3 with a component/circuitry/mechanism (“**identification component**”) configured to provide identifying information (e.g., ID/serial number (or similar identifying information)) associated with the above-

identified “**receiver**” (discussed in Section IX.A.1(d)) that is wirelessly provided to apparatus 1 (“**base unit**”) using the inductive transfer mechanisms described by *Nakamura*. (*Id.*; see my analysis and discussions regarding *Nakamura* and *Calhoon* in this section; see also my analysis and discussions regarding *Nakamura* in Sections IX.A.1(a)-1(d).)

177. For example, in my opinion, a person of ordinary skill in the art would have considered designs/implementations that modify or complement components in the above-modified *Nakamura* mobile device 2/3 that are associated with obtaining/generating/transmitting information signals (e.g., “code indicating being power reception equipment”) to apparatus 1 and/or those associated with maintaining/providing the equipment ID of the device (e.g., Ex. 1005, ¶¶0148-0151) with a component/mechanism that facilitates the provision of such device and receiver identifying information to apparatus 1 for identification / verification / authentication / security, etc. purposes, consistent with that taught by *Nakamura* and *Calhoon*. (*Id.*; see my analysis and discussions regarding *Nakamura* and *Calhoon* in this section; see also my analysis and discussions regarding *Nakamura* in Sections IX.A.1(a)-1(d).) In my opinion, a person of ordinary skill in the art would have recognized that such a modification would have beneficially allowed apparatus 1 to detect, identify, verify, authenticate, and otherwise ensure an authorized/recognized/authenticated and properly detected and positioned/aligned

mobile device is present to receive power at an appropriate level, consistent with the teachings/suggestions of *Nakamura* and *Calhoon*. (*Id.*; Ex. 1005, ¶¶0077-0083, FIGS. 3-5; Ex. 1006, Abstract (“provide for authentication of devices that are allowed by the source to be powered or otherwise charged”), ¶¶0022, 0034, 0046-0048, 0050-0052, FIGS. 3, 5A, 6.)

178. In my opinion, coupled with the teachings/suggestions of *Calhoon*, a person of ordinary skill in the art would have appreciated, and been motivated by, *Nakamura*’s teachings regarding use of information (e.g., “code indicating being power reception equipment”) that identifies the mobile device (e.g., to a base unit) as power reception equipment capable to receive power, and teachings relating to storage and use of a device equipment ID that can be stored at the device and shared with apparatus 1 (e.g., in a host system like a ticket dispenser) (Ex. 1005, ¶0151) to modify the *Nakamura-Odendaal* system/device with an “**identification component**” like that claimed. (*Id.*; see my analysis and discussions regarding *Nakamura* and *Calhoon* in this section; see also my analysis and discussions regarding *Nakamura* in Sections IX.A.1(a)-1(d).)

179. In my opinion, a person of ordinary skill in the art would have found rationale for the above-discussed modification given *Nakamura* contemplates applications/configurations where inductive powering of (or communication with) a mobile device by a base unit occurs in public and/or commercial settings (e.g.,

apparatus 1 embedded in a table / seat holder on a **train**, in “a table in a **facility at a destination** (a **shop** or a **conference room**),” in a surface/shelf inside a public **locker**, or “in a **ticket dispenser** installed at a **ticket vending corner in the station**”). (Ex. 1005, ¶¶0108, 0110, 0113-0114, 0117, 150-151, FIGS. 13C-E, 15A-B, 17.) Such a skilled person would have appreciated and understood that in such public/commercial applications, detection / identification / authentication / verification of mobile device 2/3 (and its receiver) would have been desirable (e.g., especially from the perspective of service providers (e.g., train operators, shop/facility owners, and owners of public lockers) who make the wireless charging service and/or other services available to consumers with mobile devices (e.g., through apparatus 1 embedded in host surfaces (e.g., desks/tables, shelves, lockers, ticket dispensers, etc.)).

180. In my opinion, a person of ordinary skill in the art would have thus been motivated to consider and implement authentication / identification / verification / confirmation features that wirelessly identify a mobile device (and its “**receiver**”) using identifying information (e.g., ID/serial number, etc.) provided by the device when the device is attempting to use (or using) inductive-based power transfer features with apparatus 1 for powering/charging the device and/or its battery. (*Id.*; *see also* my analysis and discussions regarding *Nakamura* and *Calhoon* in this section; *see also* my analysis and discussions regarding *Nakamura* in Sections

IX.A.1(a)-1(d).) Such a skilled person would have appreciated the benefits and advantages of such an implementation/modification, such as for example, for verifying/tracking power system use, deterring improper or misuse of power source equipment, improving security, virus protection, data integrity, and confirming an authorized/verified device is present on or near a base unit (e.g., apparatus 1) and is properly positioned/aligned so that a high degree of magnetic coupling can be established for power transfer, like that disclosed/suggested by *Nakamura* and *Calhoon*. (*Id.*, see e.g., Ex. 1006, Abstract, ¶¶0022, 0034, 0036, 0042, 0046-0048, 0050-0052, 0065, FIGS. 3, 5A, 6; Ex. 1005, ¶¶0066, 0074-89, 0099.)

181. In my opinion, a person of ordinary skill in the art would have also recognized that the *Nakamura-Odendaal* system's mobile device and *Calhoon*'s mobile device (e.g., including an inductive power receiver) have similar components and functionalities, which would have further motivated the above-modification. For example, as discussed above, modulation circuit 45 in *Nakamura*'s mobile device 2/3 is used to modulate relevant information such as "code indicating being power reception equipment" and provide such information wirelessly (via coils) to the base unit (apparatus 1), for use by the base unit in transmitting power to the device. (Ex. 1005, ¶¶0077-0078, FIGS. 3-5.) *Calhoon*'s mobile device similarly has a component that is used in modulating relevant information (e.g., power/voltage requirement, ID number/serial number, etc.) and providing such information

wirelessly (via coils) to a base unit, for use by the base unit in transmitting power to the device. (Ex. 1006, ¶¶0034 (“[M]odem 310, 318 may be adapted to **modulate** and demodulate **signals** appropriate to the frequency supplied by the power supply 306, 320 to **receive and transmit data**. Thus, **the power transmission coil 312 of the charging source 302 and the power pickup coil 324 of battery charger assembly 304 are used to provide inductive data communications over an inductive pathway.**”), 0047-0048, FIGS. 3, 5A, 6; *see also* my analysis and discussions regarding *Calhoon* and *Nakamura* in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-1(d).) (*See also* Ex. 1005, ¶0074 (power receiving control IC 42); Ex. 1006, ¶¶0036, 0042 (controller 316 for storing, transmitting, receiving information for power operations), 0047-0048, FIGS. 3, 5A, 6.)

182. In my opinion, such teachings/suggestions (discussed above) would have guided a person of ordinary skill in the art to consider and implement configurations to include an “identification component” in mobile device 2/3, similar to that claimed with a reasonable expectation of success that the resulting modified device would operate as intended and consistent with *Nakamura-Odendaal*’s operations/features. (*Id.*; *see also* my analysis and discussions regarding *Calhoon* and *Nakamura* in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-1(d).) A person of ordinary skill in the art would have had the

skills, knowledge, rationale, and capability to implement such a modification with a reasonable expectation of success given the above-teachings/suggestions in *Nakamura*, *Odendaal*, and *Calhoon*, and the state of art knowledge. (*Id.*)

183. In my opinion, a person of ordinary skill in the art would have appreciated that implementing such a modification would have involved applying known technologies (e.g., use of identifier information (e.g., ID/serial number (*Nakamura* and *Calhoon*)) to verify/identify/authenticate/confirm device(s) (receiver/battery, etc.) receiving power from an inductive power source (*Nakamura* and *Calhoon*) according to known techniques (e.g., components and/or processes that use identifier/device information wirelessly transmitted/received to control and manage inductive powering/charging of a device/battery (*Nakamura* and *Calhoon*)) to yield a foreseeable inductive power transfer/charging system that wirelessly identifies the device (and its receiver) to a base unit to monitor, detect, facilitate, and/or ensure proper use of the system by authorized and/or verified power reception equipment. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(d), IX.A.1(f)-(m); *see also* my analysis and discussions in Section VIII.)

f) a means for avoiding overcharging one or both of the mobile device and battery inductively, and

(1) Plain Meaning and Means-Plus-Function Interpretation

184. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation under its plain meaning and as a means-plus-function term as I was asked to consider in Section VII. (*See* Section VII; *see also* my analysis and discussions below in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(e), IX.A.1(g)-(m); *see also* my analysis and discussions in Section VIII.)

185. For example, *Nakamura*'s mobile device includes a regulator 47 that converts the DC voltage obtained via circuitry (e.g., part of the “**receiver**” (as I discussed in Section IX.A.1(d)) coupled to secondary coil 12 “to a predetermined voltage used for charging” that is “supplied to a charge control circuit 14” for “charg[ing] a battery.”¹⁵ (Ex. 1005, ¶¶0065, 0074-0075, FIGS. 3-5 (“FULL

¹⁵ I have been asked for purposes of my opinions to consider the scenario where the “means for avoiding overcharging” is construed to encompass a structure such as a voltage regulator that is similar to the regulator recited in limitation 3(g). While I provide no opinion as to whether I agree or disagree with such a scenario, under that

CHARGE CONTROL 14”); *see also* my analysis and discussions in Section IX.A.1(g).) For example, *Nakamura* explains:

Next, description will be given of the portable telephone 2 side. A smoothing capacitor C4 and a rectification circuit 41 are connected to both ends of the secondary side coil 12, and an **induced voltage across the secondary side coil 12 is full-wave rectified in the rectification circuit 41 and, thereafter, smoothed by a smoothing circuit constituted of a coil L3 and a capacitor C3 and converted to a DC voltage. The DC voltage is supplied to a power-on reset circuit (carrier wave detection circuit) 44, a power clamp circuit 46, and a regulator 47 in a power receiving side control IC (power adjusting section) 42 that performs power receiving control of the secondary side circuit 13.**

The power-on reset circuit 44 is a circuit that **detects a DC voltage obtained by converting a carrier wave transmitted from the primary side circuit 10** described later and thereby, determines that a request for an

assumption, it is my opinion that the “regulator” I discuss based on *Nakamura*’s regulator 47 below for limitation 3(g) also discloses the “means for avoiding overcharging” in limitation 3(f) for similar reasons. (*See* my discussions and analysis below in Section IX.A.1(g).)

information signal has been issued from the power transmission apparatus 1 so as to reset the power receiving control IC 42 to cause transmission of the information signal to be started. The voltage clamp circuit 46 is a circuit in which the DC voltage obtained by the conversion is clamped at a predetermined voltage to thereby prevent circuits from being subjected to voltage breakdown, and **the regulator 47 converts the DC voltage obtained by the conversion to a predetermined voltage used for charging and supplies the predetermined voltage to the charge control circuit 14. . . .**

(Ex. 1005, ¶¶0074-0075; *see also id.*, ¶0065 (“**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.”).)

186. In my opinion, a person of ordinary skill in the art would have understood *Nakamura*’s “full charge control” features (e.g., relating to Full Charge Control 14 that charges device 2/3’s battery with a supplied DC voltage) encompass/suggest a circuit/component that enables the battery to achieve full charge, while not charging beyond the state of full charge (e.g., not overcharging).

(Ex. 1005, ¶¶0065, 0074-0075, FIGS. 3-5 (“FULL CHARGE CONTROL 14”).)

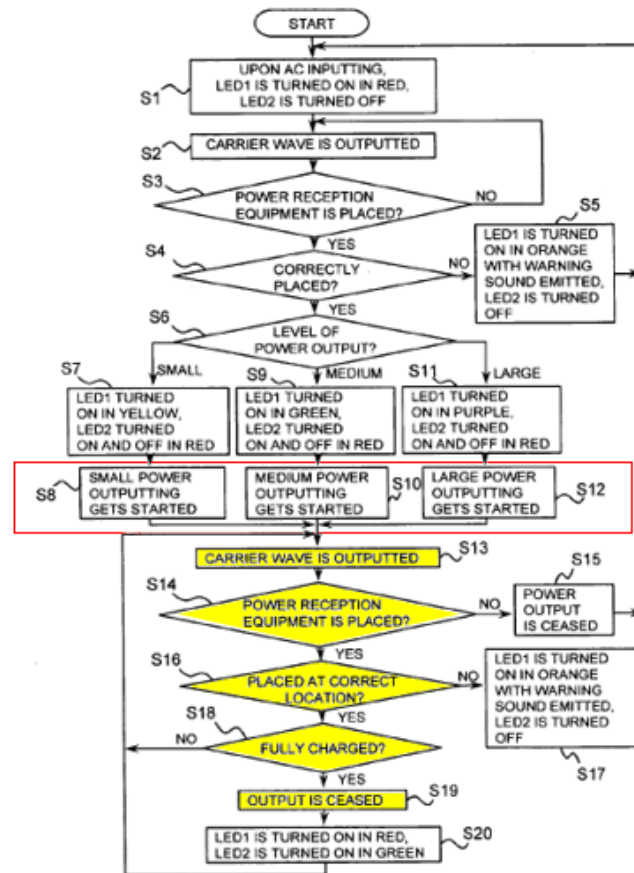
Moreover, *Nakamura* discloses that during power transfer operations, mobile device 2/3 communicates “full charge” information (e.g., “information on full charge”), which is used by the primary circuit 10 in apparatus 1 to stop charging/powering the battery/device. (Ex. 1005, ¶0066 (“necessary to cease power transmission” when device 2 is “fully charged”), 0077-0078 (transmission of “information on full charge” from device 2/3 to apparatus 1), 0079-0087 (providing power when device 2/3 is determined to be correctly placed), 0088 (transistors TR11/TR12/TR13 are turned off to “cease power output” upon determining device 2 is fully charged based on the “information on full charge” communicated from “**mobile device**” 2/3 to “**universal base unit**” 1), 0090-0091, 0096-0097, FIG. 4 (annotated below (e.g., S18-S19))).) 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, **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; *see also id.*, FIG. 4.)

FIG. 4



(*Id.*, FIG. 4 (annotated).)

187. In addition, *Nakamura* also discloses other ways to detect/determine when the battery (e.g., of device 2/3) is fully charged to stop power transfer (and thus prevent overcharging). (Ex. 1005, ¶¶0096, 0100-0101, FIGS. 3-5.) For example, full-charge determination circuit 35 may determine “whether or not the portable telephone 2 has been fully charged based on the change in the current flowing in the primary side coil 11 detected by the current voltage detection circuit 38” and “[i]f a fully charged condition is determined, the power change-over circuit

32 is controlled so that transistors [TR11/TR12/TR13] are all turned off to enable power transmission to be ceased.” (*Id.*, ¶0100; *see also id.*, ¶0101 (“[w]hen the placed power reception equipment has been fully charged, power transmission can be ceased”).) *Nakamura* explains that “[w]ith this arrangement, it is not necessary to transmit an information signal between power transmission apparatus 1 and the portable telephone 2.” (*Id.*, ¶0101.) In my opinion, such above-discussed features disclose the claimed “**means for avoiding overcharging**” (under its plain meaning and as interpreted (as a means-plus-function term) in Section VII) in the claimed “**system**” discussed above. (*See* my analysis and discussions above in this section and in Sections IX.A.1(a)-(e); *see also* my analysis and discussions in Section VIII.A.)

188. While the above-discussed features of *Nakamura* avoid overcharging the mobile device/battery, which involve apparatus 1 components that rely on information transmitted by device 2/3 during power operations (*see* my analysis and discussions above in this section), I have been asked to consider the scenario where this limitation is interpreted such that the “**mobile device**” must include the claimed “**means for avoiding overcharging**” (under its plain meaning and as interpreted (as a means-plus-function term) in Section VII). While I provide no opinion as to whether I agree or disagree with such a scenario, under that scenario, *Nakamura* does not expressly disclose that mobile device 2/3 includes a “**means for avoiding**

overcharging.” However, it is my opinion that a person of ordinary skill in the art would have been motivated to implement such features in view of *Calhoon* and such a skilled person’s state of art knowledge at the time. (See my analysis and discussions below; *see also* my analysis and discussions in Sections VIII.A and VIII.C.)

189. In my opinion, a person of ordinary skill in the art would have been aware that continuing to charge a fully charged battery may cause the battery to heat up, which can damage or detrimentally affect the battery and/or related components (e.g., mobile device components). (Ex. 1019, 8:67-9:7 (temperature rise of a battery during recharging can dramatically reduce reliability and service life of the battery), 9:11-18, 9:38-53 (preventing overcharging “*even if the ‘stop’ command was not received* by the transmitter 12 due to electromagnetic interference”); *see also id.*, 6:15-20, 7:60-67, 14:1-6, FIG. 1; Ex. 1031, FIG. 5, ¶¶0007, 0045; Ex. 1042, 1:59-67 (“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.”).) For example, *Barreras* (Ex. 1019) (which (like the above-cited Exs. 1031

and 1042) discloses features consistent with the state of art knowledge of a person of ordinary skill in the art at the time) explains:

During this recharging operation, the micro controller regulates, as a function of temperature, the current level used to recharge the rechargeable power source 44. The temperature is measured by a thermistor 80 which is adhered to the rechargeable power source 44 during manufacturing. The junction between the thermistor 80 and a resistor 82 form a voltage divider which is fed through an analog switch 84 to an analog to digital converter 86 and, via a line conductor 88, to the micro controller 46. As the voltage rises, the ohmic value of the thermistor 80 drops proportionally to the temperature, thus reducing the voltage at the line conductor 88 to the micro controller 46. **This loop forms a temperature-controlled, current-regulated charging system which restricts the temperature rise of the rechargeable power source 44 during recharging, thus preventing the power source 44 from suffering electrolyte starvation and gas generation. Both of these phenomena will, if left unchecked, dramatically reduce the reliability and service life of the power source 44.** Also, during recharging of the power source 44, the micro controller 46 will monitor the voltage level of the power source 44 via a line conductor 90, analog switch 92, the

A/D converter 86 and, finally, the line conductor 88. **Upon sensing a fully charged state, the micro controller 46 will telemeter to transmitter 12, via the RF communications link 61, a “stop” recharging command and simultaneously will turn off a D/A converter 94 which will cut off the current needed to charge the rechargeable power source 44. In this manner, the power source 44 cannot be overcharged, even if the “stop” command was not received by the transmitter 12 due to electromagnetic interference.**

(Ex. 1019, 8:56-9:18.)

190. Therefore, in my opinion, a person of ordinary skill in the art would have known that it was advantageous to address overcharging issues with respect to batteries and portable devices, and that there were multiple ways to achieve such features and goals, and further that it was advantageous for a system (e.g., such as *Nakamura’s* system, including as modified) to have multiple ways/processes/features/components for avoiding overcharging (e.g., in case one does not work properly, as demonstrated by *Barreras* (Ex. 1019)). (*Id.*; *see also* Ex. 1019, 6:15-20, 7:60-67, 14:1-6, FIG. 1; Ex. 1031, FIG. 5, ¶¶0007, 0045; Ex. 1042, 1:59-67.)

191. Accordingly, even though *Nakamura* describes configurations that address battery overcharging (e.g., by stopping power transfer by apparatus 1 upon

determining that device 2/3 is fully charged based on “information on full charge” transmitted from device 2/3), a person of ordinary skill in the art would have been motivated to consider and implement other ways and mechanisms to supplement/complement such overcharge prevention features (including those encompassed within mobile device 2/3) in order to prevent/avoid overcharging damage issues in the event *Nakamura*’s existing full-charge / overcharge prevention functionalities reliant on apparatus 1 do not/cannot function properly (e.g., due to issues with current detection/measurement, disruption in carrier wave and/or information signal transmission, reception, generation, and/or processing)). (*Id.*; *see also* my analysis and discussions in this section.) *Calhoon* discloses/suggests such features implemented in a power receiver device in a contactless inductive power transfer system. (*See* my analysis and discussions below; *see also* my analysis and discussions in Section IX.A.1(e); *see also* my analysis and discussions in Section VIII.C.)

192. In addition to its teachings/suggestions I discussed above in Section IX.A.1(e), *Calhoon* discloses a mechanism in the mobile device (inductive power receiver with battery pack) for avoiding overcharging of the mobile device battery. For example, *Calhoon* explains:

In another alternative arrangement [relating to FIG. 3], a thermistor or “T” line [not shown in FIG. 3] between the

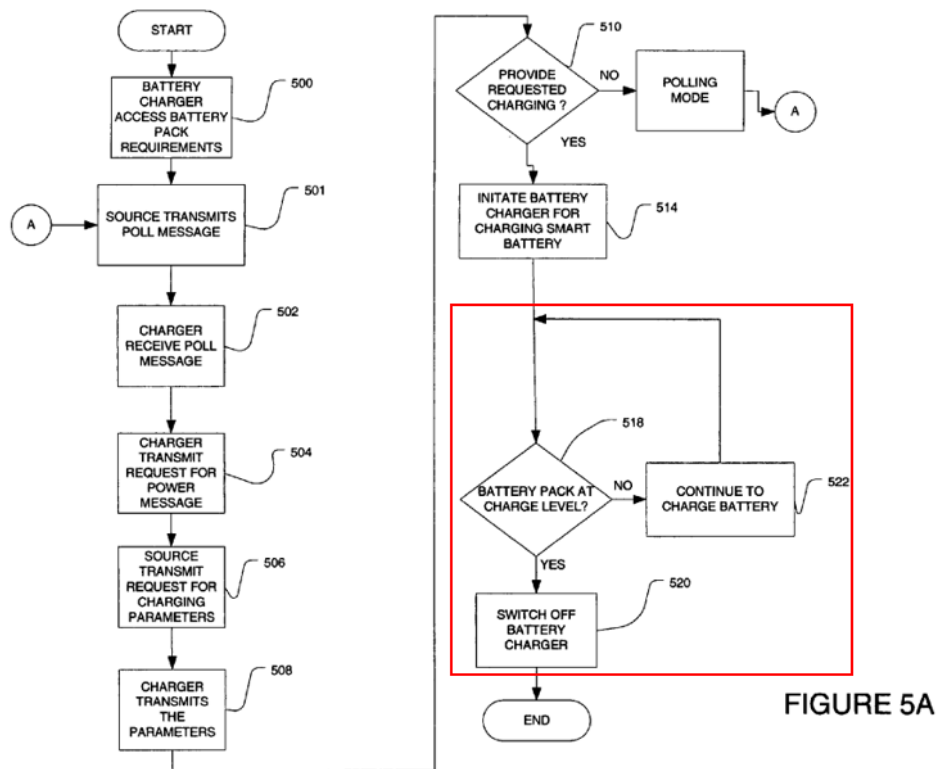
charger 322 of battery charger assembly 304 [associated with the power receiver/mobile device] and the battery pack 350 can be used as a *safety control to disrupt charging in the event the battery pack 350 experiences an overcharge* or over-temperature condition.

(Ex. 1006, ¶0038; *see also id.*, FIGS. 3, 5A.) *Calhoon* also explains:

After the negotiation process, in process block 514, when the battery charger assembly 304 begins to receive its requested voltage and power, the *controller 316 may turn on the battery charger 322 in order to charge the battery pack 350*. In process block 520, *if the battery is charged to the desired level, the battery charger 322 can be switched off-line*. When power from the source is lost, the battery pack returns to its listening mode. In process block 522, if the battery 314 is not at the desired level of charge, then the charging process is continued.

(*Id.*, ¶0048; *see also id.*, ¶0044 (“controller 316 . . . may be configured to read . . . other functions, alarms, and signals from the battery pack 350” such as “battery pack voltage, relative state of charge, absolute state of charge, remaining capacity, full charge capacity, alarm warning, average time to full, battery chemistry”).) In my opinion, a person of ordinary skill in the art would have thus understood that controller 316 and/or battery charger 322 in *Calhoon*’s power receiver controls and regulates battery charging such that charging is disrupted when the battery is charged

to a desired level (e.g., full) or experiences an overcharge (e.g., because it is full), thus preventing overcharging (or further overcharging). (*Id.*, see also Ex. 1006, FIG. 5A (showing that a battery charger is switched off if a battery pack is at a desired charge level).)



(Ex. 1006, FIG. 5A (annotated); see also *id.*, ¶¶0038, 0044, 0048, FIG. 3; see also my analysis and discussions regarding *Calhoon* in this section; see also my analysis and discussions in Sections VIII.C, IX.A.1(e).)

193. Therefore, in my opinion, *Calhoon* discloses/suggests a mechanism that encompasses the corresponding structures or equivalents thereof (and claimed function) for the claimed “**means for avoiding overcharging . . .**” term. (*Id.*; see

also Section VII.) For example, in my opinion, the controller 316 and/or battery charger 322 (including its stored program(s) or in ASIC-based form) discloses or is equivalent to a “*battery regulator chip and/or a circuit that measures parameters of a battery (voltage, degree of charging, temperature, etc.) and uses an internal program to regulate the power drawn from a circuit to ensure overcharging does not occur*” (corresponding structures mentioned above in Section VII). (*Id.*; Ex. 1006, ¶¶0038, 0040, FIG. 4, 0043 (“controller 316 may have computer-readable media 415, which provides nonvolatile storage of computer-readable instructions, data structures, program modules and other data relevant for charging operations”), 0044, 0048, 0066 (“the aspects may be implement via . . . (ASICs)”)).

194. For example, as discussed above, *Calhoon*’s controller 316 and/or battery charger 322 (in an inductive power receiver) stops charging a battery (e.g., stops providing power/voltage to a battery) when the battery is full (to avoid overcharging) (“*regulate the power drawn from the circuit to ensure over-charging does not occur*”). (*Id.*) As discussed above, *Calhoon* explains that such components use “**a thermistor or ‘T’ line between the charger 322 of battery charger assembly 304 and the battery pack 350 . . . as a safety control to disrupt charging in the event the battery pack 350 experiences an overcharge.**” (Ex. 1006, ¶0038.) Thus, a person of ordinary skill in the art would have understood that such components of

Calhoon measure temperature of a battery. (*Id.*) *Calhoon* also explains that controller 316 obtains voltage and state/degree of charging of a battery.

[V]alues for the charging current and the charging voltage may be determined from the battery pack 350. The requirements data, once obtained from the battery pack 350, may be stored in the computer readable storage 415 of controller 316 for use during charging operations or for later transmission to the inductive power source 302. Nevertheless, **the controller 316 of battery charger assembly 350 may be configured to read, via the bus 328, other functions, alarms, and signals from the battery pack 350.** For example, **values can be obtained from the battery pack 350 for battery pack voltage, relative state of charge, absolute state of charge, remaining capacity, full charge capacity, alarm warning, average time to full, battery chemistry.**

(Ex. 1006, ¶0044.) Thus, a person of ordinary skill in the art would have understood that *Calhoon* discloses a “*battery regulator chip*” and/or “*circuit [that] measures the various parameters of the battery (voltage, degree of charging, temperature, etc.) . . . to regulate the power drawn from the circuit to ensure over-charging does not occur,*” or equivalents thereof. (*Id.*; see also Ex. 1006, ¶¶0038, 0040, 0043-0044, 0048, 0066, FIGS. 3-4, 5A.)

195. *Calhoon* explains that the features, functions, and operations of its invention (including those discussed above) can be implemented with “a wide range of hardware, software, firmware, or any combination thereof,” including for example, “via Application Specific Integrated Circuits (ASICs).” (Ex. 1006, ¶0066.) *Calhoon* also explains that such features, functions, and operations (including those discussed above) “can be equivalently implemented in **standard Integrated Circuits, as a computer program** running on a computer, **as a program running** on a processor, as firmware, or as virtually any combination thereof and that designing the **circuitry and/or writing the code** for the software or firmware would be well within the skill of one of ordinary skill in the art in light of this disclosure.” (*Id.*) Thus, and for the reasons discussed above, a person of ordinary skill in the art would have understood that *Calhoon* discloses a “*battery regulator chip*” and/or “*circuit [that] measures the various parameters of the battery (voltage, degree of charging, temperature, etc.) and uses an internal program to regulate the power drawn from the circuit to ensure over-charging does not occur,*” or equivalents thereof. (*Id.*; see also my analysis, discussions, and citations regarding *Calhoon* in this section.)

196. In my opinion, in view of the teachings/suggestions of *Calhoon* in context of *Nakamura*’s disclosures and a person of ordinary skill in the art’s state of art knowledge, such a skilled person would have been motivated to further modify

the mobile device 2/3 in the above-discussed *Nakamura-Odendaal-Calhoon* combination (discussed in Sections IX.A.1(a)-(e)) to include a battery regulator chip and/or a circuit that measures battery parameters (e.g., voltage, degree of charging, temperature, etc.) and uses an internal program to regulate the power drawn from battery circuit to prevent overcharging, similar to the teachings/suggestions provided by *Calhoon*. (Ex. 1006, ¶¶0038, 0040, 0043, 0044, 0048, 0066, FIGS. 3-4, 5A; *see also* my analysis, discussions, and citations regarding *Calhoon* and *Nakamura* in this section; *see also* my analysis and discussions in Sections VIII, IX.A.1.(a)-(e).)¹⁶

197. In my opinion, a person of ordinary skill in the art would have been motivated to implement such a modification to enhance, supplement, complement, and/or improve *Nakamura's* above-discussed full charge features in order to ensure battery overcharging does not occur even where the components/processes involved with *Nakamura's* full charge features fail to stop power from being transferred to device 2/3 and/or its battery (e.g., due to disruptions, circuit component failures/issues, or other potential issues that affect proper operation of component(s))

¹⁶ In my opinion, a person of ordinary skill in the art had reasons to consider the teachings of *Calhoon* in context of the *Nakamura-Odendaal* system for the same/similar reasons discussed above for limitation 3(e). (*See* my analysis and discussions in Section IX.A.1(e).)

and/or signal/information transfer/processing etc.), as known in the art. (*Id.*; Ex. 1019, 8:56-9:18, 9:38-53, FIG. 1; *see also* my analysis and discussions above in this section.) For example, a person of ordinary skill in the art would have appreciated that such a modification would have been beneficial where, during power transfer operations, the above-discussed signals (of *Nakamura*) are not/cannot be sent or received, or appropriately converted or processed, which would prevent generation and/or transmission of the information signals (e.g., “information on full charge”) used by full charge determination circuit 35 to stop power/charge operations as discussed above. (*See* my analysis and discussions above in this section; *see also* Ex. 1005, ¶¶0077-0078, 0086-0088, FIG. 4.) Similar benefits would have been realized where component issues exist that preclude/hinder such full charge operations, such as with, for example, modulation circuit 45, oscillation circuit 37, demodulation circuit 36, determination circuit 35, conductors/wires relating thereto, etc., or other potential issues that affect proper information generation and/or transfer, reception, processing, etc. (*Id.*) In my opinion, a person of ordinary skill in the art would have understood that the same is true in applications based on *Nakamura*’s FIG. 6 configuration, where failures/errors occur with components/circuitry used to provide separate information and signal communications regarding the full charge state features (e.g., coils 11n, 12b,

oscillation circuit 37, modulation circuit 45, demodulation circuit 36, etc.). (*Id.*, Ex. 1005, ¶¶0092-0094, FIG. 6.)

198. In my opinion, a person of ordinary skill in the art would have understood that *Nakamura-Odendaal*'s system and *Calhoon*'s system have similar approaches/processes regarding wireless/inductive charging and stopping charge operations upon full charge status of a battery/device is reached (*see* my analysis and discussions above) and have similar and compatible components for providing such features (e.g., *Calhoon*'s controller 316 and *Nakamura*'s power receiving control IC 42 (which contains regulator 47), full charge control circuit 14). (*See* my analysis and discussions above in this section; *see also* my analysis and discussions in Section IX.A.1(e); *see also* Ex. 1005, ¶¶0065, FIGS. 3, 5; Ex. 1006, ¶¶0038, 0043-0044, 0048, FIG. 3.) Such teachings/suggestions (and those above) would have guided/motivated a person of ordinary skill in the art to consider and implement configurations to include an “**means for avoiding overcharging . . .**” (as discussed above) in mobile device 2/3, similar to that claimed with a reasonable expectation of success that the resulting modified device would operate as intended and consistent with *Nakamura-Odendaal*'s (and *Nakamura-Odendaal-Calhoon*'s (as discussed in Section IX.A.1(e))) operations/features. (*Id.*; *see also* my analysis and discussions in Section IX.A.1(a)-(e).)

199. In my opinion, a person of ordinary skill in the art would have had the skills, knowledge, rationale, and capability to implement such a modification with a reasonable expectation of success given the above-discussed teachings/suggestions in *Nakamura*, *Odendaal*, and *Calhoon* and the state of art knowledge. (*Id.*) In my opinion, implementing such a modification would have involved applying known technologies (e.g., overcharge protection mechanisms (*Calhoon*, *Nakamura*, state of art knowledge (Ex. 1019, 8:55-9:53, Ex. 1031, ¶¶0007, 0045))) to provide enhanced prevention of device/battery overcharging (*id.*) according to known methods and techniques (e.g., measuring/processing parameters, values, signals, information and/or program instructions to determine full charge status and preventing further charging (*Nakamura*, *Calhoon*)) to yield a predictable inductive power transfer/charging system that mitigates against damage caused by battery overcharging. (*Id.*; *see also* my analysis and discussions above in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(e); *see also* my analysis and discussions in Section VIII.)

200. Therefore, in my opinion, the *Nakamura-Odendaal-Calhoon* modified system/device discloses and/or suggests limitation 3(f) under both its plain meaning and as a means-plus-function term noted in Section VII. (*Id.*; *see also* Section VII.)

(2) Other Scenarios

201. In addition to and separate from the analysis above, I have been asked to consider four other scenarios pertaining to the claimed **“means for avoiding overcharging one or both of the mobile device and battery inductively.”** It is my opinion that *Nakamura* alone and/or *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests the claimed **“means for avoiding overcharging . . .”** under such other scenarios.¹⁷ (See my analysis and discussions below.)

202. *First*, I have been asked to consider the scenario where the claimed **“means for avoiding overcharging . . .”** of this limitation is determined to encompass a means (e.g., a wireless power receiver/transceiver ASIC) to send an end power transfer message to a wireless charger base unit, which signals the base unit to stop inductive charging (e.g., of a device/battery), and thus prevent overcharging. In my opinion, under that scenario, the above-discussed teachings/suggestions of *Nakamura* disclose and/or suggest this limitation.

203. For example, *Nakamura*’s components and related processes discussed above that use information signals with codes generated and transmitted by mobile

¹⁷ In conducting such analysis, I treat such scenarios as hypotheticals and do not provide any opinion as to whether I agree or disagree with such scenarios or whether they properly define the “means for avoiding overcharging” as recited in the claims.

device 2/3 and used by apparatus 1 to stop power transfer to device 2/3 (which prevents overcharging) discloses and/or suggests the claimed “**means for avoiding overcharging . . .**” under this scenario. (*See* my analysis and discussions regarding *Nakamura* above in this section (IX.A.1(f)); *see also* my analysis and discussions in Sections VIII.A and IX.A.1(a)-(e), (g)-(m).)

204. For example, *Nakamura*’s mobile device uses modulation circuit 45 (part of a power receiving control IC 42) and other relevant components/circuitry to transmit “**information on full charge**” that indicates “**a state of full charge**” to apparatus 1. (*See, e.g.*, Ex. 1005, FIGS. 3-5, ¶¶0070, 0078-0078, 0086-0088, 0090-0091; *see* my analysis and discussions regarding *Nakamura* in this section (IX.A.1(f)) and in Sections VIII.A and IX.A.1(a)-(e), (g)-(m).) Full-charge determination circuit 35 in apparatus 1 uses that information to determine whether device 2/3 (or its battery) is fully charged, and if so, power-over circuit 32 turns off transistors TR11/TR12/TR13 to cease power output (step S19). (*Id.*) Thus, *Nakamura*’s mobile device, such as a cellphone or laptop, contains integrated chip component and/or a circuit (e.g., power receiving IC 42, secondary side circuit 13, which contains modulation circuit 45 and other components/circuitry) that sends the information on full charge that a person of ordinary skill in the art would have understood to functions similar to an end of power message since it signals apparatus 1 to cease power transfer to device 2/3. (*Id.*) Thus, in my opinion, a person of

ordinary skill in the art would have understood that *Nakamura* discloses and/or suggests this limitation or its equivalents under this scenario.

205. *Second*, I have been asked to consider the scenario where the claimed “**means for avoiding overcharging . . .**” of this limitation is determined to encompass communicating voltage/current/power requirements to a charger (for regulation by the charger) which the charger uses for closed-loop control of the voltage/current/power delivered to a device. In my opinion, under that scenario, the above-discussed teachings/suggestions of *Nakamura* disclose and/or suggest this limitation.

206. For example, as I discussed above, *Nakamura* discloses generating at and sending from the mobile device 2/3 information on power requirements for the mobile device/receiver/battery (“**information on consumed power**”) to apparatus 1, which is used by power amount determination circuit 34 (of apparatus 1) to determine whether power of device 2/3 requires large, medium, or small power, and (like determination circuit 33) works with power change-over circuit 32 in a closed-loop fashion to adjust power/voltage/current transmitted (inductively) to mobile device 2/3. (See, e.g., Ex. 1005, Abstract, FIGS. 3-5, ¶¶0017-0019, 0078, 0083-0085, 0090-0091, 0099; see my analysis and discussions regarding *Nakamura* in this section (IX.A.1(f)) and in Sections VIII.A and IX.A.1(a)-(e), (g)-(m).) Thus, in my

opinion, a person of ordinary skill in the art would have understood that *Nakamura* discloses and/or suggests this limitation under this scenario.

207. *Third*, I have been asked to consider the scenario where the claimed “**means for avoiding overcharging . . .**” of this limitation is determined to encompass a regulator that limits voltage, current, or power delivered (and thus reducing the charge delivered), and is configured to provide such regulated/limited power to a battery and can also be shut down if needed. In my opinion, under that scenario, *Nakamura* alone and/or *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation.

208. For example, as explained above and below for limitation 3(g), *Nakamura* discloses a regulator 47 in device 2/3 that converts the DC voltage obtained via circuitry (e.g., part of the “**receiver**” (discussed in Section IX.A.1(d))) coupled to secondary coil 12 “to a predetermined voltage used for charging” that is “supplied to a charge control circuit 14” for “charg[ing] a battery.”¹⁸ (Ex. 1005,

¹⁸ As I mentioned above, I have been asked for purposes of my opinions to consider the scenario where the “means for avoiding overcharging” is construed to encompass a structure such as a voltage regulator that is similar to the regulator recited in limitation 3(g). While I provide no opinion as to whether I agree or disagree with

¶¶0065, 0074-0075, FIGS. 3-5 (Full Charge Control 14); *see* my analysis and discussions in Section IX.A.1(g).) In my opinion, a person of ordinary skill in the art would have understood that in accordance with *Nakamura*'s power control features discussed above (*see* my analysis and discussions above in this section (IX.A.1(f)) and in Sections IX.A.1(a)-(e); Ex. 1005, ¶¶0086-0088 (full charge), ¶¶0079-0082 (positional/alignment deviation)), the regulator 47 "can also be shut down if needed" since if no power is being transferred (upon full charge or excessive positional/alignment deviation), the regulator 47 would not be regulating such power and thus is effectively shut down. (*Id.*) Thus, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura* discloses and/or suggests this limitation under this scenario. (*Id.*)

209. Moreover, in my opinion, the *Nakamura-Odendaal-Calhoon* combination I discussed above in this section (IX.A.1(f)) also discloses and/or suggests this limitation under this scenario. For example, I explained above in this section (IX.A.1(f)) how and why a person of ordinary skill in the art would have

such a scenario, under that assumption, it is my opinion that the "regulator" I discuss based on *Nakamura*'s regulator 47 below for limitation 3(g) also discloses the "means for avoiding overcharging" in limitation 3(f) for similar reasons. (*See* my discussions and analysis below in Section IX.A.1(g).).

been motivated to modify the *Nakamura-Odendaal-Calhoon* system/device to include a mechanism that avoids overcharging one or both of the mobile device and battery inductively. (See my analysis and discussions above in this section (IX.A.1(f)).) In my opinion, a person of ordinary skill in the art would have understood that controller 316 and/or battery charger 322 in *Calhoon*'s inductive power receiver (discussed above) act as a "regulator" to control and regulate charging of a battery such that when the battery is charged to a desired level (e.g., full or near full) or when it experiences an overcharge (e.g., because it is full), charging of the battery is stopped to prevent overcharging (or further overcharging) of the battery. (*Id.*) The modified *Nakamura-Odendaal-Calhoon* system/device would have included similar features, such that the mechanism for avoiding overcharging discussed above in this section (IX.A.1(f)) would likewise operate like a regulator to limit the voltage, current, or power delivered (thereby reducing the charge delivered) and would have been configured to provide such regulated/limited power to a battery and could also be shut down if needed. (*Id.*) Thus, in my opinion, a person of ordinary skill in the art would have understood that the *Nakamura-Odendaal-Calhoon* system/device also discloses and/or suggests this limitation under this scenario. (*Id.*)

210. Therefore, for the reasons above, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura* alone and/or *Nakamura* in

view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation under this *third* scenario. (*Id.*)

211. *Fourth*, I have been asked to consider the scenario where the claimed “**means for avoiding overcharging . . .**” of this limitation is determined to encompass, in addition to a regulator in a receiver ASIC, Battery Charger or Power Management (PMIC) ICs that charge a battery (and include means for avoiding overcharging a mobile device and/or a battery). In my opinion, under that scenario, *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation.

212. For example, in my opinion, the *Nakamura-Odendaal-Calhoon* combination discussed above in this section (IX.A.1(f)) also discloses and/or suggests this limitation under this scenario, for the reasons similar to those I provided for the *third* scenario above. (*See* my analysis and discussions above in this section (IX.A.1(f)); *see also* discussions above regarding the *third* scenario; *see also* my analysis and discussions in Sections VIII.A and IX.A.1(a)-(e), (g)-(m).) As I explained, *Nakamura*’s mobile device includes power receiving side control IC 42 and full charge control circuit 14. IC 42 (which is “in the shape of an IC chip”) performs power receiving control of secondary side circuit 13, and prevents circuits from voltage breakdown (e.g., using voltage clamp circuit 46), and regulator 47

converts obtained DC voltage to supply it to full charge control circuit 14 for charging the battery of device 2/3. (*Id.*; Ex. 1005, ¶¶0065, 0074-0075, FIGS. 3, 5.)

213. In my opinion, a person of ordinary skill in the art would have understood that power receiving side control IC 42 (or IC 42 and full charge control circuit 14) disclose and/or suggest (or is equivalent to) a Battery Charger or Power Management (PMIC) ICs that charge a battery. (*Id.*) Power control IC 42 (also referred to as “**power adjusting** section”) includes components such as voltage clamp circuit 46 and regulator 47 that manage power/voltage that is received (inductively) from apparatus 1, and/or manage, control, or regulate power/voltage used to charge a battery. (*Id.*) In my opinion, such features would have been included or modified with the features in the above-discussed combined *Nakamura-Odendaal-Calhoon* system/device. (*Id.*) In my opinion, the resulting modified *Nakamura-Odendaal-Calhoon* system/device would have included a mechanism (including integrated circuitry) that would have prevented/avoided the device’s battery from overcharging. (*Id.*; *see also* my analysis and discussions above in this section (IX.A.1(f)).)

214. Therefore, for the reasons above, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation under this scenario. (*Id.*)

- g) **a regulator, coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the mobile device or battery, to be within a range of parameters for the mobile device or the battery;**

215. 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), IX.A.1(h)-(m); *see also* my analysis and discussions in Section VIII.)

216. As I explained, *Nakamura*'s mobile device 2/3 includes a power receiving side control IC (power adjusting section) 42 with a regulator 47 "that performs power receiving control of the secondary side circuit 13." (Ex. 1005, ¶0074, FIGS. 3, 5.) As I explained, "the regulator 47 converts the DC voltage obtained by the conversion to a predetermined voltage used for charging and supplies the predetermined voltage to the charge control circuit 14." (*Id.*, ¶0075.) *Nakamura* also explains that "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." (Ex. 1005, ¶0065.) For example, *Nakamura* explains:

Next, description will be given of the portable telephone 2 side. A smoothing capacitor C4 and a rectification circuit 41 are connected to both ends of the secondary side coil 12, and an **induced voltage across the secondary side coil 12 is full-wave rectified in the rectification circuit**

41 and, thereafter, smoothed by a smoothing circuit constituted of a coil L3 and a capacitor C3 and converted to a DC voltage. The DC voltage is supplied to a power-on reset circuit (carrier wave detection circuit) 44, a power clamp circuit 46, and a regulator 47 in a power receiving side control IC (power adjusting section) 42 that performs power receiving control of the secondary side circuit 13.

The power-on reset circuit 44 is a circuit that **detects a DC voltage obtained by converting a carrier wave transmitted from the primary side circuit 10** described later and thereby, determines that a request for an information signal has been issued from the power transmission apparatus 1 so as to reset the power receiving control IC 42 to cause transmission of the information signal to be started. The voltage clamp circuit 46 is a circuit in which the DC voltage obtained by the conversion is clamped at a predetermined voltage to thereby prevent circuits from being subjected to voltage breakdown, and **the regulator 47 converts the DC voltage obtained by the conversion to a predetermined voltage used for charging and supplies the predetermined voltage to the charge control circuit 14. . . .**

(Ex. 1005, ¶¶0074-0075.)

217. In my opinion, a person of ordinary skill in the art would have understood that regulator 47 alone, or collectively with charge control circuit 14, is an example of a **“regulator”** that is **“coupled to the output of the receiver or to the battery, that regulates an output voltage or output current provided by the receiver, to the mobile device or battery”** as claimed.¹⁹ (Ex. 1005, ¶¶0065, 0074-0075, FIGS. 3, 5; *see* my analysis and discussions below.) For example, regulator 47 converts the DC voltage “to a predetermined voltage used for charging and supplies [it] to the charge control circuit 14,” which is provided to the battery of mobile device 2/3 for charging. (Ex. 1005, ¶0075; *see also id.*, ¶0074.) The DC voltage is provided by circuitry that is part of the **“receiver”** examples I identified above for limitation 3(d). Therefore, in my opinion, output voltage or current provided by such a “receiver” is regulated via regulator 47 or regulator 47 and charge control circuit 14—each of which is an example of the claimed **“regulator.”** (*Id.*)

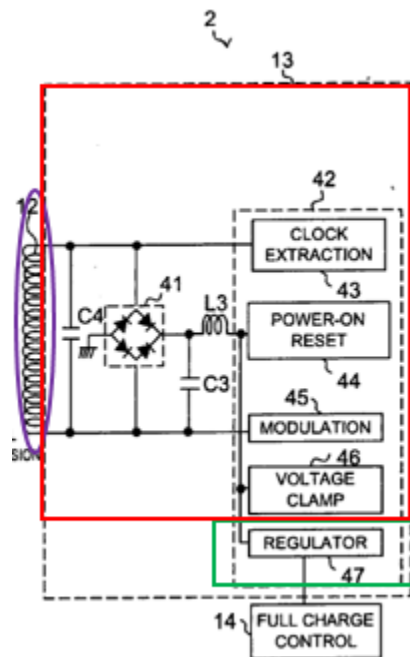
218. In my opinion, regulator 47 is **“coupled to the output of the receiver”** that I discussed above for limitation 3(d). (*See* my analysis and discussions in Section IX.A.1(d).) As I show below,²⁰ such a **“regulator”** (identified in green in

¹⁹ *See* footnote n.15 above.

²⁰ *See* footnote n.11, above.

the exemplary annotated figures below) is coupled to each of the exemplary “**receiver(s)**” that I discussed above in Section IX.A.1(d)). These include:

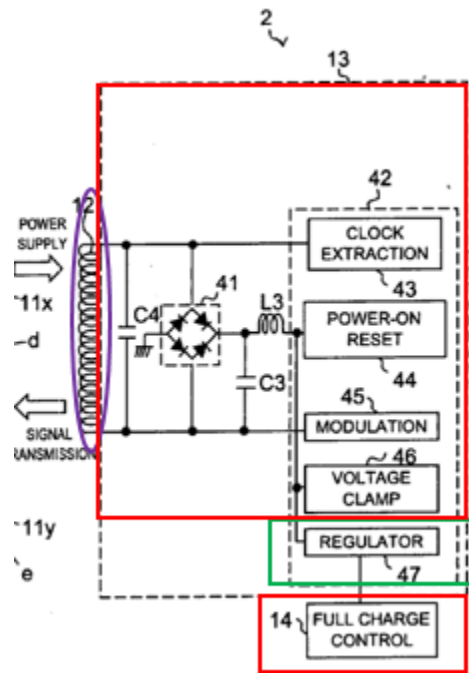
- a. **(1)** Secondary side circuit 13 (with or without regulator 47)²¹
(e.g., shown below in red without including regulator 47).



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

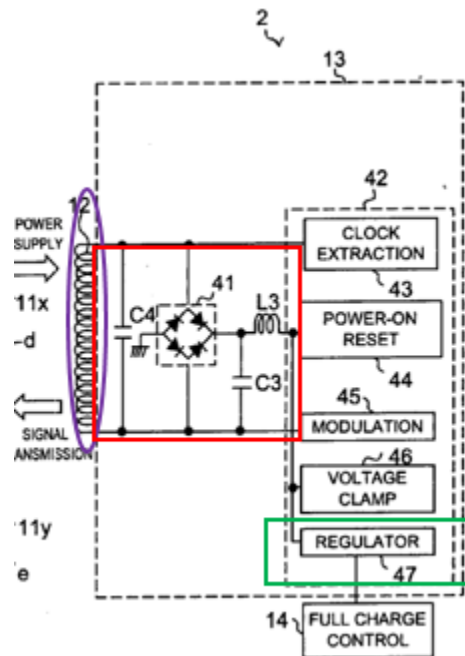
- b. **(2)** Secondary side circuit 13 (with or without regulator 47) together with full charge control 14 (e.g., shown in red below without including regulator 47).

²¹ See footnote n.12, above.



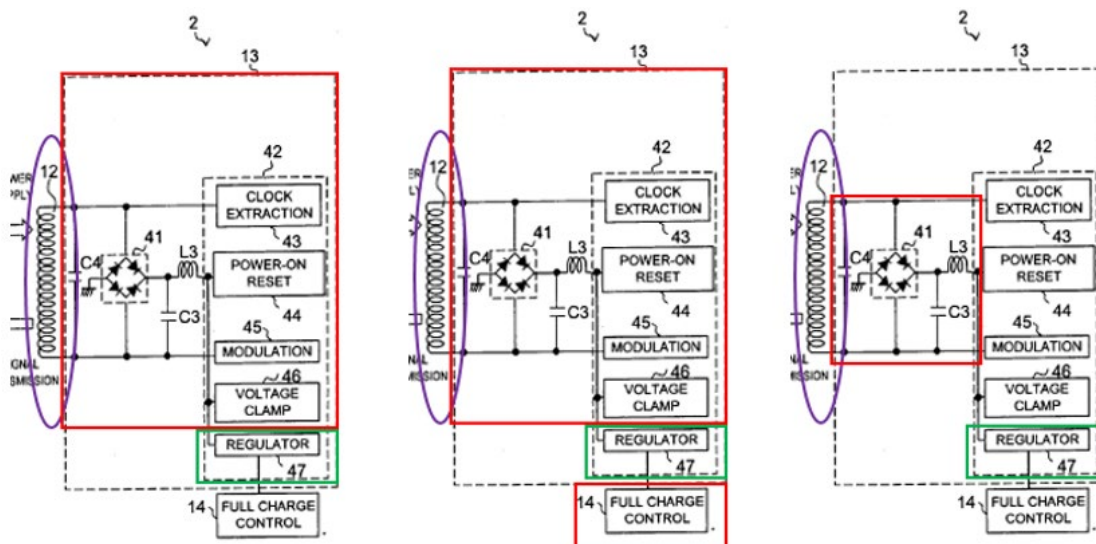
(Ex. 1005, FIG. 5 (annotated).)

- c. **(3)** Other circuitry/components in secondary side circuit 13 (e.g., one or more of capacitor C4, rectifier 41, inductor L3, and/or capacitor C3 (e.g., shown in red below)).

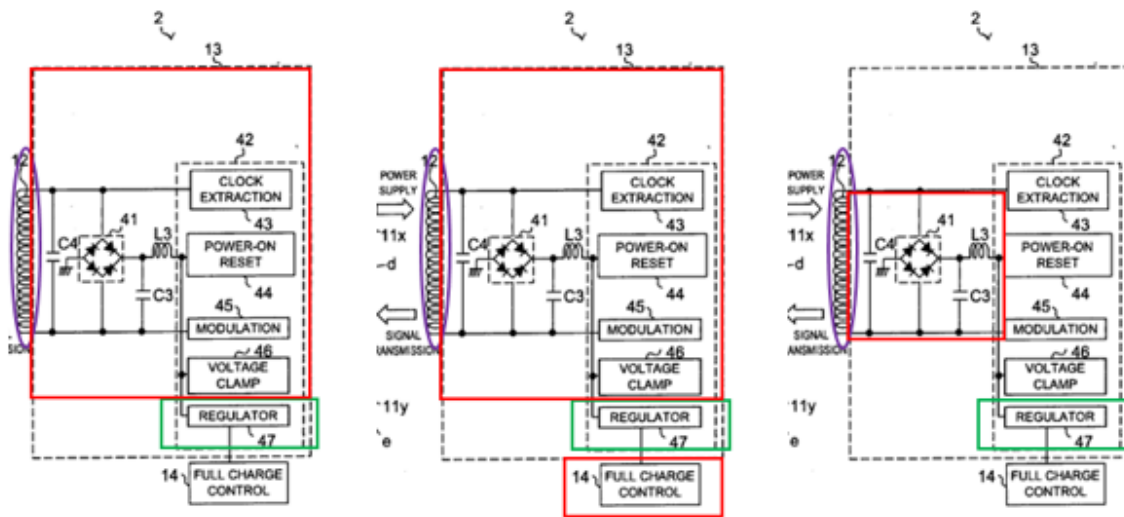


(Ex. 1005, FIG. 5 (annotated).)

I recreate the three above exemplary mappings below together for visual aid purposes.



(Id., FIG. 3 (annotated).)

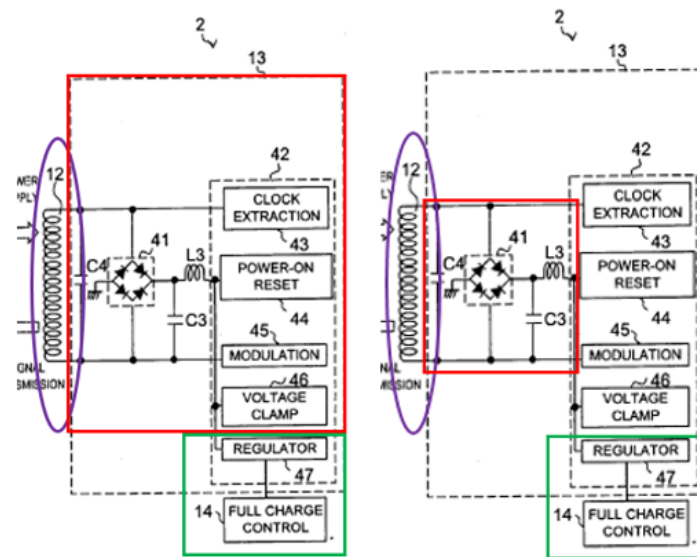


(*Id.*, FIG. 5 (annotated).)

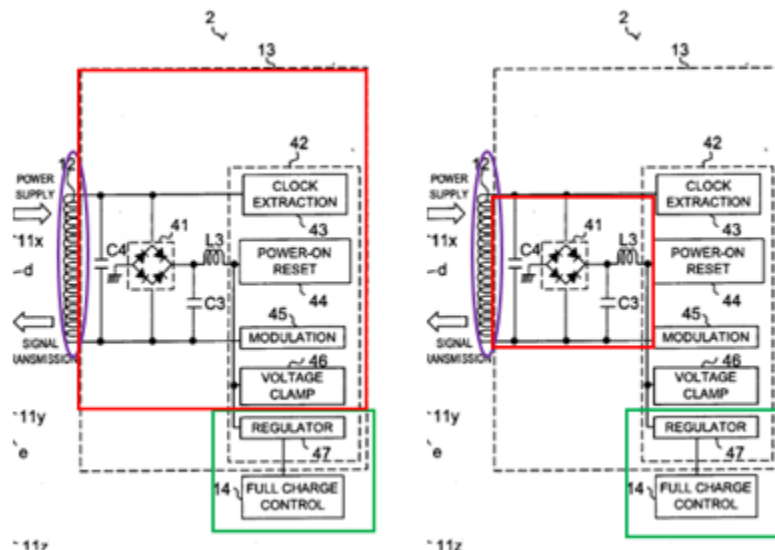
219. Similarly, regulator 47 is also “coupled to . . . the battery” (*see* my analysis and discussions in Section IX.A.1(d)), which while not shown in *Nakamura*’s figures, is contained within the “**mobile device**” 2/3 and receives the regulated voltage/current for charging via charge control circuit 14. (*See* my analysis and discussions in Sections IX.A.1(a)-(d), IX.A.1(f); *see also* Ex. 1005, ¶¶0062-0063, 0065, 0074-0075, 0110, Claims 15, 29-30, 35.)

220. In my opinion, for similar reasons, *Nakamura*’s regulator 47 collectively with charge control circuit 14 also discloses the claimed “**regulator**” (green in the exemplary annotated figures below) coupled to the “**battery**” or the “**receiver**” (with or without regulator 47, e.g., which is shown in red below without including regulator 47). (*See* my analysis and discussions in Sections IX.A.1(a)-(d),

IX.A.1(f); *see also* my analysis, discussions, and citations regarding *Nakamura* above in this section.)



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



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

221. In my opinion, the above-identified “**regulator**” regulates the output voltage or current provided by the above-identified “**receiver**” “**to be within a**

range of parameters for the mobile device or the battery” as claimed. (*See my analysis and discussions above and below in this section.*) As I explained, *Nakamura* discloses “regulator 47 convert[ing] the DC voltage obtained by the [carrier wave] conversion to a ***predetermined voltage*** used for charging” a battery. (*See my analysis, discussions, and citations above; see also* Ex. 1005, ¶¶0065, 0074-0075, FIGS. 3-5.) In my opinion, a person of ordinary skill in the art would have understood that “a predetermined voltage” is an acceptable voltage for the battery given *Nakamura* describes providing appropriate power (and voltage) to device 2/3 for charging the battery based on power requirements. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(f); Ex. 1005, FIGS. 3-5, Abstract, ¶¶0017-0019, 0063, 0066, 0085, 0086-0088, 0091.) Therefore, in my opinion, a person of ordinary skill in the art would have also understood that such a predetermined voltage is necessarily within a range of parameters for the device or its battery since *Nakamura*’s system would not operate as intended if the regulated power (voltage and/or current) from the “receiver” was outside of proper operational range. (*Id.*)

222. I have been asked to consider the scenario where *Nakamura* (as modified above) does not disclose this feature. Under that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to configure the above-identified “**regulator**” to regulate the “**receiver**” output voltage/current “**to be within a range of parameters for the mobile device or the battery**” in light of

the teachings/suggestions of *Nakamura* and *Calhoon* and state of art knowledge.
(See my analysis and discussions below.)

223. For example, as explained above, *Nakamura* discloses adjusting the power/voltage/current level (e.g., small, medium, and large) used to power/charge a particular mobile device 2/3 and/or its battery based on power requirements of the device/battery. (See my analysis and discussions above in Sections IX.A.1(a)-(d), (f); see also Ex. 1005, FIGS. 3-5, Abstract, ¶¶0017-0019, 0063, 0066, 0085-0088, 0091.) In my opinion, a person of ordinary skill in the art would have understood and appreciated that circuits/systems/components in power transfer, control, regulation, etc. applications were known to experience fluctuations in signal levels/values during normal operations. (*Id.*; see also Section V.) Thus, as known in the art, components, circuits, etc. were typically designed, manufactured, and implemented with tolerances that permitted operations within a range of values or parameters. (*Id.*) In my opinion, a person of ordinary skill in the art would have applied and implemented the same common design concepts (or used components manufactured according to such design concepts) in the circuits/components/configurations in *Nakamura*'s system and mobile device 2/3 (including as modified above). (*Id.*)

224. Thus, in my opinion, such a skilled person would have been motivated to configure (and would have been capable of configuring) the above-modified

Nakamura system/device so the “**regulator**” regulates the power (voltage and/or current) provided to the battery of device 2/3 according to the adjusted power level transmitted by apparatus 1 to be within a range of acceptable values/parameters appropriate for the mobile device and battery to promote proper and flexible operations. (*Id.*)

225. In my opinion, a person of ordinary skill in the art would have appreciated that such an implementation would have advantageously provided the modified *Nakamura* system (and mobile device) flexibility in operations by, for example, not limiting such voltage or current to a narrow or single value, thus allowing for normal fluctuations in the voltage or current regulated to the battery. (*Id.*) In my opinion, a person of ordinary skill in the art would have understood that, otherwise, the above-identified “**regulator**” would have limited the functionality of the charging system disclosed by *Nakamura* given the known and predictable fluctuations that typically occur in power control/regulation circuit design and operation. (*Id.*) In my opinion, a person of ordinary skill in the art would have been motivated by such knowledge, coupled with the teachings/suggestions of *Calhoon*, to implement such a modification/configuration in the *Nakamura-Odendaal-Calhoon* combined system discussed above. (*Id.*; *see also* discussions above.)

226. For example, in addition to the teachings/suggestions discussed above, *Calhoon* discloses the mobile device’s power receiver includes a battery charger

assembly 304 that is “enabled to determine the power requirements or other data of a battery pack 350” based on “[r]equirements data [that] are obtained from the smart controller 352 of battery pack 350,” such as “values for the charging current and the charging voltage.” (Ex. 1006, ¶0044, FIG. 5A.) For example, *Calhoon* explains:

[B]attery charger assembly 304 is enabled to determine **the power requirements or other data of a battery pack 350** when inserted into communication bus 328. **Requirements data are obtained from the smart controller 352 of battery pack 350.** In one implementation, the requirements data may include those as specified in the smart battery data specification revision 1.1 available from the SBS Implementer Forum. For example, **values for the charging current and the charging voltage may be determined from the battery pack 350. The requirements data, once obtained from the battery pack 350, may be stored in the computer readable storage 415 of controller 316 for use during charging operations** or for later transmission to the inductive power source 302. Nevertheless, the controller 316 of battery charger assembly 350 may be configured to read, via the bus 328, other functions, alarms, and signals from the battery pack 350. For example, values can be obtained from the battery pack 350 for battery pack voltage, relative state of charge, absolute state of charge,

remaining capacity, full charge capacity, alarm warning,
average time to full, battery chemistry.

(Ex. 1006, ¶0044.) In addition, *Calhoon* discloses that controller 316 “may determine or otherwise access the *battery pack 350 charging requirements and charge parameters* as discussed with respect to block 500 shown in FIG. 5A.” (*Id.*, ¶0049; *see also id.*, ¶0037 (“bus 328 can be used to inform controller 316 as to a wide range of information about the legacy battery pack 350, e.g., current, voltage, power requirements, and rated capacity.”).)

227. In my opinion, such teachings/suggestions, in context of *Nakamura*’s disclosures and a person of ordinary skill in the art’s state of art knowledge, would have guided and motivated such a skilled person to consider and configure the above-identified “**regulator**” in the *Nakamura-Odendaal-Calhoon* combined system/device to regulate the “**receiver**” output voltage/current to be “**within a range of parameters for the mobile device or the battery**” like that claimed, and done so with a reasonable expectation of success that the resulting modified device would operate as intended and be consistent with *Nakamura*’s operations/features. (Ex. 1006, ¶¶0037, 0044, 0049; *see also* my analysis, discussions, and citations regarding *Nakamura* and *Calhoon* in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-1(f).)

228. In my opinion, a person of ordinary skill in the art would have had the skills, knowledge, rationale, and capability to implement such a modification, especially where implementing it would have involved applying known technologies (e.g., regulator circuitry) according to known methods and techniques (e.g., regulating voltage or current to be within an acceptable range of values or parameters) to yield a predictable inductive power transfer/charging system that provides appropriate regulated power/voltage/current to a mobile device and battery according to conventional design techniques/concepts. (*Id.*)

h) wherein different mobile devices and batteries can have different charging characteristics associated therewith; and

229. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation for the reasons similar to those discussed above for limitations 3(a)-(d), (f)-(g). (*See* my analysis and discussions below in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(d), IX.A.1(f)-(g), IX.A.1(m); *see also* my analysis and discussions in Section VIII.)

230. For example, as I discussed above, *Nakamura*'s system/configurations are configured to adjust the level of charging power to accommodate different mobile devices (e.g., cellphones, laptops) with different batteries having different power requirements (“**charging characteristics**”). (*Id.*; *see, e.g.*, Ex. 1005, FIGS. 3-5, ¶¶0016-0019, 0021, 0063, 0099.) Also, as I explained above, *Calhoon* confirms

a person of ordinary skill in the art's understanding that different devices/batteries were known to have different charging characteristics. (*See, e.g.*, Ex. 1006, ¶¶0033, 0037, 0040 (“different battery packs can have different charging requirements”), 0045 (“multiple battery packs may have different power requirements”), 0049; *see also* my analysis and discussions in Section IX.A.1(g).) Thus, in my opinion, the *Nakamura-Odendaal-Calhoon* system discloses and/or suggests this limitation. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(d), IX.A.1(f), IX.A.1(m).)

i) wherein the receiver communicates with the base unit to

231. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation for the reasons discussed above and below. (*See* my analysis and discussions below in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(h), IX.A.1(j)-(m); *see also* my analysis and discussions in Section VIII.)

232. For example, as I explained above, the “**receiver**” identified above (where I discuss in Sections IX.A.1(d), IX.A.1(g)) in mobile device 2/3 communicates information with apparatus 1 (“**base unit**”). (*See* my analysis and discussions in Sections IX.A.1(a)-(g); *see, e.g.*, 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 (“The power receiving control IC 42 is further provided with a clock extraction circuit 43 connected to the secondary side coil 12 and a modulation circuit 45, and performs a signal processing for a signal transmitted through the primary side coil 11 and the secondary side coil 12.”), 0076-0077 (“The carrier wave oscillation circuit 37 outputs a predetermined carrier wave” which is subsequently “transmitted to the secondary side coil 12 which is magnetically coupled with the primary side coil 11.”).)

233. A person of ordinary skill in the art would have understood that in *Nakamura*, the carrier wave signal transmitted from primary coil(s) 11 in apparatus 1 is received by the secondary coil 12 (“**secondary coil**”) and above-identified “**receiver**” (discussed in Section IX.A.1(d)) so that information regarding device 2/3 (e.g., “code indicating being power reception equipment,” “information on consumed power,” and “information on full charge”) is modulated and transmitted back (as modulated wave) to apparatus 1.²² (*Id.*; Ex. 1005, FIGS. 4-5, ¶¶0077-0078;

²² As I explained above for limitation 3(e), the “**receiver**” in the *Nakamura-Odendaal-Calhoon* modified mobile device also communicates identifier information (e.g., ID/serial number, etc.) with apparatus 1 (“**base unit**”). (See my analysis and discussions in Sections IX.A.1(d)-(e).)

see also my analysis and discussions in Section VIII.A.) 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. 3-5, ¶¶0079-0091.)

234. As discussed above, the information signal communicated from the “receiver” in device 2/3 is used to control powering/charging operations. (*Id.*; *see, e.g.*, Ex. 1005, FIGS. 3-5, ¶¶0078-0089, 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.*”); *see also* my analysis and discussions in Sections IX.A.1(a)-(h), IX.A.1(j)-(m); *see also* my analysis and discussions in Section VIII.A.)

j) **detect, identify and authenticate the receiver with the base unit, as provided by the identification component,**

235. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* 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)-(i), IX.A.1(k)-(m); *see also* my analysis and discussions in Section VIII.)

236. For example, the *Nakamura-Odendaal-Calhoon* system/device discussed above would have been configured to perform operations consistent with that disclosed by *Nakamura*. (*Id.*; *see* my analysis and discussions in Sections IX.A.1(a)-(i).) Therefore, in my opinion, the “**receiver**” in the *Nakamura-Odendaal-Calhoon* system/device would have been configured to communicate with apparatus 1 to “**detect, identify and authenticate the receiver with the base unit**” (apparatus 1), “**as provided by the identification component**” as discussed in (and for reasons similar to those I discussed above for limitations 3(d)-(e). (*See* my analysis and discussions in Sections IX.A.1(d)-(e).)

237. For example, as I explained above, the *Nakamura-Odendaal-Calhoon* system/device would have included an “**identification component**” configured to provide “**receiver**” detection, identification, and/or authentication information (e.g., “code indicating being power reception equipment,” ID/serial number, security certificate, digital signature, manufacturer’s name, etc.) to apparatus 1 (“**base unit**”)

so that the apparatus 1 can “**detect, identify, and authenticate the receiver**” in mobile device 2/3. (See my analysis and discussions in Section IX.A.1(e).) As discussed, such a modification would have allowed apparatus 1 (“**base unit**”) to detect, identify, verify, authenticate, and ensure an identified / authorized / verified / authenticated and properly detected/positioned/aligned mobile device/receiver is provided power, consistent with the teachings/suggestions of *Nakamura* and *Calhoon*. (See my analysis and discussions in Section IX.A.1(e); see, e.g., Ex. 1005, ¶¶0077-0078, FIGS. 3-5; Ex. 1006, Abstract (“provide for authentication of devices that are allowed by the source to be powered or otherwise charged”), ¶¶0022, 0034, 0042, 0046-0048, 0050-0052, FIGS. 3, 5A, 6.)

238. Also, consistent with what I discussed above in Section IX.A.1(e), a person of ordinary skill in the art would have appreciated and recognized that implementing such features in the *Nakamura-Odendaal-Calhoon* system/device would have beneficially enhanced/expanded the way the system provides power/charge to different mobile devices/batteries, especially in public/commercial applications (e.g., discussed in Section IX.A.1(e)), where enhanced mobile device/receiver detection, verification, identification, and authentication would be desirable to ensure properly detected, positioned, identified, and authenticated devices receive appropriate power, thus deterring improper or misuse of the power source equipment, improving security, providing virus protection, ensuring data

integrity, etc., like that disclosed/suggested by *Nakamura* and *Calhoon*. (*Id.*, *see also* my analysis and discussions in Sections IX.A.1(e), IX.A.1(i); *see, e.g.*, Ex. 1006, Abstract (“provide for **authentication** of devices that are allowed by the source to be powered or otherwise charged”), ¶¶0022, 0034, 0046, 0047 (“**battery charger identification (ID) number**, battery type chemistry of the battery pack, or **serial number of the battery charger** or the **serial number of the battery pack** . . . can be used for **security, data integrity, or other purposes**”), 0048, 0050-0052, 0065, FIGS. 3, 5A, 6; Ex. 1005, ¶0066, 0074-0089, 0099, 0150-0151; *see also* my analysis and discussions in Sections IX.A.1(k)-(m); *see also* my analysis, discussions, and citations below in this section.)

239. In my opinion, a person of ordinary skill in the art would have had similar motivation, rationale, skills, and expectation of success in configuring the *Nakamura-Odendaal-Calhoon* system/device in implementing such features (as recited in limitation 3(j)) as those explained above. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(e)-(i).) In addition, such a skilled person would have been further motivated in view of *Calhoon*’s teachings/suggestions noted above, such as those associated with transmitting identifying/authenticating information such as a security certificate, digital signature, and/or information provided by a

manufacturer (e.g., manufacturer's code)²³ that is used by the base unit to authenticate the receiver before power is transmitted. (Ex. 1006, ¶¶0042, 0052 (“inductive charging source 302 may request for a security certificate or digital signature from the battery charger assembly 304 to authenticate it” and if authenticated, “source 302 supplies the requested voltage and power”), FIGS. 2-3, 5A-5B, 6.) For example, *Calhoon* explains:

In one arrangement, **controller 316** [e.g., of a receiver] **may contain computer readable data programmed by the manufacturer or other entity, such as a battery charger ID number, serial number, manufacturer's name and date of manufacture. This data can be used by the inductive power source 302** [e.g., base unit] **for novel power operations** according to aspects of the present invention, such as shown in FIGS. 5A, 5B, and 6.

(Ex. 1006, ¶0042.) *Calhoon* also explains:

In process block 606, upon receiving the battery pack's request for power, **the inductive charging source 302**

²³ In my opinion, *Calhoon*'s teachings/suggestions are consistent with the '440 patent's discussions that appear to associate a manufacturer code with a process of authenticating a device. (Ex. 1001, 7:46-49 (“... mobile device, its authenticity (for example its manufacturer code) . . .”).)

may request for a **security certificate or digital signature from the battery charger assembly 304 to authenticate it**. The security certification or digital signature may be stored in the computer readable storage of the controller 308. In process block 608, **if battery charger assembly 304 has a digital certificate or digital signature stored, the battery charger assembly 304 transmits it to the source 302**. In process block 610, **if the battery charger assembly 304 is authenticated in view of the certification or signature, the source 302 supplies the requested voltage and power the battery charger as shown in process block 612**.

(Ex. 1006, ¶0052.)

240. Moreover, *Calhoon* provides guidance as to how the above-discussed authentication features would have prevented/mitigated damage to device 2/3 involved in inductive power/data transfer systems caused by virus infections. (*See, e.g., Ex. 1006, ¶¶0022, 0050, 0065, FIG. 6.*) For example, *Calhoon* explains:

In one arrangement, **inductive charging source 302 and battery charger assembly 304 may be configured for wireless data communications as well as energy transfer based on authentication information thereby forming a trusted energy transfer arrangement. This trusted energy transfer arrangement is useful to prevent authorized [sic - unauthorized] use of an**

inductive charging source. Also the trusted energy transfer arrangement may prevent a computer virus from infecting the controller 316 or the host device 100.

(Ex. 1006, ¶0050.) In my opinion, given that *Nakamura*'s system (including as modified) involves communication (e.g., of information/data) between device 2/3 and apparatus 1 (including transmission of information/data from device 2/3 to apparatus 1), a person of ordinary skill in the art would have understood (in view of such disclosures of *Calhoon*) that apparatus 1 can also be infected with viruses (e.g., through its communication with (e.g., information/data sent from) mobile devices). (*Id.*; *see also* Ex. 1006, ¶0065 (discussing “computer viruses which may attempt to infect the battery pack or charger assembly **during data transmission** or energy transfer”); *see also* my analysis and discussions in Sections IX.A.1(e)-(i).) Therefore, in my opinion, a person of ordinary skill in the art would have been motivated to implement the above-discussed authentication features to also protect apparatus 1 (base unit), for example, from virus infections (and also protect assets/objects/devices with apparatus 1 embedded therein (e.g., a table / seat holder on a train, “a table in a facility at a destination (a shop or a conference room),” a surface/shelf inside a public locker, or “a ticket dispenser installed at a ticket vending

corner in the station”), and/or related components). (*Id.*; *see also id.*, Ex. 1005, ¶¶0108, 0110, 0113-0114, 0117, 150-151, FIGS. 13C-E, 15A-B, 17.)

241. Furthermore, in my opinion, a person of ordinary skill in the art would have appreciated and understood that communicating with the base unit to detect, identify, verify, and authenticate the receiver in the *Nakamura-Odendaal-Calhoon* system/device would have ensured that the mobile device 2/3 would work properly with the apparatus 1 for charging the device’s battery, which would mitigate/prevent issues/problems such as, for example, damage cause by overheating. (*Id.*; Ex. 1005, ¶¶0066, 0099; Ex. 1006, ¶¶0006-0007, 0050.)

242. Therefore, for the same reasons that I discussed above in this section and those I explained above for limitation 3(e), in my opinion, a person of ordinary skill in the art would have been motivated to implement the above-modification to the *Nakamura-Odendaal-Calhoon* system/device (e.g., to improve efficiency, safety and/or security of the system (e.g., to protect mobile devices, base units, and/or valuable assets with embedded base units such as a table/seat holder on a train, “a table in a facility at a destination (a shop or a conference room),” a surface/shelf inside a public locker, or “a ticket dispenser installed at a ticket vending corner in the station”)). (*Id.*; Ex. 1005, ¶¶0108, 0110, 0113-0114, 0117, 150-151, FIGS. 13C-E, 15A-B, 17; *see also* my analysis and discussions in Sections VIII, IX.A.1(e).)

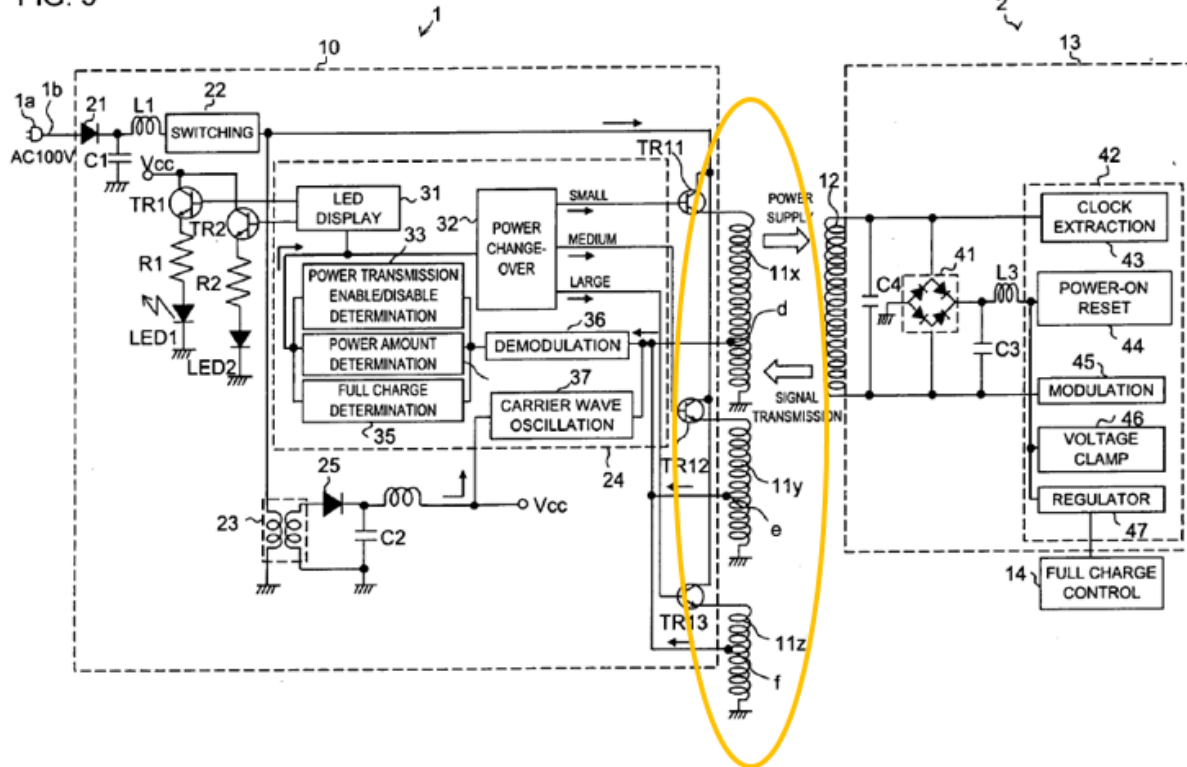
- k) determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,²⁴**

243. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* 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)-(j), IX.A.1(l)-(m); *see also* my analysis and discussions in Section VIII.)

244. For example, as I explained above, *Nakamura* discloses that the information signals communicated from mobile device 2/3 to apparatus 1 includes code/information that is used to detect and verify presence and determine and activate one or more primary coils that is properly aligned with secondary coil 12. (See my analysis and discussions in Sections IX.A.1(a)-(j), (l)-(m); *see also* my analysis and discussions in Section VIII.A.) For example, as discussed above, *Nakamura* discloses configurations where apparatus 1 uses switching circuits associated with one of a plurality primary coils 11x-11z (shown in orange in the annotated figure below) to power/charge the mobile device 2/3. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(f); Ex. 1005, FIG. 5 (annotated below), FIGS. 1A-4, ¶¶0062-0065, 0069-0076, 0077-0079, 0083-0091.)

²⁴ For purposes of rendering my opinion, I have been asked to assume “receiver coil” recited in this limitation refers to the claimed “secondary coil.”

FIG. 5



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

245. One of the primary coils 11x-11z is selected via a selected switch/transistor TR11-TR13 based on the “information on consumed power” included in the information signal transmitted from device 2/3 and demodulated by demodulation component 36. (Ex. 1005, FIGS. 3-5, Ex. 1005, ¶¶0077-0078, 0083, 0090-0091; *see also* my analysis and discussions in Sections IX.A.1(a), (e)-(f), (i); *see also* my analysis and discussions in Section VIII.A.) Determination circuit 34 uses the information signal to determine whether a small, medium, or large power level is to be provided by apparatus 1, and selectively switches one of the associated transistors TR11/TR12/TR13 to allow current to pass through the appropriate

primary coil 11x-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-11z and secondary coil 12. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-1(j); *see also* Ex. 1005, FIGS. 1-5, ¶¶0083-0085, 0090-0091; *see also* my analysis and discussions in Section VIII.) As I explained above, similar features are provided with the multi-tap primary coil 11 of FIG. 3 (which is “one [or more] primary coil[s]”). (*See* my analysis and discussions in Sections VIII.A, IX.A.1(a)-(b).)

246. As discussed above, *Nakamura* also discloses that the information signal communicated from device 2/3 to apparatus 1 includes “code” information (“code indicating being power reception equipment”) that is used to detect and verify presence and proper alignment of secondary coil 12 with primary coil(s) 11. For example, as I explained above (e.g., for limitations 3(b)-(c)), power to mobile device 2/3 is provided via the primary and secondary coils when it is determined that mobile device 2/3 (“**mobile device**”) and its secondary/receiver side coil 12 (“**receiver coil**”/“**secondary coil**”) are present and properly positioned/aligned with apparatus 1 (“**base unit**”) and its primary side coils (“**primary coils**”) such that a high degree of magnetic coupling is established. (Ex. 1005, ¶¶0062, 0065, 0078-0083, 0086, 0087 (“determining whether not a deviation” of device 2 from apparatus 1 “exceeds a predetermined value”), 0088, 0090-0091, 0096, 0109, FIGS. 3-5, 11A-B; *see also*

my analysis and discussions in Sections IX.A.1(a)-(j).) For example, *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.

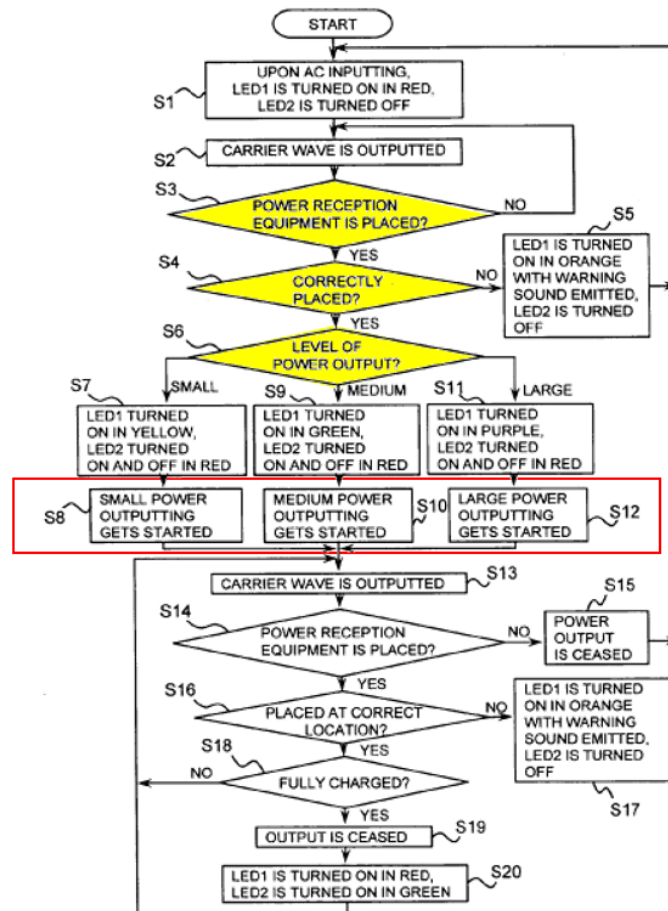
(*Id.*, ¶0079.)

247. Thus, as discussed above, *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.) Demodulation circuit 36—connected to primary side coils 11x-11z—receives/demodulates the modulated information signal communicated from device 2/3 (including a “code indicating being power reception equipment”) and provides it to “power transmission enable/disable determination circuit 33.” (*Id.*, FIGS. 4-5, ¶0078.) 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.*, ¶0078) 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.*, ¶¶0077-0078, 0079 ("[F]or 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" or a "high coupling degree in magnetic coupling is established"), 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 are from "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 ("[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*" because of low power transmission efficiency.), FIGS. 11A-11B, 0083, 0088, 0090 ("Note that, although the primary side coils 11 x, 11 y, and 11 z 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.”), 0090-0091, 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. 3-5, 13A-13E; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a)-(c), (i).)

FIG. 4



(Ex. 1005, FIG. 4 (showing the above-discussed steps relating to determining that mobile device 2/3 and its secondary/receiver side coil 12 are present and properly positioned/aligned with apparatus 1 and its primary side coil(s) 11 (e.g., S3 and S4)

taking place before the steps relating to activation of primary side coil(s) 11 for power transmission (e.g., S6, S8, S10, S12)) (annotated).)

248. A person of ordinary skill in the art would have understood that such features would have been implemented to work in the *Nakamura-Odendaal-Calhoon* system/device discussed above. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(j).) Accordingly, for reasons explained above and below, the “receiver” in the mobile device 2/3 in the *Nakamura-Odendaal-Calhoon* combination discussed would likewise have been configured to communicate with apparatus 1 (“**base unit**”) to “**determine and then activate one or more primary coils** [e.g., coils 11x-11z] **of the base unit** [apparatus 1] **which are aligned with the receiver coil** [coil 12]” as claimed. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(j), (l)-(m); *see also* Ex. 1005, FIG. 4 (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 that pertain to activation of primary coil(s) for power transmission), ¶¶0076-0081, 0082 (no power transmission is performed if positional/alignment deviation of device 2 from apparatus 1 “exceeds a predetermined value (step S4)”), 0086 (ceasing power transmission by turning off transistors TR11/TR12/TR13 when device 2 has been removed), 0090-0091.)

249. Also, although I explained (above in this section) the above disclosures of *Nakamura* with reference to illustrations to the FIG. 5 configuration, that was for

exemplary purposes, as my analysis and supporting disclosures (as I mentioned above) are also applicable to *Nakamura*'s FIG. 3 configuration (as I discussed, for example, in Section IX.A.1(a)). For instance, as I have explained above (*see* Section IX.A.1(a)), FIG. 3 shows a single primary coil with multiple taps. (*See* my analysis and discussions in Section IX.A.1(a); *see, e.g.*, Ex. 1005, FIG. 3, ¶¶0019, 0084; *see also* my analysis and discussions in Section VIII.A.) Because this limitation recites **“determine and then activate one or more primary coils of the base unit which are aligned with the receiver coil,”** it is my opinion that the above-discussed disclosures of *Nakamura* (e.g., determining and activating a primary coil of apparatus 1 that is determined to be present and properly aligned with a receiver/secondary coil), as implemented in the FIG. 3 configuration, also disclose and/or suggest this limitation. (*Id.*; *see also* my analysis, discussions, and citations regarding *Nakamura* in this section; *see also* my analysis and discussions in Sections IX.A.1(a)-(j), (l)-(m).)

l) verify the continued presence of the receiver near the base unit, and

250. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* 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)-(k), IX.A.1(m); *see also* my analysis and discussions in Section VIII.)

251. For example, as I explained above, *Nakamura* discloses verifying the continued presence/alignment of mobile device 2/3 (and thus its “**receiver**”) and its coil on or near apparatus 1 (“**base unit**”) and its coil(s) to allow power/charge operations to continue. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(f), IX.A.1(i)-(k); *see also* my analysis and discussions in Section VIII.A.) For example, *Nakamura* discloses that the presence/alignment of mobile device 2/3 (and its receiver and coil) with apparatus 1 (“**base unit**”) (and an activated primary coil) is continuously checked and verified during power/charge operations using the above-discussed information/modulated signals (containing, for example, “code indicating being power reception equipment”) communicated to apparatus 1. (*Id.*; *see e.g.*, my analysis and discussions in Sections IX.A.1(a)-(f), IX.A.1(i)-(k) (demonstrating how *Nakamura* discloses checking the continued presence and proper positioning/alignment of device 2/3 (and its coil/receiver) near the apparatus 1 (and an activated primary coil) to allow powering/charging of the device/battery to continue); *see also* Ex. 1005, FIGS. 3-5, ¶¶0020, 0076-0083, 0086-0091, 0096, 0109.) 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.

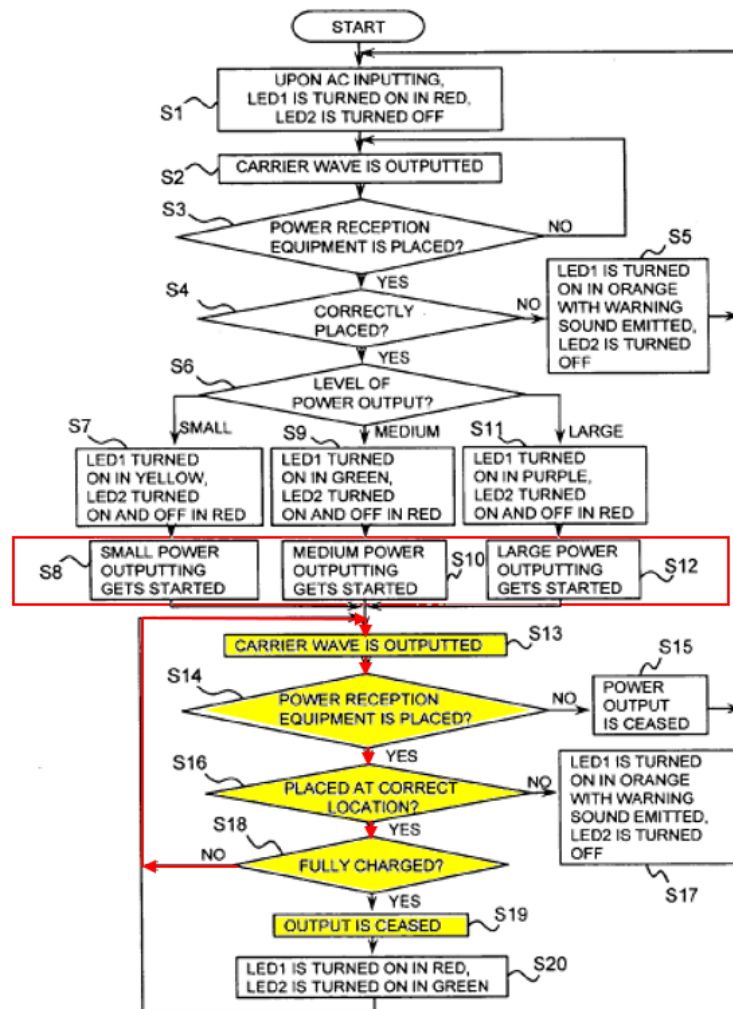
If the information shows a state of full charge, the power change-over circuit 32 turns off all of the transistors TR11, TR12, and TR13 to cease power output (step S19), and the LED1 is turned on in red and the LED2 is turned on in green (step S20) so as to indicate that the power transmission ceases, 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.*, ¶¶0078-0083, FIG. 4 (annotated below).)

FIG. 4



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

252. In my opinion, based on the above-disclosures and disclosures of FIG. 4 (*see, e.g.*, annotated figure above), a person of ordinary skill in the art would have readily understood that steps S13, S14, S16, and S18 (which include step S14 which (alone, or in combination with step S16) relates to verification of the presence/alignment of mobile device 2/3 (and its receiver and coil) on or near apparatus 1 (and its coil(s)) form a loop within the overall FIG. 4 process of

Nakamura, and thus continue continuously (e.g., until a certain condition is met such as device 2/3 (and its receiver) ceases to be present near apparatus 1, device 2/3 and/or its battery is fully charged, etc.). (Ex. 1005, ¶¶0086-0088, FIG. 4.) Also, as discussed above, these steps (e.g., S13, S14, S16, S18) involve the above-discussed communication of relevant signal/information (e.g., communication of carrier wave from apparatus 1 to device 2/3 (and its receiver) and communication of modulated wave containing information/code (e.g., regarding device 2/3) from device 2/3 (and its receiver) to apparatus 1) and/or use such communicated signal/information. (*Id.*; *see, e.g.*, my analysis and discussions in Sections VIII.A, IX.A.1(a)-(f), IX.A.1(i)-(k).)

253. Therefore, for the reasons provided above, it is my opinion that the *Nakamura-Odendaal-Calhoon* modified system/device discloses and/or suggests “the receiver communicates with the base unit to” (limitation 3(i)) “**verify the continued presence of the receiver near the base unit**” (limitation 3(l)). (*Id.*; *see also* my analysis, discussions, and citations regarding *Nakamura* in this section.)

- m) communicate information describing the characteristics²⁵ of the mobile device or the battery, for use by the base unit to provide power transfer to the receiver and to the mobile device and the battery according to their particular charging characteristics.**

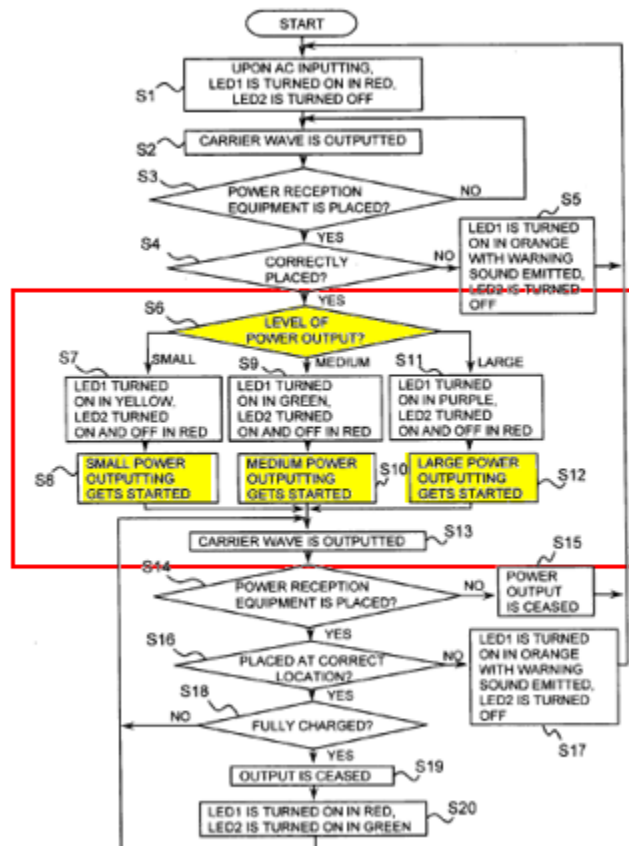
254. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* discloses and/or suggests this limitation for the reasons similar to those discussed above for limitations 3(a)-(l). (*See* my analysis and discussions in Sections IX.A.1(a)-(l); *see also* my analysis and discussions below in this section and above in Section VIII.)

255. For example, as I explained above, *Nakamura*'s configurations are configured to adjust the level of charging power to accommodate different mobile devices (e.g., portable telephones (cellphones), notebook PCs (laptops), etc.) with different batteries having different charging characteristics, and *Calhoon* discloses similar features (e.g., confirming knowledge of a person of ordinary skill in the art). (*Id.*; *see, e.g.*, my analysis and discussions in Sections IX.A.1(a), IX.A.1(d)-(i), IX.A.1(k); Ex. 1005, FIGS. 3-5, ¶¶0016-0019, 0021, 0063, 0077-0078, 0083-0085, 0090-0091, 0099; Ex. 1006, ¶¶0033, 0037, 0040 ("different battery packs can have different charging requirements"), 0044 ("multiple battery packs may have different

²⁵ For purposes of rendering my opinion, I have been asked to assume "the characteristics" recited in this limitation to encompass the "charging characteristics" recited in the claims.

power requirements”), 0049.) Also, for example, as discussed above, *Nakamura* discloses that mobile device 2/3 communicates information signals (e.g., “information on consumed power”) describing the power/charge characteristics of the mobile device/battery (positioned near and properly aligned with the apparatus 1) for use by apparatus 1 (“**base unit**”) to adjust and provide the appropriate power to the device 2/3 (“**mobile device**”), its “**receiver**” and “**battery**” according to their particular charging characteristics (e.g., small, medium, or large). (Ex. 1005, ¶¶0077-0078, 0083-0085, 0090-0091, FIGS. 3-5; *see also id.*, ¶¶0065, 0074-0075; *see also* my analysis and discussions in Sections IX.A.1(a), IX.A.1(d)-(i).)

FIG. 4



(Ex. 1005, FIG. 4 (annotated); *see also* my analysis and discussions in Sections VIII, IX.A.1(a)-(l).)

256. Thus, in my opinion, for reasons explained above, the *Nakamura-Odendaal-Calhoon* device/system would have been configured to include such features to ensure the appropriate level of power is provided to a present and properly positioned/aligned and detected / verified / identified / authenticated mobile device 2/3 and receiver (and battery), in a manner consistent with the operations and configurations contemplated by *Nakamura* and those taught/suggested by *Calhoon*

and *Odendaal*. (*Id.*; *see also* my analysis and discussions in Sections IX.A.1(a)-(l); *see also* my analysis and discussions in Section VIII.) In my opinion, a person of ordinary skill in the art would have had the same motivation, skills, knowledge in the art, and expectation of success as those explained above for the modifications involving *Calhoon* and *Odendaal*, in configuring the above features that meet limitation 3(m). (*Id.*)

2. Claim 13

- a) **The system of claim 3, further comprising a data storage component for storage of data, for subsequent transmission of data to or from the mobile device.**²⁶

257. In my opinion, *Nakamura* in view of *Odendaal* and *Calhoon* 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)-(m); *see also* my analysis and discussions in Section VIII.)

258. As I discussed above, *Nakamura*'s device 2/3 communicates/transmits information to apparatus 1 (e.g., "code[s]" and information used to verify power reception equipment, adjust power levels, and cease power transfer if a device is

²⁶ For purposes of rendering my opinion, I have been asked to assume that the stored "data" of claim 13 can be the same as or different from the "data" to be subsequently transmitted to or from the mobile device.

fully charged (e.g., “code indicating being power reception equipment,” “information on consumed power,” “information on full charge”). (*See* my analysis and discussions in Sections IX.A.1(a)-(m); *see, e.g.*, Ex. 1005, ¶¶0077-0079, 0086-0091, FIGS. 3-5; *see also* my analysis and discussions in Section VIII.A.) Moreover, as I discussed above, device 2/3 can be a portable telephone (cellphone), a notebook personal computer (laptop computer), or other digital/computing/electronic devices, etc. (e.g., PDA, digital camera, camcorder, etc.), which a person of ordinary skill in the art would have known to necessarily include data storage/memory components (e.g., memory device, hard disk/drive, register(s), circuitry, etc. to store signals reflecting the codes, or other known types of components suitable for storing data) for data to be received/transmitted by/from the device. (*Id.*; Ex. 1005, ¶¶0003, 0062, 0063 (“[A] single power transmission apparatus 1 can charge even batteries of electronic equipment different in power required for charging, such as the **portable telephone 2 and the notebook PC 3**. Though not shown, any type of **electronic equipment equipped with a battery, such as a digital camera, a camcorder, a PDA, or the like**, can be charged similarly.”), 0102 (“... power reception equipment such as notebook PCs, digital cameras, PDAs . . .”), 0103, FIGS. 1A-2A, 8-9, 13A-19; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a)-(m).)

259. For example, *Koreis* (Ex. 1009) (which discloses features consistent with the state of art knowledge of a person of ordinary skill in the art at the time) explains:

Preferably, the contactless power supply is employed on a mobile platform, e.g. a commercial aircraft, wherein the inductive coil is disposed in a seatback tray and a user simply places **a computing device such as a laptop computer** on the seatback tray in order to provide power for continuous operation. Additionally, **the power supply may further provide battery charging capability to the computing device.**

The contactless power supply may further comprise a shielding member disposed within **the computing device in order to protect elements of the computing device** from any detrimental effects of magnetic fields produced by the inductive coil. For example, **the hard drive and any disk drives are preferably shielded to prevent contents therein from being inadvertently erased by the magnetic fields. Additional components of the computing device such as the internal clock, among others, may also be shielded as required, depending on the strength of the inductive coil.**

The **computing device according to the present invention may be a personal computer, a laptop**

computer, or a personal digital assistant (PDA), among others.

(Ex. 1009, 1:63-2:15; *see also id.*, 3:9-19, 3:39-49, FIGS. 1-3.) Also, *Calhoon* describes a “**general-purpose digital computing environment**” with “a **computer 100** [that] includes a processing unit 110, a **system memory 120**” (wherein “[t]he **system memory 120** includes **read only memory (ROM) 140** and **random access memory (RAM) 150**”) and other various components including “hard disk drive 170, magnetic disk drive 180, and optical disk drive 191.” (Ex. 1006, ¶¶0058-0060, FIG. 1.) “The drives and their associated computer-readable media provide nonvolatile storage of computer readable instructions, data structures, program modules, and other data for the personal computer 100.” (*Id.*, ¶0059.) (*See also* Ex. 1019, Title, Abstract, 7:32-46 (implantable medical device (implanted power receiver) with non-volatile memory for storing data), FIG. 1.)²⁷

260. Moreover, in my opinion, in context of the above-discussed teachings/suggestions of *Nakamura*, a person of ordinary skill in the art would have

²⁷ I reference Exhibits 1009 and 1019 here to support my opinions regarding the state of art knowledge of a person of ordinary skill in the art at the relevant time (like other extraneous references I may refer to throughout this Declaration when discussing what such a skilled person would have understood/appreciated, etc.).

understood device 2/3 necessarily includes a data storage/memory component that stores the information signals (e.g., code) (“**data**”) that is generated/obtained and subsequently transmitted to apparatus 1 (“**for subsequent transmission of data . . . from the mobile device**”), for example, to facilitate/control inductive power transfer operations discussed above. (See my analysis and discussions in Sections IX.A.1(a)-(m) (discussing *Nakamura*’s operations for generating/obtaining and transmitting information signals (“code(s)”) used by primary side circuit 10 to detect/verify presence/alignment and selectively transfer the appropriate level of power (or to cease power transfer), etc.); see, e.g., Ex. 1005, FIG. 4, ¶¶0076-0089, FIGS. 3-5, 21-25, ¶¶0129-0155; see also my analysis and discussions in Section VIII.A.)

261. In my opinion, a person of ordinary skill in the art would have understood that *Nakamura*’s operations would not be able to perform such disclosed processes without storing (even temporarily) such information (e.g., the code provided in the information/modulated signals) before/during obtaining, generating, and/or modulating the information signal (“**data**”) for transmission. (Ex. 1005, ¶¶0075 (“signal processing for a signal transmitted through the primary side coil 11 and the secondary side coil 12”), 0077 (“modulation circuit 45 modulates the carrier wave based on information regarding the portable telephone 2” and “supplies the modulated wave to the secondary side coil 12”), 0077-0089, FIG. 4; see also my analysis and discussions in Sections IX.A.1(a), IX.A.1(d)-(f), IX.A.1(h)-(m); see

also my analysis and discussions in Sections VIII.A, IX.A.1.) For example, for device 2/3 to be able to provide required power level information (e.g., “information on consumed power”), the device necessarily must include a storage component to store such information for transmission to apparatus 1. (*Id.*; *see also* Ex. 1005, ¶¶0075, 0077-0078, 0083-0085.) Also, for example, *Nakamura* explains that power receiving control IC (integrated circuit) 42 (of secondary side circuit 13) of device 2/3 (which (as I discussed above) contains, is connected to, and/or works with various components/circuitry related to *Nakamura*’s inductive power transfer operations) “is in the shape of an IC chip,” which (e.g., integrated circuit, IC chip) a person of ordinary skill in the art would have understood to include storage components. (Ex. 1005, ¶0075; *see also id.*, ¶0074 (“ . . . power receiving side control IC (power adjusting section) 42 . . .”), FIGS. 3-5; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a)-(m).)

262. In my opinion, such storage features would have likewise been included in the *Nakamura-Odendaal-Calhoon* system/device I discussed above for claim 3. (*See* my analysis and discussions in Sections IX.A.1(a)-(m); *see also* my analysis and discussions in Section VIII.) Thus, in my opinion, a person of ordinary skill in the art would have understood that since *Nakamura*’s device 2/3 necessarily includes a storage component (e.g., memory device, hard disk/drive, register(s), circuitry, etc. to store signals reflecting the codes, or other known types of components suitable

for storing data) to store the information signals (data) prior to transmission to apparatus 1, the device 2/3 in the above-discussed *Nakamura-Odendaal-Calhoon* system (for claim 3) would have likewise included a “**data storage component**” that stored such information signal(s) (“**data**”) for subsequent transmission from device 2/3 to apparatus 1 for power control/transfer processing consistent with that described by *Nakamura*. (*Id.*)

263. I have been asked to consider the scenario where such claimed features were not necessarily disclosed/present in the *Nakamura* system/device discussed above. Under that scenario, in my opinion, the *Nakamura-Odendaal-Calhoon* combined system discloses and/or suggests such claimed features for the reasons I explained above for claim 3 (e.g., for limitations 3(e) and 3(j)). (*See* my analysis and discussions in Sections IX.A.1(e), (j); *see also* my analysis and discussions in Sections VIII, IX.A.1(a), IX.A.1(f)-(m).) For example, as I explained, *Nakamura* discloses configuration/applications where “**equipment ID of the portable telephone 2**” is “**recorded**” (stored) in the device (e.g., device 2) and used to identify/verify/authenticate the device to facilitate mobile payment processes. (*See* my analysis and discussions in Sections IX.A.1(e), (j); Ex. 1005, ¶¶0149; *see also id.*, ¶¶0148-0151, FIGS. 21-22, 25-26, ¶¶0125-0141, 0147-0153.)

264. For example, *Nakamura* explains:

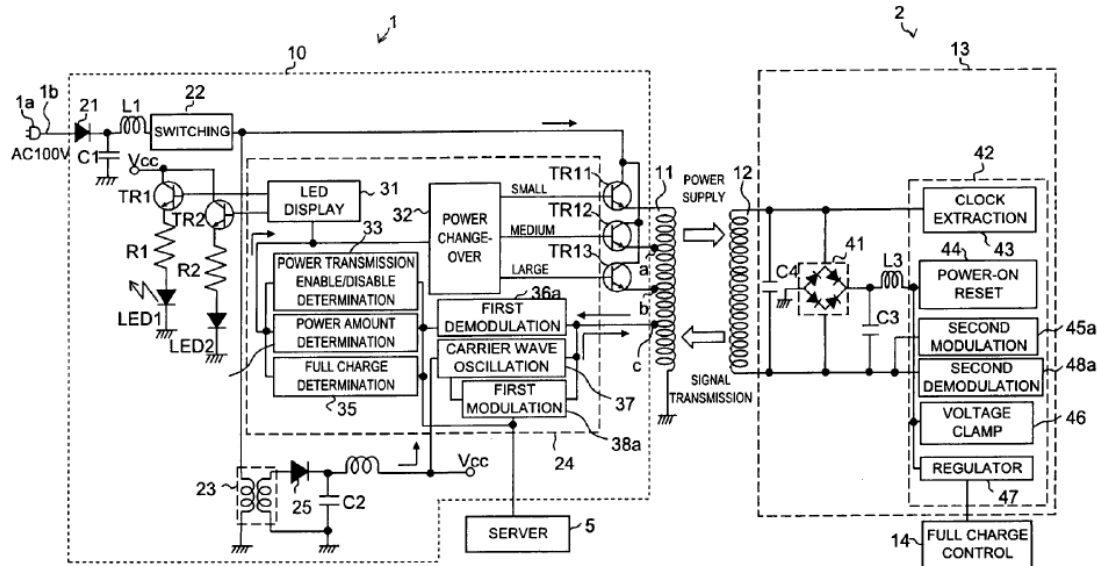
[T]he user who has reached the arrival station at the destination places the portable telephone 2 on a power transmission apparatus 1 embedded in an automatic ticket examining machine installed at ticket gate of the arrival station (step S74). Then, the fare is paid by means of the mobile banking according to the departing station information and the **personal information (equipment ID of the portable telephone 2) recorded in the portable telephone 2**. Here, the departing station information and the personal information recorded in the computer of the railway company are also accessed through a server 5 of the arrival station (step S75). In this way, the user is relieved from troublesome work that includes finding a fare to the destination and buying a ticket.

(Ex. 1005, ¶0149.)

265. A person of ordinary skill in the art would have understood such features to include the device storing/transmitting/providing the equipment ID information to facilitate the verification of payment processes. (*Id.*; Ex. 1005, ¶0149 (personal information [equipment ID] “*are also* accessed through a server 5 . . .”), 0150 (“power transmission apparatus 1 is embedded in a ticket dispenser installed at a ticket vending corner in the station” and the “ticket dispenser is connected to the server 5 of the station, and the power transmission apparatus is connected to the server 5 of the station through the network 6 of the station”), 0151 (equipment ID of

device 2 is recorded into computer of the railway company connected to server 5 after device 2 is “placed at a predetermined po[r]tion of the ticket dispenser in which power transmission apparatus 1 is embedded” (when rapid charging starts) and a button is selected on the dispenser).) (*See also id.*, FIGS. 22 (below showing server 5 connected to apparatus 1), 21, 25-26.)

FIG. 22



(Ex. 1005, FIG. 22.)

266. Accordingly, in my opinion, a person of ordinary skill in the art would have understood that *Nakamura's* device 2/3 (e.g., power reception equipment) contains mechanisms (e.g., component(s)) that are configured to store and provide identification of the device and/or information associated with the device, such as ID information and/or e.g., certain "code[s]" (e.g., "code indicating being power reception equipment," "information on consumed power," "information on full

charge”). (See my analysis, discussions, and citations regarding *Nakamura* above in this section; see also my analysis and discussions in Sections IX.A.1(e), (j); see also my analysis and discussions in Sections VIII.A, IX.A.1(a)-(m).)

267. Therefore, in view of such teachings/disclosures in *Nakamura*, a person of ordinary skill in the art would have understood the mobile device 2/3 in the *Nakamura-Odendaal-Calhoon* system I discussed above for claim 3 to include a **“data storage component”** that stores the ID information and/or other information relevant to the system’s inductive power/data transfer operations (e.g., the above-discussed “code[s]”) (**“storage of data”**), **“for subsequent transmission of data . . . from the mobile device”** as claimed since, for example, the ID information is recorded in a memory or other data storage component in device 2/3 prior to its transmission for recording in the computer of the railway company’s ticket dispenser that hosts apparatus 1 receiving that information, which is connected to a server. (Ex. 1005, ¶0149; see also *id.*, ¶¶0148-0151, FIGS. 21-22, 25-26, ¶¶0125-0141, 0147-0153; see also my analysis, discussions, and citations regarding *Nakamura* in this section; see also my analysis and discussions in Sections VIII.A, IX.A.1(a)-(m).) In my opinion, a person of ordinary skill in the art would have understood such features were applicable to the power transfer operations discussed elsewhere in *Nakamura* (and I discussed above) (see, e.g., Sections IX.A.1(a), IX.A.1(b)-(m), VIII.A), and thus would have been included in the *Nakamura-Odendaal-Calhoon*

system/device for the same reasons discussed for such modifications for claim 3. (See, e.g., my analysis and discussions in Sections IX.A.1(e)-(m); see also my analysis and discussions in Sections VIII.A, IX.A.1(a)-(d).) Therefore, in my opinion, the *Nakamura-Odendaal-Calhoon* system/device discussed above for claim 3 discloses and/or suggests the claimed features of claim 13. (*Id.*; see also my analysis and discussions above in this section.)

268. I have been asked to consider the scenario where the above-disclosures do not disclose or suggest the features of this limitation. Under that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to configure the *Nakamura-Odendaal-Calhoon* combined system/device to include such a “data storage component” for reasons similar to those I explained above for claim 3 (e.g., limitations 3(e), 3(j), and others). (See my analysis and discussions in Sections IX.A.1(e), (j); see also my analysis and discussions in Sections VIII.A, IX.A.1(a)-(m).)

269. For example, my analysis for limitations 3(e) and 3(j) explains how and why the device 2/3 in the *Nakamura-Odendaal-Calhoon* modified system would have been configured to include an identification component and performed features that provided wireless identification/verification/authentication of the “**receiver**” (and device 2/3 and/or its battery) and stored relevant information (e.g., ID/serial numbers, security certificates, digital signatures, etc.) in a data storage (“**data**

storage component”) of device 2/3 (e.g., component(s) similar to *Calhoon*’s computer readable storage 415 of controller 316) for such subsequent transmission. (See, e.g., Ex. 1006, Abstract, ¶¶0022, 0034, 0036-0038, 0040-0049, 0050-0052, 0056, 0065-0066, FIGS. 2-3, 4, 5A-5B, 6; see also my analysis and discussions in Sections VIII.C, IX.A.1(e), (j).) For example, as I explained above, *Calhoon* explains that various information regarding a battery charger/battery pack (mobile device / inductive power receiver) (e.g., power/charging requirements, charging parameters, ID/serial numbers, manufacturer’s names, security certificates, digital signatures, etc.) can be obtained, stored (e.g., in mobile device’s storage), and transmitted/communicated (e.g., from the mobile device / inductive power receiver to an inductive power source) to be used for/in inductive power transfer operations.

270. For example, *Calhoon* explains:

In one arrangement, **controller 316 may contain computer readable data programmed by the manufacturer or other entity, such as a battery charger ID number, serial number, manufacturer’s name and date of manufacture. This data can be used by the inductive power source 302 for novel power operations according to aspects of the present invention, such as shown in FIGS. 5A, 5B, and 6.**

(*Id.*, ¶0042.) *Calhoon* also explains:

[B]attery charger assembly 304 is enabled to determine **the power requirements or other data of a battery pack 350** when inserted into communication bus 328. **Requirements data are obtained from the smart controller 352 of battery pack 350.** In one implementation, the requirements data may include those as specified in the smart battery data specification revision 1.1 available from the SBS Implementer Forum. For example, **values for the charging current and the charging voltage may be determined from the battery pack 350.** The requirements data, once obtained from the battery pack 350, may be stored in the computer readable storage 415 of controller 316 for use during **charging operations or for later transmission to the inductive power source 302.** Nevertheless, the controller 316 of battery charger assembly 350 may be configured to read, via the bus 328, other functions, alarms, and signals from the battery pack 350. For example, values can be obtained from the battery pack 350 for battery pack voltage, relative state of charge, absolute state of charge, remaining capacity, full charge capacity, alarm warning, average time to full, battery chemistry.

(*Id.*, ¶0044; *see also id.*, ¶0049 (“[C]ontroller 316 of the battery charger assembly 304 may determine or otherwise access the battery pack 350 **charging requirements and charge parameters** as discussed with respect to block 500

shown in FIG. 5A. The **requirements data and parameters can be stored in the non-volatile computer readable memory 415 for later use. . . . [T]he battery pack ID of each battery pack may be stored along with the charging requirements.** Battery charger assembly 304 may then have a plurality of different charging requirements stored therein.”); *see also id.*, ¶¶0037 (“[B]us 328 can be used to **inform controller 316** as to a wide range of information about the legacy battery pack 350, e.g., **current, voltage, power requirements, and rated capacity.**”), 0043 (“[C]ontroller 316 may have **computer-readable media 415, which provides nonvolatile storage of computer-readable instructions, data structures, program modules and other data relevant for charging operations.**”).)

271. *Cahoon* also explains:

Accordingly, FIG. 5A illustrates an example communication process according to one or more aspects of the present invention that enables **communication between a charging source and a battery charger assembly.** Various aspects of the present invention may at least be described in the general context of apparatus and computer-executable instructions, such as program modules, executed by one or more computers or other devices, such as microprocessors. For example, controller 308 and **controller 316 may have computer-readable media 415, which provides nonvolatile storage of**

computer readable instructions, data structures, program modules, and other data relevant for charging operations. In one arrangement, **inductive charging source 302 and battery charger assembly 304** may be configured for wireless data communications as well as energy transfer.

(Ex. 1006, ¶0043.) *Calhoon* further explains:

[T]he **battery charger assembly 304** may also include a **controller 316** that may be configured for receiving, transmitting and storing data and performing mathematic calculations relevant to legacy battery pack 350. Additionally, controller 308 of source 302 and **controller 316 of charger 304 are enabled to have features of authentication and security.** Examples of the authentication and security aspects of the present invention as shown in FIGS. 5A and 6. Controller 308 and **controller 316 may have computer-readable media 415** (see FIG. 4), which provides nonvolatile storage of **computer readable instructions, data structures, program modules, and other data relevant for charging operations.** Other examples of computer-readable media include flash memory, random access memories (RAMs), read only memories (ROMs), and the like.

(Ex. 1006, ¶0036.)

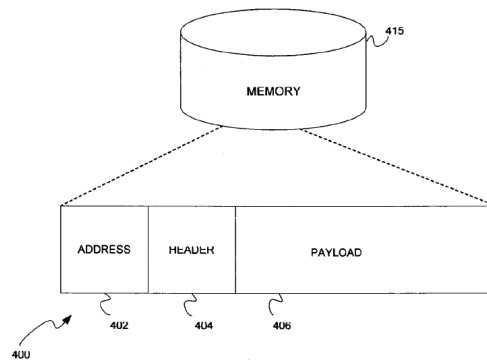


FIGURE 4

(*Id.*, FIG. 4.)

272. *Calhoon* also explains that various information regarding a battery charger/battery pack that has been obtained and stored (e.g., power requirements, charging parameters, ID/serial numbers, security certificates, digital signatures, etc.) can be transmitted/communicated wirelessly from an inductive power receiver (e.g., mobile device) to an inductive power source (e.g., base unit) to be used for inductive powering/charging processes (e.g., for ensuring proper power transmission with appropriate voltage/power, “security, data integrity, or other purposes,” or authenticating an inductive power receiver with an inductive power source). (Ex. 1006, Abstract, ¶¶0022, 0034, 0036, 0042, 0046-0048, 0050-0052, 0056, 0065, FIGS. 2-3, 4, 5A-5B, 6; *see also* my analysis and discussions in Sections VIII.C, IX.A.1(e), (j).)

273. For example, *Calhoon* explains:

[T]he source 302 may request information or charging parameters from the battery charger assembly 304, such as the required charging voltage and maximum power requirement. Nevertheless, the inductive charging source 302 can request other information relevant to the battery charger assembly 304, such as a battery charger identification (ID) number, battery type chemistry of the battery pack, or serial number of the battery charger or the serial number of the battery pack. This information can be used for security, data integrity, or other purposes. In process block 508, the battery charger assembly 304 transmits the requested information. In process block 510, the source 302, via controller 308, determines if it can supply the requested voltage and power to battery charger assembly 304. In process block 512, if the source 302 cannot supply the requested voltage and/or power, then the source 302 can change to the polling mode. Alternatively, if the source 302 can provide the voltage and/or power, then the process flows to process block 514 for the charging mode.

After the negotiation process, in process block 514, when the battery charger assembly 304 begins to receive its requested voltage and power, the controller 316 may turn

on the battery charger 322 in order to charge the battery pack 350.

(Ex. 1006, ¶¶0047-0048; *see also id.*, ¶¶0034 (“[M]odem 310, 318 may be adapted to modulate and demodulate signals appropriate to the frequency supplied by the power supply 306, 320 to **receive and transmit data**. Thus, the **power transmission coil 312 of the charging source 302 and the power pickup coil 324 of battery charger assembly 304 are used to provide inductive data communications over an inductive pathway.**”), 0050 (“[I]nductive charging source 302 and battery charger assembly 304 may be configured for **wireless data communications.**”); *see also* my analysis, discussions, and citations regarding *Calhoon* in this section.)

274. *Calhoon* also explains that stored information such as a digital certificate or digital signature is transmitted from an inductive power receiver (e.g., mobile device) to authenticate it (and/or its components):

In process block 606, upon receiving the battery pack’s request for power, **the inductive charging source 302 may request for a security certificate or digital signature from the battery charger assembly 304 to authenticate it**. The security certification or digital signature may be stored in the computer readable storage of the controller 308. In process block 608, **if battery charger assembly 304 has a digital certificate or digital signature stored,**

the battery charger assembly 304 transmits it to the source 302. In process block 610, if the battery charger assembly 304 is authenticated in view of the certification or signature, the source 302 supplies the requested voltage and power the battery charger as shown in process block 612.

(Ex. 1006, ¶0052; *see also id.*, Abstract, ¶¶0022, 0036, 0042, 0050, 0065, FIGS. 2-3, 4, 5A-5B, 6.) *Calhoon* explains that such inductive “energy transfer based on authentication information [] form[s] a trusted energy transfer arrangement [which] is useful to prevent authorized [sic - unauthorized] use of an inductive charging source [and] may prevent a computer virus from infecting the controller 316 or the host device 100.” (*Id.*, ¶0050; *see also id.*, ¶¶0022, 0065, FIGS. 2-3, 4, 5A-5B, 6.)

275. Thus, in my opinion, for reasons similar to those I provided for claim 3 (e.g., limitations 3(e) and 3(j)), a person of ordinary skill in the art would have been motivated, in light of the teachings/suggestions of *Calhoon*, to configure the *Nakamura-Odendaal-Calhoon* system such that device 2/3 includes a data storage component for storage of identification/verification/authentication information or other information relevant for inductive power transfer operations, for subsequent transmission of such data/information from the mobile device 2/3 to apparatus 1. (*See* my analysis and discussions in this section; *see also* my analysis and discussions in Sections VIII.C, IX.A.1(a)-(m).)

276. Moreover, as I explained above, *Calhoon* describes features where “information or charging parameters” pertaining to a battery/inductive power receiver/battery charger assembly (e.g., mobile device) are stored and then transmitted from the receiver (e.g., mobile device) to an inductive power source (e.g., base unit), for use by the base unit in transmitting power/voltage to the receiver. (*Id.*; *see, e.g.*, Ex. 1006, ¶¶0036-0037, 0042-0044, 0047-0049, FIGS. 2-6; *see also* my analysis and discussions in this section.) Such information/data is stored in a data storage component (e.g., computer readable storage 415 of controller 316) of the receiver for subsequent transmission to a base unit. (*Id.*; Ex. 1006, ¶0044 (“The requirements data, once obtained from the battery pack 350, may be stored in the computer readable storage 415 of controller 316 for use during charging operations or for later transmission to the inductive power source 302.”); *see also id.*, ¶¶0036, 0043, FIGS. 3-6; *see* my analysis and discussions in this section; *see also* my analysis and discussions in Sections VIII.C, IX.A.1(e), (j).) In my opinion, a person of ordinary skill in the art would have understood that such teachings are substantially similar to and compatible with the above-discussed disclosures of *Nakamura* pertaining to transmitting data (e.g., “information on consumed power” (e.g., power/voltage requirements)) from the mobile device 2/3 to apparatus 1 (“base unit”) to be used for inductive power transfer operations. (*Id.*; *see also* my analysis and discussions in Sections VIII.A, IX.A.1(a), 1(d), 1(h), 1(m).)

277. Therefore, for reasons similar to those I explained for claim 3, a person of ordinary skill in the art would have been motivated to incorporate a data storage component into device 2/3 in the *Nakamura-Odendaal-Calhoon* system to ensure identification/verification/authentication information or other information relevant for inductive power transfer operations was accessible for subsequent transfer to and use by apparatus 1 for purposes of e.g., security / identification / verification / authentication, ensuring proper power transmission, etc. (*Id.*; *see also* my analysis and discussions in Sections VIII.A, VIII.C, IX.A.1(a), 1(e), 1(i)-(m).)

278. Furthermore, in my opinion, a person of ordinary skill in the art would have understood that, consistent with that explained, the mobile device in the *Nakamura-Odendaal-Calhoon* system would have transmitted information/data to the base unit (e.g., ID/serial numbers, security certificates, digital signatures (e.g., relating to the device 2/3 and its receiver), etc.), which would have been used by the base unit to identify/verify/authenticate the receiver/mobile device (e.g., for enhanced security/safety, etc. of the system). (*Id.*; *see also* my analysis and discussions in Sections VIII.A, VIII.C, IX.A.1(d)-(e), (i)-(j); Ex. 1006, FIGS. 3-6, ¶¶0042-0043, 0047, 0052 (explaining such information/data is stored in a mobile device/inductive power receiver and subsequently transmitted to a base unit).) Thus, for similar reasons explained above for limitations 3(e) and 3(j) (and others), a person of ordinary skill in the art would have been motivated, in light of the

teachings/suggestions of *Calhoon*, to configure the device 2/3 in the modified *Nakamura-Odendaal-Calhoon* system to include a data storage component to store identification/verification/authentication information or other relevant information for inductive power transfer operations, for subsequent transmission of such data from device 2/3 to apparatus 1 to ensure the information (data) was accessible for subsequent use for, e.g., identification / security / verification / authentication and/or other purposes relating to inductive power transfer operations like that I explained. (*Id.*; *see also* my analysis and discussions in Sections VIII.C, IX.A.1(e), IX.A.1(i)-(m).)

279. In my opinion, a person of ordinary skill in the art would have had the same motivation, skills, knowledge in the art, and expectation of success as those explained above for the modifications involving *Nakamura*, *Calhoon*, and *Odendaal*, in configuring the above features that meet claim 13 (*id.*; *see also* my analysis and discussions in Sections VIII, IX.A.1(a)-(m)), especially given implementing such “data storage component” features like that claimed would have been a predictable and straightforward implementation involving known technologies according to known methods and techniques (e.g., use of storage/memory device/component in known mobile device to store data eventually transmitted to another device, like that described/suggested by *Nakamura* and

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U.S. Patent No. 9,577,440

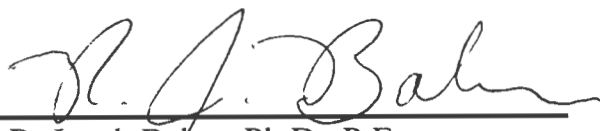
Calhoon). (See, e.g., Ex. 1006, ¶¶0036, 0042-0044, 0052, 0066; see my analysis, discussions, and citations in this section and in Sections VIII, IX.A.1(a)-(m).)

X. CONCLUSION

280. In summary, it is my opinion that all of the features recited in claims 3 and 13 of the '440 patent are disclosed and/or suggested by the prior art.

281. 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.