

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Inventors: Dong-Young Park et al.
Patent Owner: LS Cable & System Ltd.
Patent. No.: 8,013,568
Filing Date: May 8, 2006
Issue Date: September 6, 2011
Title: CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE,
BATTERY CHARGING SET, AND CHARGING CONTROL METHOD
THEREOF
Docket No.: 0313071.00020

Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR SUPPLEMENTAL EXAMINATION

Dear Sir or Madam:

Supplemental Examination under 35 U.S.C. § 257 is hereby requested for Claims 1-24 of U.S. Patent No. 8,013,568 (hereinafter “the ‘568 Patent”), which issued September 6, 2011, to Dong-Young Park, Sung-Wook Moon, Sung-Wook Choi, Gwang-Hee Gwon, Sub Han, and Jung-Bum Kim. This Request for Supplemental Examination is being submitted by LS Cable & System Ltd., (“LSC”) the owner of the entire right, title, and interest in the ‘568 Patent.

Requestor has also confirmed that Deposit Account 02-1818 has sufficient funds to pay any necessary fees.

TABLE OF EXHIBITS

- A. Exhibit A - Korean Patent No. KR950005819B1 to Hong Chung-sik (“Chung-sik”)
- B. Exhibit B - PCT Publication No. WO 02/15320 to Kim et al. (“Kim”)
- C. Exhibit C - U.S. Patent Publication No. 2004/0145342 to Lyon (“Lyon”)
- D. Exhibit D - U.S. Patent No. 7,211,986 to Flowerdew et al. (“Flowerdew”)
- E. Exhibit E - U.S. Patent No. 6,912,137 to Berghegger (“Berghegger”)
- F. Exhibit F - U.S. Patent No. 5,949,213 to Lanni (“Lanni”)
- G. Exhibit G - U.S. Patent No. 8,013,568, for which Supplemental Examination is requested (“the ‘568 Patent”)
- H. Exhibit H - Declaration of Jaeyong Jung
- I. Exhibit I - English Language Translation of Exhibit A
- J. Exhibit J - Statement under 37 C.F.R. § 3.73(c)

I. 37 C.F.R. § 1.610(a):

The required fee for this Request for Supplemental Examination has been submitted. Requestor does not believe that any additional fee is required. However, please charge any additional fee that may be owed to Deposit Account 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 0313071.00020 on the account statement.

II. 37 C.F.R. § 1.610(b)(1)

Supplemental examination under 35 U.S.C. § 257 *et. seq.* is requested for Claims 1-24 of U.S. Patent No. 8,013,568 entitled CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF, which issued on September 6, 2011.

III. 37 C.F.R. § 1.610(b)(2)

The items of information requested to be considered are:

1. Korean Patent No. 950005819B1 which published May 31, 1995 (Requestor further submits the accompanying translation as Exhibit I) (hereinafter “Chung-Sik”) attached hereto as Exhibit A;
2. PCT Publication No. WO 02/15320 A1 which published February 21, 2002 (hereinafter “Kim”) attached hereto as Exhibit B;
3. U.S. Patent Publication No. 2004/0145342 A1 which published on July 29, 2004 (hereinafter “Lyon”) attached hereto as Exhibit C;
4. U.S. Patent No. 7,211,986 which issued on May 1, 2007 (hereinafter “Flowerdew”) attached hereto as Exhibit D;
5. U.S. Patent No. 6,912,137 which issued on June 28, 2005 (hereinafter “Berghegger”) attached hereto as Exhibit E;
6. U.S. Patent No. 5,949,213 which issued on September 7, 1999 (hereinafter “Lanni”) attached hereto as Exhibit F; and
7. The Declaration of Jaeyong Jung¹ attached hereto as Exhibit H

IV. 37 C.F.R. § 1.610(b)(3)

There are no prior or concurrent proceedings involving the ‘568 Patent.

¹ A copy of the supplemental declaration under 37 C.F.R. § 1.63 of the six named inventors (Dong-Young Park, Sung-Wook Moon, Sung-Wook Choi, Gwang-Hee Gwon, Sub Han, and Jung-Bum Kim) filed August 4, 2020 is attached as Exhibit A to the Declaration of Jaeyong Jung.

V. 37 C.F.R. § 1.610(b)(4)

Supplemental examination is requested for Claims 1–24 of the ‘568 Patent.

VI. 37 C.F.R. § 1.610(b)(5)

A summary of the claimed subject matter and a detailed explanation of the relevance and manner of applying each item of information to each claim of the ‘568 Patent is provided below.

A. Background

The ‘568 Patent relates to wireless charging for a mobile communication terminal utilizing electromagnetic wave generation and intercepting technology. (‘568 Patent at Abstract). This charging may be accomplished by way of a charger body that receives power from a power supply, converts it to wireless form for transmission, and then transmits that power to a receiver, as well as a receiver that can receive a wireless transmission of power and converts it back to AC current to provide a charge to a connected battery.

Personal portable devices are supplied with power through a battery, often a chargeable battery. (‘568 Patent at 1:32-34). When the voltage of that battery falls below a pre-determined level, the user then charges that device to be able to use the device again. (‘568 Patent at 1:34-37). When inducing an AC current on a wireless device, the intensity of the induced current is based upon the relative positioning of the coil in the mobile device as compared to the charger in the charger body. (‘568 Patent at 2:21-41). The ‘568 Patent “provide[s a] contact-less chargeable battery and charging device capable of preventing any damage of an internal battery circuit together with solving a restriction for relative positions between the chargeable battery and the charging device when charging the battery in a contact-less charging method.” (‘568 Patent at 3:29-34). The ‘568 Patent sets forth a charging receiver for receiving an induced magnetic field from a charging device that includes a rectifier, a constant voltage/constant current supplier, and

an overvoltage monitoring unit that monitors voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device. ('568 Patent at 3:49-62, Fig. 3).

B. Item of Information No. 1 - Chung-Sik

i. Explanation of the relevance and manner of applying Chung-Sik to each claim of the '568 Patent

The following portions of Chung-sik may be considered important to the examiner as these portions may relate to the respective claim limitations presented below. In accordance with MPEP § 2811.01, "[t]hese statements will NOT be construed as an admission of unpatentability . . . [and] only indicate that the patent owner is requesting that the Office consider whether certain issues may be raised by each item of information with respect to specific claims."

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik²
A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:	"Another objective of the present invention is to provide a system for charging a battery in a portable device by inductively coupling a voltage from a charger to a portable device. Yet another objective of the present invention is to provide a contactless charge system for detecting a voltage of a rechargeable battery to control the charge between the charger and the portable device." (Chung-sik at 8-2; Fig. 2).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	"In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device." (Chung-sik at 8-2).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	"In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit

² Citations to Chung-sik are to the English translation submitted with Chung-sik as Exhibit I.

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik ²
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	within the portable device when the portable device is placed on the charging device.” (Chung-sik at 8-2). “In the drawings, 42 is a constant voltage unit for regulating a voltage input to the power line 40 and outputting the voltage as a constant voltage, and includes a regulator 62 for regulating an input power voltage (Vcc) to outputting the same as a predetermined voltage, and noise removing capacitors 58 and 60 which are connected between the input and terminal ends of the regulator 62.” (Chung-sik at 8-3). “a52 is a charging unit configured in such a way that a resistor 84 and a diode 86 are connected in series to each other between the battery 32 and an output terminal of the rectifier 80, and which outputs a charge voltage of the battery 32 using output of the rectifier 80 in one direction.”(Chung-sik at 8-3)
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL). In addition, 56 is a second microcomputer and is a microcomputer for controlling the portable device 18.” (Chung-sik at 8-3, Fig 2). “The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik ²
	charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2). “When a charge level of the battery 32 is increased through the aforementioned operation, the charge level detection voltage V2 of a second voltage splitter 93 increases, and when the detection voltage V2 becomes higher than the reference voltage V1, the output VDL of the comparator 96 is transitioned to logic "high" from logic "low" and is input to the second microcomputer 56. Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.” (Chung-sik at 8-5; Fig. 3B).

Claim 2 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“The induced voltage rectifying unit 50 corresponds to an induced voltage detector for detecting and rectifying the induced voltage output from the induced voltage generator inside the aforementioned charge voltage generator. The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting means 81 that is inductively coupled to the induced voltage generator 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting means 81.” (Chung-sik at 8-3, Fig. 2).

Claim 3 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 4 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“The control signal (SCTL) output from the output port P1 is applied to a base of the transistor 70 through a resistor 72 and switches “on/off” the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between “low” and “high” depending on a period of the control signal (SCTL), and the signal is applied to a base of the transistor 64.” (Chung-sik at 8-4, Fig. 2).

Claim 5 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-3–8-4, Fig. 2).

Claim 6 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.	"54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL). In addition, 56 is a second microcomputer and is a microcomputer for controlling the portable device 18." (Chung-sik at 8-3, Fig. 2).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:	"Another objective of the present invention is to provide a system for charging a battery in a portable device by inductively coupling a voltage from a charger to a portable device. Yet another objective of the present invention is to provide a contactless charge system for detecting a voltage of a rechargeable battery to control the charge between the charger and the portable device." (Chung-sik at 8-2; Fig. 2).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	"In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generator of the charging device is inductively coupled to the induced voltage rectifier within the portable device when the portable device is placed on the charging device." (Chung-sik at 8-2).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	"In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generator of the charging device is inductively coupled to the induced voltage rectifier within the portable device when the portable device is placed on the charging device." (Chung-sik at 8-2).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	"In the drawings, 42 is a constant voltage unit for regulating a voltage input to the power line 40 and outputting the voltage as a constant voltage, and includes a regulator 62 for regulating an input power voltage (Vcc) to outputting the same as a predetermined voltage, and noise removing capacitors 58 and 60 which are connected between the input and terminal ends of the regulator 62." (Chung-sik at 8-3).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
	“52 is a charging unit configured in such a way that a resistor 84 and a diode 86 are connected in series to each other between the battery 32 and an output terminal of the rectifier 80, and which outputs a charge voltage of the battery 32 using output of the rectifier 80 in one direction.”(Chung-sik at 8-3)
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL). In addition, 56 is a second microcomputer and is a microcomputer for controlling the portable device 18.” (Chung-sik at 8-3, Fig 2). “The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2). “When a charge level of the battery 32 is increased through the aforementioned operation, the charge level detection voltage V2 of a second voltage splitter 93 increases, and when the detection voltage V2 becomes higher than the reference voltage V1, the output VDL of the comparator 96 is transitioned to logic "high" from logic "low" and is input to the second microcomputer 56.

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
	Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112." (Chung-sik at 8-5; Fig. 3B).

Claim 8 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	"The induced voltage rectifying unit 50 corresponds to an induced voltage detecting means for detecting and rectifying the induced voltage output from the induced voltage generating means inside the aforementioned charge voltage generating means. The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting unit 81 that is inductively coupled to the induced voltage generating unit 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81." (Chung-sik at 8-3, Fig. 2).

Claim 9 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the	"The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the

monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 10 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging circuit module according to claim 9, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“The control signal (SCTL) output from the output port P1 is applied to a base of the transistor 70 through a resistor 72 and switches “on/off” the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between “low” and “high” depending on a period of the control signal (SCTL), and the signal is applied to a base of the transistor 64.” (Chung-sik at 8-4, Fig. 2).

Claim 11 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-3–8-4, Fig. 2).

Claim 12 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL). In addition, 56 is a second microcomputer and is a microcomputer for controlling the portable device 18.” (Chung-sik at 8-3, Fig. 2).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:	“Another objective of the present invention is to provide a system for charging a battery in a portable device by inductively coupling a voltage from a charger to a portable device. Yet another objective of the present invention is to provide a contactless charge system for detecting a voltage of a rechargeable battery to control the charge between the charger and the portable device.” (Chung-sik at 8-2; Fig. 2). “The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
	52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).
a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device.” (Chung-sik at 8-2). “The induced voltage rectifying unit 50 corresponds to an induced voltage detector for detecting and rectifying the induced voltage output from the induced voltage generator inside the aforementioned charge voltage generator. The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting means 81 that is inductively coupled to the induced voltage generating means 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81.” (Chung-sik at 8-3, Fig. 2).
a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and	“In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device.” (Chung-sik at 8-2).
a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the	“Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-5).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	

Claim 14 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.	“The induced voltage rectifying unit 50 corresponds to an induced voltage detecting means for detecting and rectifying the induced voltage output from the induced voltage generating means inside the aforementioned charge voltage generator. The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting means 81 that is inductively coupled to the induced voltage generating means 46, and a rectifying unit 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81.” (Chung-sik at 8-3, Fig. 2).

Claim 15 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 16 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less chargeable battery according to claim 15, further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes: a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 17 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.	“Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generator 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 18 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging device according to claim 16, wherein the constant voltage supplier includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current; a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.	“Another objective of the present invention is to provide a system for charging a battery in a portable device by inductively coupling a voltage from a charger to a portable device. Yet another objective of the present invention is to provide a contactless charge system for detecting a voltage of a rechargeable battery to control the charge between the charger and the portable device.” (Chung-sik at 8-2; Fig. 2). “52 is a charging unit configured in such a way that a resistor 84 and a diode 86 are connected in series to each other between the battery 32 and an output terminal of the rectifying unit 80, and which outputs a charge voltage of the battery 32 using output of the rectifying unit 80 in one direction.”(Chung-sik at 8-3) “The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 19 (*568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.	“Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 20 (*568 Patent)	Relevance of Specific Disclosures in Chung-sik
The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 21 (*568 Patent)	Relevance of Specific Disclosures in Chung-sik
A battery charging set including a contact-less chargeable battery and a contact-less charging device,	“Another objective of the present invention is to provide a system for charging a battery in a portable device by inductively coupling a voltage from a charger to a portable device.

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
	Yet another objective of the present invention is to provide a contactless charge system for detecting a voltage of a rechargeable battery to control the charge between the charger and the portable device." (Chung-sik at 8-2; Fig. 2).
wherein the battery includes: a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;	"In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device." (Chung-sik at 8-2).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	"In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device." (Chung-sik at 8-2).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode;	"In the drawings, 42 is a constant voltage unit for regulating a voltage input to the power line 40 and outputting the voltage as a constant voltage, and includes a regulator 62 for regulating an input power voltage (Vcc) to outputting the same as a predetermined voltage, and noise removing capacitors 58 and 60 which are connected between the input and terminal ends of the regulator 62." (Chung-sik at 8-3). "52 is a charging unit configured in such a way that a resistor 84 and a diode 86 are connected in series to each other between the battery 32 and an output terminal of the rectifier 80, and which outputs a charge voltage of the battery 32 using output of the rectifier 80 in one direction." (Chung-sik at 8-3)
and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,	"54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL). In addition, 56 is a second microcomputer and is a microcomputer for controlling the portable device 18." (Chung-sik at 8-3, Fig 2).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2). “When a charge level of the battery 32 is increased through the aforementioned operation, the charge level detection voltage V2 of a second voltage splitter 93 increases, and when the detection voltage V2 becomes higher than the reference voltage V1, the output VDL of the comparator 96 is transitioned to logic "high" from logic "low" and is input to the second microcomputer 56. Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
	(the portable device is normal), and performs operation 112.” (Chung-sik at 8-5; Fig. 3B).
wherein the charging device includes: a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The induced voltage rectifying unit 50 corresponds to an induced voltage detector for detecting and rectifying the induced voltage output from the induced voltage generator inside the aforementioned charge voltage generator. The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting means 81 that is inductively coupled to the induced voltage generator 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting means 81.” (Chung-sik at 8-3, Fig. 2).
a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and	“In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device.” (Chung-sik at 8-2).
a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 22 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:	“Another objective of the present invention is to provide a system for charging a battery in a portable device by inductively coupling a voltage from a charger to a portable device. Yet another objective of the present invention is to provide a contactless charge system for detecting a voltage of a rechargeable battery to control the charge between the charger and the portable device.” (Chung-sik at 8-2; Fig. 2).
(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;	“In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device.” (Chung-sik at 8-2).
(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-	“The induced voltage rectifying unit 50 corresponds to an induced voltage detecting means for detecting and rectifying the induced voltage output from the induced voltage generating means inside the aforementioned charge voltage generating means. The induced voltage

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
induced high frequency AC current;	rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting unit 81 that is inductively coupled to the induced voltage generating unit 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81." (Chung-sik at 8-3, Fig. 2).
(c) rectifying the output high frequency AC current to be converted into a DC current;	"In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device." (Chung-sik at 8-2).
(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;	"In the drawings, 42 is a constant voltage unit for regulating a voltage input to the power line 40 and outputting the voltage as a constant voltage, and includes a regulator 62 for regulating an input power voltage (Vcc) to outputting the same as a predetermined voltage, and noise removing capacitors 58 and 60 which are connected between the input and terminal ends of the regulator 62." (Chung-sik at 8-3). "52 is a charging unit configured in such a way that a resistor 84 and a diode 86 are connected in series to each other between the battery 32 and an output terminal of the rectifier 80, and which outputs a charge voltage of the battery 32 using output of the rectifier 80 in one direction." (Chung-sik at 8-3)
(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and	"The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
	charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).
(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.	“The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.” (Chung-sik at 8-4; <i>see also</i> 8-5, Fig. 2).

Claim 24 ('568 Patent)	Relevance of Specific Disclosures in Chung-sik
The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL). In addition, 56 is a second microcomputer and is a microcomputer for controlling the portable device 18.” (Chung-sik at 8-3, Fig 2).

ii. The Claims Patentably Distinguish over Chung-sik. Chung-sik does Not Raise a Substantial New Question of Patentability

For at least the reasons set forth below, Claims 1-24 are patentably distinct over Chung-sik. Any basis set forth below that applies to one of independent Claims 1, 7, 13, 21, or 23 also

provides a patentable distinction for dependent claims 2-6, 8-12, 14-20, 22, or 24 respectively based on the dependent nature of those claims, as well as for the independent elements set forth therein.

1. Chung-sik does not disclose the claimed overvoltage monitoring unit of Claims 1, 3, 4, 6, 7, 9, 10, or 21, or the claimed monitoring of voltages at both ends of the constant voltage/constant current supplier of Claims 13 and 20-23

Chung-sik fails to disclose the claimed “overvoltage monitoring unit” that monitors a voltage at both ends of a constant voltage/constant current supplier and fails to disclose any monitoring of voltages at both ends of a constant voltage/constant current supplier by any mechanism. Instead, in Chung-sik, charge unit 52 receives a rectified voltage and provides that voltage to battery 32. (Chung-sik, 10-11, 15). Chung-sik fails to describe anything that monitors for an overvoltage situation.

Further, Chung-sik fails to disclose the claimed constant voltage/constant current supplier. The only mention of providing any constant profile during charging is located in the transmitter side 28 of the charging system. (Chung-sik at 12, Fig. 2). As a result, Chung-sik fails to disclose the claimed overvoltage monitoring unit in the receiver side of a charging system that monitors “voltages at both ends of the constant voltage/constant current supplier.” (See e.g., ‘568 Patent at Claim 1)(emphasis added).

2. Chung-sik does not disclose a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode (Claims 1, 3, 6, 7, 9, 12, 13, 20-24)

Chung-sik fails to disclose the claimed constant voltage/constant current supplier that is capable of providing both “a constant voltage” and “a constant current” depending on what is

needed for that specific time during the contactless charge of a battery. The only mention of providing any constant charging is located in the transmitter side 28 of the charging system. (Chung-sik at 12, Fig. 2). However, as this disclosure is regarding a component located on the wrong side of the contactless charging system, this disclosure fails to suggest the claimed constant voltage/constant current supplier in the claimed power receiver. Conversely, the '568 Patent states that "microprocessor 310 controls the constant voltage/constant current supplier 290" ('568 Patent at 7:43-44), such that the constant voltage/constant current supplier is a component that is entirely lacking from Chung-sik.

3. Chung-sik does not disclose a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends and the subsequent outputting of the end time point to the microprocessor (Claims 4 and 10)

Chung-sik is silent with regard to any pause detecting unit, and is further silent with regard to the detection, and output, of an end time point. Chung-sik's charge termination determination is based upon a temperature detected via thermostatic switch 74. (Chung-sik at 14).

C. Item of Information No. 2 - Kim

i. Explanation of the relevance and manner of applying Kim to each claim of the '568 Patent

The following portions of Kim may be considered important to the examiner as these portions may relate to the respective claim limitations presented below. In accordance with MPEP § 2811.01, "[t]hese statements will NOT be construed as an admission of unpatentability . . . [and] only indicate that the patent owner is requesting that the Office consider whether certain issues may be raised by each item of information with respect to specific claims."

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Kim
A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:	“The present invention relates to a battery charging system and a battery charging apparatus thereof that are adapted for use in combination with mobile terminals. More specifically, the present invention relates to a battery charging system and a battery charging apparatus thereof that make use of an induced voltage in charging a battery without terminal contact between a battery pack and the charging apparatus.” (Kim at 1:7-12).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24). “The switching power section 13, which is a device for generating a switching power necessary for charging, comprises a fly-back type switching mode power supply (SMPS) and uses a current amplifier to make the switching power applicable to the load fluctuation rate on the receiver side. Hence, the switching power section 13 receives a pulse width modulation(PWM) type control signal from the power controller 16 and supplies a switching power (e.g., over 100 KHz) to the power transmitter 14.” (Kim at 7:12-18). “The power transmitter 14 generates an induced voltage from the magnetic field generated by the switching power of the switching power section 13, and for this purpose, uses an induction coil.” (Kim at 7:19-21)
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“a smoothing circuit for converting the induced voltage to a DC voltage” (Kim at 2:24-3:1; <i>see also</i> 6:18-7:11). “the battery charging apparatus comprising: a filter for eliminating noise included in external AC power and interrupting flow of a transient current; a rectifier for converting the AC power supplied via the filter to DC power” (Kim at Claim 1). “The switching power section 13, which is a device for generating a switching power necessary for charging, comprises a fly-back type switching mode power supply (SMPS) and uses a current amplifier to make the

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Kim
	switching power applicable to the load fluctuation rate on the receiver side. Hence, the switching power section 13 receives a pulse width modulation(PWM) type control signal from the power controller 16 and supplies a switching power (e.g., over 100 KHz) to the power transmitter 14.” (Kim at 7:12-18). “The power transmitter 14 generates an induced voltage from the magnetic field generated by the switching power of the switching power section 13, and for this purpose, uses an induction coil.” (Kim at 7:19-21)
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	“controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “Supply of a constant voltage or a constant current is necessary in charging a battery.” (Kim at 5:19-20).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 2 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“FIG. 5 shows the battery pack associated with the charging apparatus in accordance with the present invention, in which terminals of the battery pack are not in contact with terminals of the charging apparatus because the apparatus charges the battery with a voltage induced by an induction coil rather than by way of contact between terminals, thereby allowing the battery to be chargeable irrespective of the type of mobile terminal concerned.” (Kim at 9:10-16).

Claim 3 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“The controller 3 outputs a control signal to a signal generator 4 based on the charging status of the battery 2. The signal generator 4, which comprises, for example, light-emitting elements of an optical sensor, receives the control signal and generates an optical signal having a predetermined frequency based on the control signal.” (Kim at 5:3-7). “With a built-in algorithm programmed to supply a constant voltage or a constant current to the battery so as to properly charge the battery, the microcontroller generates a control signal according to the execution of the program so that the signal generator 4 generates an optical signal.” (Kim at 5:14-18). “The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13).

Claim 4 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field, and a smoothing circuit for converting the induced voltage to a DC voltage; a battery being charged with the DC voltage supplied from the power receiver; a controller including a microcontroller programmed with an algorithm for monitoring the voltage and a current supplied to the battery, generating a control signal based on a charging status of the battery and supplying a constant voltage and a constant current to the battery for proper charging; and a signal generator for generating a signal based on input of the control signal.” (Kim at 2:20-3:7).

Claim 5 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“a power controller including a microcontroller programmed with an algorithm for generating a control signal to the switching power section based on a signal supplied from the signal receiver and effecting proper charging.” (Kim at 3:16-19).

Claim 6 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Kim
A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:	“The present invention relates to a battery charging system and a battery charging apparatus thereof that are adapted for use in combination with mobile terminals. More specifically, the present invention relates to a battery charging system and a battery charging apparatus thereof that make use of an induced voltage in charging a battery without terminal contact between a battery pack and the charging apparatus.” (Kim at 1:7-12).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“a smoothing circuit for converting the induced voltage to a DC voltage” (Kim at 2:24-3:1; <i>see also</i> 6:18-7:11). “the battery charging apparatus comprising: a filter for eliminating noise included in external AC power and interrupting flow of a transient current; a rectifier for converting the AC power supplied via the filter to DC power” (Kim at Claim 1).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and	“controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Kim
supplying a charging power to the battery cell in a constant voltage/constant current mode; and	the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “Supply of a constant voltage or a constant current is necessary in charging a battery.” (Kim at 5:19-20).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 8 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“FIG. 5 shows the battery pack associated with the charging apparatus in accordance with the present invention, in which terminals of the battery pack are not in contact with terminals of the charging apparatus because the apparatus charges the battery with a voltage induced by an induction coil rather than by way of contact between terminals, thereby allowing the battery to be chargeable irrespective of the type of mobile terminal concerned.” (Kim at 9:10-16).

Claim 9 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“The controller 3 outputs a control signal to a signal generator 4 based on the charging status of the battery 2. The signal generator 4, which comprises, for example, light-emitting elements of an optical sensor, receives the control signal and generates an optical signal having a predetermined frequency based on the control signal.” (Kim at 5:3-7). “With a built-in algorithm programmed to supply a constant voltage or a constant current to the battery so as to properly charge the battery, the microcontroller generates a control signal according to the execution of the program so that the signal generator 4 generates an optical signal.” (Kim at 5:14-18). “The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13).

Claim 10 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging circuit module according to claim 9, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field, and a smoothing circuit for converting the induced voltage to a DC voltage; a battery being charged with the DC voltage supplied from the power receiver; a controller including a microcontroller programmed with an algorithm for monitoring the voltage and a current supplied to the battery, generating a control signal based on a charging status of the battery and supplying a constant voltage and a constant current to the battery for proper charging; and a signal generator for generating a signal based on input of the control signal.” (Kim at 2:20-3:7).

Claim 11 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“a power controller including a microcontroller programmed with an algorithm for generating a control signal to the switching power section based on a signal supplied from the signal receiver and effecting proper charging.” (Kim at 3:16-19).

Claim 12 (*568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 13 (*568 Patent)	Relevance of Specific Disclosures in Kim
A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:	“The present invention relates to a battery charging system and a battery charging apparatus thereof that are adapted for use in combination with mobile terminals. More specifically, the present invention relates to a battery charging system and a battery charging apparatus thereof that make use of an induced voltage in charging a battery without terminal contact between a battery pack and the charging apparatus.” (Kim at 1:7-12). “controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “Supply of a constant voltage or a constant current is necessary in charging a battery.” (Kim at 5:19-20). “The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Kim
a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12). “The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24). “The switching power section 13, which is a device for generating a switching power necessary for charging, comprises a fly-back type switching mode power supply (SMPS) and uses a current amplifier to make the switching power applicable to the load fluctuation rate on the receiver side. Hence, the switching power section 13 receives a pulse width modulation(PWM) type control signal from the power controller 16 and supplies a switching power (e.g., over 100 KHz) to the power transmitter 14.” (Kim at 7:12-18). “The power transmitter 14 generates an induced voltage from the magnetic field generated by the switching power of the switching power section 13, and for this purpose, uses an induction coil.” (Kim at 7:19-21)
a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24). “The switching power section 13, which is a device for generating a switching power necessary for charging, comprises a fly-back type switching mode power supply (SMPS) and uses a current amplifier to make the switching power applicable to the load fluctuation rate on the receiver side. Hence, the switching power section 13 receives a pulse width modulation(PWM) type control signal from the power controller 16 and supplies a switching power (e.g., over 100 KHz) to the power transmitter 14.” (Kim at 7:12-18).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Kim
	“The power transmitter 14 generates an induced voltage from the magnetic field generated by the switching power of the switching power section 13, and for this purpose, uses an induction coil.” (Kim at 7:19-21)
a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 14 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.	“FIG. 5 shows the battery pack associated with the charging apparatus in accordance with the present invention, in which terminals of the battery pack are not in contact with terminals of the charging apparatus because the apparatus charges the battery with a voltage induced by an induction coil rather than by way of contact between terminals, thereby allowing the battery to be chargeable irrespective of the type of mobile terminal concerned.” (Kim at 9:10-16).

Claim 15 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.	“The controller 3 outputs a control signal to a signal generator 4 based on the charging status of the battery 2. The signal generator 4, which comprises, for example, light-emitting elements of an optical sensor, receives the control signal and generates an optical signal having a predetermined frequency based on the control signal.” (Kim at 5:3-7). “With a built-in algorithm programmed to supply a constant voltage or a constant current to the battery so as to properly charge the battery, the microcontroller generates a control signal according to the execution of the program so that the signal generator 4 generates an optical signal.” (Kim at 5:14-18). “The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13).

Claim 16 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less chargeable battery according to claim 15, further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes: a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.	“Hence, the switching power section 13 receives a pulse width modulation (PWM) type control signal from the power controller 16 and supplies a switching power (e.g., over 100 KHz) to the power transmitter 14.” (Kim at 7:16-18).

Claim 17 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.	“Hence, the switching power section 13 receives a pulse width modulation (PWM) type control signal from the power controller 16 and supplies a switching power (e.g., over 100 KHz) to the power transmitter 14.” (Kim at 7:16-18).

Claim 18 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging device according to claim 16, wherein the constant voltage supplier includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current; a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.	“a smoothing circuit for converting the induced voltage to a DC voltage” (Kim at 2:24-3:1; <i>see also</i> 6:18-7:11). “the battery charging apparatus comprising: a filter for eliminating noise included in external AC power and interrupting flow of a transient current; a rectifier for converting the AC power supplied via the filter to DC power” (Kim at Claim 1). “controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “Supply of a constant voltage or a constant current is necessary in charging a battery.” (Kim at 5:19-20).

Claim 19 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field, and a smoothing circuit for converting the induced voltage to a DC voltage; a battery being charged with the DC voltage supplied from the power receiver; a controller including a microcontroller programmed with an algorithm for monitoring the voltage and a current supplied to the battery, generating a control signal based on a charging status of the battery and supplying a constant voltage and a constant current to the battery for proper charging; and a signal generator for generating a signal based on input of the control signal.” (Kim at 2:20-3:7).

Claim 20 ('568 Patent)	Relevance of Specific Disclosures in Kim
The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Kim
A battery charging set including a contact-less chargeable battery and a contact-less charging device,	“The present invention relates to a battery charging system and a battery charging apparatus thereof that are adapted for use in combination with mobile terminals. More specifically, the present invention relates to a battery charging system and a battery charging apparatus thereof that make use of an induced voltage in charging a battery without terminal contact between a battery pack and the charging apparatus.” (Kim at 1:7-12).
wherein the battery includes: a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“a smoothing circuit for converting the induced voltage to a DC voltage” (Kim at 2:24-3:1; <i>see also</i> 6:18-7:11). “the battery charging apparatus comprising: a filter for eliminating noise included in external AC power and interrupting flow of a transient current; a rectifier for converting the AC power supplied via the filter to DC power” (Kim at Claim 1).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Kim
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode;	“controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “Supply of a constant voltage or a constant current is necessary in charging a battery.” (Kim at 5:19-20).
and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).
wherein the charging device includes: a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24).
a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24).
a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 22 ('568 Patent)	Relevance of Specific Disclosures in Kim
The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Kim
A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:	“The present invention relates to a battery charging system and a battery charging apparatus thereof that are adapted for use in combination with mobile terminals. More specifically, the present invention relates to a battery charging system and a battery charging apparatus thereof that make use of an induced voltage in charging a battery without terminal contact between a battery pack and the charging apparatus.” (Kim at 1:7-12).
(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field, and a smoothing circuit for converting the induced voltage to a DC voltage; a battery being charged with the DC voltage supplied from the power receiver; a controller including a microcontroller programmed with an algorithm for monitoring the voltage and a current supplied to the battery, generating a control signal based on a charging status of the battery and supplying a constant voltage and a constant current to the battery for proper charging; and a signal generator for generating a signal based on input of the control signal.” (Kim at 2:20-3:7).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Kim
(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;	“The battery pack includes: a power receiver for converting an externally induced voltage to a DC voltage, the power receiver comprising an induction coil for inducing the external voltage through a magnetic field.” (Kim at 2:20-24).
(c) rectifying the output high frequency AC current to be converted into a DC current;	“a smoothing circuit for converting the induced voltage to a DC voltage” (Kim at 2:24-3:1; <i>see also</i> 6:18-7:11). “the battery charging apparatus comprising: a filter for eliminating noise included in external AC power and interrupting flow of a transient current; a rectifier for converting the AC power supplied via the filter to DC power” (Kim at Claim 1). “The switching power section 13, which is a device for generating a switching power necessary for charging, comprises a fly-back type switching mode power supply (SMPS) and uses a current amplifier to make the switching power applicable to the load fluctuation rate on the receiver side. Hence, the switching power section 13 receives a pulse width modulation(PWM) type control signal from the power controller 16 and supplies a switching power (e.g., over 100 KHz) to the power transmitter 14.” (Kim at 7:12-18). “The power transmitter 14 generates an induced voltage from the magnetic field generated by the switching power of the switching power section 13, and for this purpose, uses an induction coil.” (Kim at 7:19-21)
(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;	“controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “Supply of a constant voltage or a constant current is necessary in charging a battery.” (Kim at 5:19-20).
(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Kim
result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and	“[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).
(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.	“a power controller including a microcontroller programmed with an algorithm for generating a control signal to the switching power section based on a signal supplied from the signal receiver and effecting proper charging.” (Kim at 3:16-19).

Claim 24 ('568 Patent)	Relevance of Specific Disclosures in Kim
The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal for charging the battery with a constant voltage and a constant current.” (Kim at 5:11-13). “[T]he microcontroller of the power controller periodically monitors the charging status of the battery so as to minimize power consumption after the battery is fully charged.” (Kim at 8:16-18). “The power controller periodically detects the current consumed in charging the battery ... so as to not supply an excess of power.” (Kim at 8:10-12).

ii. The Claims Patentably Distinguish over Kim and Kim does Not Raise a Substantial New Question of Patentability

For at least the reasons set forth below, Claims 1-24 are patentably distinct over Kim. Any basis set forth below that applies to one of independent Claims 1, 7, 13, 21, or 23 also provides a

patentable distinction for dependent claims 2-6, 8-12, 14-20, 22, or 24 respectively based on the dependent nature of those claims, as well as for the independent elements set forth therein.

1. Kim does not disclose the claimed overvoltage monitoring unit of Claims 1, 3, 4, 6, 7, 9, 10, or 21, or the claimed monitoring of voltages at both ends of the constant voltage/constant current supplier of Claims 13, 20-23

Kim fails to disclose the claimed “overvoltage monitoring unit” that monitors a voltage at both ends of a constant voltage/constant current supplier and fails to disclose any monitoring of voltages at both ends of a constant voltage/constant current supplier by any mechanism. Instead, in Kim, “controller 3 monitors the voltage and the current supplied to the battery 2 to generate a control signal.” (Kim at 5:11-13). This fails to disclose the claimed overvoltage monitoring unit that monitors “voltages at both ends of the constant voltage/constant current supplier.” (*See e.g.*, ‘568 Patent at Claim 1)(emphasis added).

Moreover, Kim is entirely silent with regard to any component that monitors for an overvoltage situation in the receiving end of wireless power transmission. As noted in the ‘568 Patent:

if standards of the constant current/constant voltage supplier 90 are defined using a small high frequency AC current, in case the battery 50 is positioned at a position where a large high frequency AC current is induced, overvoltage exceeding the standards may be applied to both ends of the constant current/constant voltage supplier 90 while charging the battery 10, thereby possibly causing a damage on parts.

(‘568 Patent at 2:42-48). Kim fails to identify, let alone solve, the problems that the overvoltage monitoring unit of the ‘568 Patent solves over the state of the art. (*See* ‘568 Patent at 7:43-55, 9:25-34).

2. Kim does not disclose a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode (Claims 1, 3, 6, 7, 9, 12, 13, 20-24)

Kim fails to disclose the claimed constant voltage/constant current supplier in the receiver. Instead, the operation of Kim states “controller 3 monitors the voltage and the current supplied to the battery 2” and it generates a control signal, that control signal is sent to the signal generator 4 to send an optical signal to the transmitter side. (Kim at 5:11-18). There is nothing in Kim that discloses, in the receiver side, the claimed constant voltage/constant current supplier, as the controller of Kim measures a voltage and provides a control signal to the power transmitter side of the system. Thus, Kim fails to disclose the claimed constant voltage/constant current supplier that receives a DC current from the rectifier and supplies a charging power to the battery cell in a constant voltage/constant current mode.

3. Kim does not disclose a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna (Claims 3, 9, 15)

Kim relies upon “a light-emitting optical sensor and a light-receiving optical sensor” for its communication between wireless power transmitter and wireless power receiver. (Kim at 3:20-25 *see also*, 11:6-9). There is no antenna relied upon to provide any monitoring result as everything is communicated using optical sensors and transmitters that rely upon light.

- 4. Kim does not disclose a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends and the subsequent outputting of the end time point to the microprocessor (Claims 4 and 10)**

Kim is silent with regard to any pause detecting unit, and is further silent with regard to the detection, and output, of an end time point. Kim's charge termination determination is based upon a voltage measured at the battery. (Kim at 6:9-13, *see also* 10:22-11:55).

D. Item of Information No. 3 - Lyon

i. Explanation of the relevance and manner of applying Lyon to each claim of the '568 Patent

The following portions of Lyon may be considered important to the examiner as these portions may relate to the respective claim limitations presented below. In accordance with MPEP § 2811.01, "[t]hese statements will NOT be construed as an admission of unpatentability . . . [and] only indicate that the patent owner is requesting that the Office consider whether certain issues may be raised by each item of information with respect to specific claims."

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Lyon
A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:	"The present invention relates to transmitting a charge to a device using inductive coils." (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2.)
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	"The present invention relates to transmitting a charge to a device using inductive coils." (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2).
a rectifier for receiving the induced high frequency AC current and converting the induced high	"Device 204 includes a controlled rectifier 230, a secondary coil 232, a battery/load 234, an output voltage control 236, a memory 238, a processor (RFID) 240, and

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Lyon
frequency AC current into a DC current;	communication port 242 for communicating over data communication channel 220. Alternatively, communication port 242 can communicate charge information and status over secondary inductor 232 and through inductors 210 to 212 rather than a separate data communication channel 220.” (Lyon at ¶23; <i>See also</i> Lyon at Fig. 2).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	“In one implementation, field patterns components 224 stores predetermined profiles and parameters for charging devices designed in accordance with implementations of the present invention. Alternatively, profiles for charging certain devices are not predetermined but discovered in accordance with the present invention prior to charging and also stored in field patterns component 224. In another implementation, profiles stored in the device are transmitted to charger device 106 prior to being charged and stored in field patterns component 224.” (Lyon at ¶21). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Lyon
	“The inductive charger operates differently depending on whether a single device or multiple devices needs charging (308). If a single device is detected, the inductive charger selects the optimal parameters and orientation for charging the device (310). These parameters activate one or more inductive coils creating a magnetic field oriented to charge the detected device. In addition, the parameters may also specify strength, phase, amplitude, and frequency of the magnetic inductive field. Using these settings, the inductive charger continues charging the device until the device is charged or removed from the proximity of the charger (312). In one implementation, the inductive charger monitors the load to determine when the device has been completely charged and then terminates the charging process (314). Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.” (Lyon at ¶29). “Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).

Claim 2 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“Instead, inductive charger 106 operates multiple inductive coils in accordance with implementations of the present invention to present each of the one or more devices with the proper magnetic field to charge each device. In one implementation, inductive charger 106 can charge devices 104 in a roundrobin scheme that incrementally charges each of the devices on the platter using a magnetic field best suited for each device. Inductive charger 106 sequences through devices 104 providing each device a charge for a fixed or variable time period before switching to and charging another device.” (Lyon at ¶16).

Claim 3 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.” (Lyon at ¶ 29; <i>see also</i> Cls. 4-6, Fig. 2). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 4 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).

Claim 5 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 6 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Lyon
A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2.).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2.).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“Device 204 includes a controlled rectifier 230, a secondary coil 232, a battery/load 234, an output voltage control 236, a memory 238, a processor (RFID) 240, and communication port 242 for communicating over data communication channel 220. Alternatively, communication port 242 can communicate charge information and status over secondary inductor 232 and through inductors 210 to 212 rather than a separate data communication channel 220.” (Lyon at ¶23; <i>see also</i> Lyon at Fig. 2.).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and	“In one implementation, field patterns components 224 stores predetermined profiles and parameters for charging devices designed in accordance with implementations of

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Lyon
supplying a charging power to the battery cell in a constant voltage/constant current mode; and	the present invention. Alternatively, profiles for charging certain devices are not predetermined but discovered in accordance with the present invention prior to charging and also stored in field patterns component 224. In another implementation, profiles stored in the device are transmitted to charger device 106 prior to being charged and stored in field patterns component 224.” (Lyon at ¶21). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24). “The inductive charger operates differently depending on whether a single device or multiple devices needs charging (308). If a single device is detected, the inductive charger selects the optimal parameters and orientation for charging the device (310). These parameters activate one or more inductive coils creating a magnetic field oriented to charge the detected device. In addition, the parameters may also specify strength, phase, amplitude, and frequency of the magnetic inductive field. Using these settings, the inductive charger continues charging the device until the device is charged or removed from the proximity of the charger (312). In one implementation, the

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Lyon
	inductive charger monitors the load to determine when the device has been completely charged and then terminates the charging process (314). Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.” (Lyon at ¶29). “Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).

Claim 8 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“Instead, inductive charger 106 operates multiple inductive coils in accordance with implementations of the present invention to present each of the one or more devices with the proper magnetic field to charge each device. In one implementation, inductive charger 106 can charge devices 104 in a roundrobin scheme that incrementally charges each of the devices on the platter using a magnetic field best suited for each device. Inductive charger 106 sequences through devices 104 providing each device a charge for a fixed or variable time period before switching to and charging another device.” (Lyon at ¶16).

Claim 9 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.” (Lyon at ¶ 29; <i>see also</i> Cls. 4-6, Fig. 2). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 10 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging circuit module according to claim 9, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).

Claim 11 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 12 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Lyon
A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1). “In one implementation, field patterns components 224 stores predetermined profiles and parameters for charging devices designed in accordance with implementations of the present invention. Alternatively, profiles for charging certain devices are not predetermined but discovered in accordance with the present invention prior to charging and also stored in field patterns component 224. In another implementation, profiles stored in the device are transmitted to charger device 106 prior to being charged and stored in field patterns component 224.” (Lyon at ¶21; <i>see also</i> Lyon at Fig. 2). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Lyon
a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1).
a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1).
a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24). “The inductive charger operates differently depending on whether a single device or multiple devices needs charging (308). If a single device is detected, the inductive charger selects the optimal parameters and orientation for charging the device (310). These parameters activate one or more inductive coils creating a magnetic field oriented to charge the detected device. In addition, the parameters may also specify strength, phase, amplitude, and frequency of the magnetic inductive field. Using these settings, the inductive charger continues charging the device until the device is charged or removed from the proximity of the charger (312). In one implementation, the inductive charger monitors the load to determine when the device has been completely charged and then terminates the charging process (314). Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.” (Lyon at ¶29).

Claim 14 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1).

Claim 15 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.	“FIG. 2 provides a block diagram of inductive charger 106 and a device 204 compatible with one implementation of the present invention. Inductive charger 106 includes a variable frequency resonant inverter for multiple inductors 206, a alternating current source 208, a set of inductors 210 through 212, an input frequency control 214, a memory 216, a processor 218, and a communication port 243 used to communicate over a separate data communication channel 220.” (Lyon at 18, <i>see also</i> Fig. 2).

Claim 16 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less chargeable battery according to claim 15, further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes: a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.	“Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 17 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.	“Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).

Claim 18 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging device according to claim 16, wherein the constant voltage supplier includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current; a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.	“Device 204 includes a controlled rectifier 230, a secondary coil 232, a battery/load 234, an output voltage control 236, a memory 238, a processor (RFID) 240, and communication port 242 for communicating over data communication channel 220. Alternatively, communication port 242 can communicate charge information and status over secondary inductor 232 and through inductors 210 to 212 rather than a separate data communication channel 220.” (Lyon at ¶23). “In one implementation, field patterns components 224 stores predetermined profiles and parameters for charging devices designed in accordance with implementations of the present invention. Alternatively, profiles for charging certain devices are not predetermined but discovered in accordance with the present invention prior to charging and also stored in field patterns component 224. In another implementation, profiles stored in the device are transmitted to charger device 106 prior to being charged and stored in field patterns component 224.” (Lyon at ¶21; <i>see also</i> Lyon at Fig. 2). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 19 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2).

Claim 20 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Lyon
A battery charging set including a contact-less chargeable battery and a contact-less charging device,	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2).
wherein the battery includes: a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Lyon
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“Device 204 includes a controlled rectifier 230, a secondary coil 232, a battery/load 234, an output voltage control 236, a memory 238, a processor (RFID) 240, and communication port 242 for communicating over data communication channel 220. Alternatively, communication port 242 can communicate charge information and status over secondary inductor 232 and through inductors 210 to 212 rather than a separate data communication channel 220.” (Lyon at ¶23; <i>see also</i> Lyon at Fig. 2).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode;	“In one implementation, field patterns components 224 stores predetermined profiles and parameters for charging devices designed in accordance with implementations of the present invention. Alternatively, profiles for charging certain devices are not predetermined but discovered in accordance with the present invention prior to charging and also stored in field patterns component 224. In another implementation, profiles stored in the device are transmitted to charger device 106 prior to being charged and stored in field patterns component 224.” (Lyon at ¶21). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24). “The inductive charger operates differently depending on whether a single device or multiple devices needs charging (308). If a single device is detected, the inductive charger selects the optimal parameters and orientation for charging the device (310). These parameters activate one or more inductive coils creating a magnetic field oriented to charge the detected device. In addition, the parameters may also specify strength, phase, amplitude, and frequency of the magnetic inductive field. Using these settings, the inductive charger continues charging the device until the device is charged or removed from the proximity of the charger (312). In one implementation, the inductive charger monitors the load to determine when the device has been completely charged and then terminates the charging process (314). Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.” (Lyon at ¶29). “Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel.

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Lyon
	Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).
wherein the charging device includes: a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2).
a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2).
a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).

Claim 22 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lyon
A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:	“The present invention relates to transmitting a charge to a device using inductive coils.” (Lyon at ¶1; <i>see also</i> Lyon at Fig. 2).
(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;	“Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.” (Lyon at ¶25).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lyon
(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).
(c) rectifying the output high frequency AC current to be converted into a DC current;	“Device 204 includes a controlled rectifier 230, a secondary coil 232, a battery/load 234, an output voltage control 236, a memory 238, a processor (RFID) 240, and communication port 242 for communicating over data communication channel 220. Alternatively, communication port 242 can communicate charge information and status over secondary inductor 232 and through inductors 210 to 212 rather than a separate data communication channel 220.” (Lyon at ¶23; <i>see also</i> Lyon at Fig. 2.).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lyon
(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;	“In one implementation, field patterns components 224 stores predetermined profiles and parameters for charging devices designed in accordance with implementations of the present invention. Alternatively, profiles for charging certain devices are not predetermined but discovered in accordance with the present invention prior to charging and also stored in field patterns component 224. In another implementation, profiles stored in the device are transmitted to charger device 106 prior to being charged and stored in field patterns component 224.” (Lyon at ¶21). “Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lyon
(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24). “The inductive charger operates differently depending on whether a single device or multiple devices needs charging (308). If a single device is detected, the inductive charger selects the optimal parameters and orientation for charging the device (310). These parameters activate one or more inductive coils creating a magnetic field oriented to charge the detected device. In addition, the parameters may also specify strength, phase, amplitude, and frequency of the magnetic inductive field. Using these settings, the inductive charger continues charging the device until the device is charged or removed from the proximity of the charger (312). In one implementation, the inductive charger monitors the load to determine when the device has been completely charged and then terminates the charging process (314). Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.” (Lyon at ¶29).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lyon
(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

Claim 24 ('568 Patent)	Relevance of Specific Disclosures in Lyon
The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.” (Lyon at ¶24).

ii. The Claims Patentably Distinguish over Lyon and Lyon does Not Raise a Substantial New Question of Patentability

For at least the reasons set forth below, Claims 1-24 are patentably distinct over Lyon. Any basis set forth below that applies to one of independent Claims 1, 7, 13, 21, or 23 also provides a

patentable distinction for dependent claims 2-6, 8-12, 14-20, 22, or 24 respectively based on the dependent nature of those claims, as well as for the independent elements set forth therein.

1. Lyon does not disclose the claimed overvoltage monitoring unit of Claims 1, 3, 4, 6, 7, 9, 10, or 21, or the claimed monitoring of voltages at both ends of the constant voltage/constant current supplier of Claims 13, 20-23

Lyon fails to disclose the claimed “overvoltage monitoring unit” that monitors a voltage at both ends of a constant voltage/constant current supplier and fails to disclose any monitoring of voltages at both ends of a constant voltage/constant current supplier by any mechanism.

Instead, in Lyon, charging state is detected on time intervals (Lyon at ¶31) and in some instances, based on “load characteristics (418)” (Lyon at ¶34, *see also* ¶6). But these load characteristics of Lyon fail to disclose the claimed overvoltage monitoring unit that monitors “voltages at both ends of the constant voltage/constant current supplier.” (*See e.g.*, ‘568 Patent at Claim 1)(emphasis added).

Moreover, Lyon is entirely silent with regard to any component that monitors for an overvoltage situation in the receiving end of wireless power transmission. As noted in the ‘568 Patent:

if standards of the constant current/constant voltage supplier 90 are defined using a small high frequency AC current, in case the battery 50 is positioned at a position where a large high frequency AC current is induced, overvoltage exceeding the standards may be applied to both ends of the constant current/constant voltage supplier 90 while charging the battery 10, thereby possibly causing a damage on parts.

(‘568 Patent at 2:42-48). Lyon fails to identify, let alone solve, the problems that the overvoltage monitoring unit of the ‘568 Patent solves over the state of the art. (*See* ‘568 Patent at 7:43-55, 9:25-34).

2. Lyon does not disclose a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode (Claims 1, 3, 6, 7, 9, 12, 13, 20-24)

Lyon fails to disclose the claimed constant voltage/constant current supplier that is capable of providing both “a constant voltage” and “a constant current” depending on what is needed for that specific time during the contactless charge of a battery. While it notes that “[v]ariable frequency resonant inverter for multiple inductors, hereinafter inverter 206, senses input voltage changes over power source 208 and controls switching frequency of the inverter to provide a relatively constant power over inductors 210 through 212” (Lyon at ¶19), Lyon does not disclose that either a constant voltage or a constant current is ever provided.

3. Lyon does not disclose a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends and the subsequent outputting of the end time point to the microprocessor (Claims 4 and 10)

Lyon is silent with regard to any pause detecting unit, and is further silent with regard to the detection, and output, of an end time point. While Lyon discloses the use of time-based charging (Lyon at ¶31, Fig. 2), Lyon fails to disclose or suggest that this time is anything other than a pre-set counter. Lyon further fails to disclose that any time is output to a multiprocessor.

E. Item of Information No. 4 - Flowerdew

i. Explanation of the relevance and manner of applying Flowerdew to each claim of the ‘568 Patent

The following portions of Flowerdew may be considered important to the examiner as these portions may relate to the respective claim limitations presented below. In accordance with MPEP

§ 2811.01, “[t]hese statements will NOT be construed as an admission of unpatentability . . . [and] only indicate that the patent owner is requesting that the Office consider whether certain issues may be raised by each item of information with respect to specific claims.”

Claim 1 (‘568 Patent)	Relevance of Specific Disclosures in Flowerdew
A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40; Fig. 2).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	“The rechargeable device includes a receive coil for coupling to the horizontal magnetic field and producing an induced voltage.” (Flowerdew at 3:51-54; Fig. 2). “The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40; Fig. 2).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“The rechargeable device further includes a rectifier for producing a rectified induced voltage to charge the battery in the rechargeable device.” (Flowerdew at 3:54-56).
a constant voltage/constant current supplier for receiving the DC	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8). “It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 2 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“The rechargeable device includes a receive coil for coupling to the horizontal magnetic field and producing an induced voltage.” (Flowerdew at 3:51-54; Fig. 2). “The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40, Fig. 2).

Claim 3 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 4 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 5 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 6 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40, Fig. 2).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contactless charging device;	“The rechargeable device includes a receive coil for coupling to the horizontal magnetic field and producing an induced voltage.” (Flowerdew at 3:51-54; Fig. 2). “The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume” (Flowerdew at 3:30-40)
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“The rechargeable device further includes a rectifier for producing a rectified induced voltage to charge the battery in the rechargeable device.” (Flowerdew at 3:54-56).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8). “It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 8 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“The rechargeable device includes a receive coil for coupling to the horizontal magnetic field and producing an induced voltage.” (Flowerdew at 3:51-54; Fig. 2). “The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40, Fig. 2).

Claim 9 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 10 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging circuit module according to claim 9, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 11 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 12 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 13 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40). “Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
	to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8). “It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52; Fig. 2).
a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40, Fig. 2).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40, Fig. 2).
a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 14 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40).

Claim 15 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 16 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less chargeable battery according to claim 15, further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes: a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8). “The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40). “The frequency, phase, amplitude, or any combination thereof of the drive voltage may be modulated in such manner as to convey data to the secondary unit 304. In an embodiment of the invention, the charger coils are driven by a voltage waveform comprising a high frequency carrier modulated with a lower frequency such that only the lower frequency produces significant magnetic flux. In one embodiment, the charger coils are driven by a voltage waveform comprising a high frequency square-wave carrier pulse-width modulated with a lower frequency sine wave such that only the lower frequency produces significant magnetic flux.” (Flowerdew at 14:1-12, Fig. 2).

Claim 17 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 18 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging device according to claim 16, wherein the constant voltage supplier includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current; a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.	“The rechargeable device further includes a rectifier for producing a rectified induced voltage to charge the battery in the rechargeable device.” (Flowerdew at 3:54-56). “Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8).

Claim 19 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 20 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 21 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
A battery charging set including a contact-less chargeable battery and a contact-less charging device,	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40, Fig. 2).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
wherein the battery includes: a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;	“The rechargeable device includes a receive coil for coupling to the horizontal magnetic field and producing an induced voltage.” (Flowerdew at 3:51-54; Fig. 2). “The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“The rechargeable device further includes a rectifier for producing a rectified induced voltage to charge the battery in the rechargeable device.” (Flowerdew at 3:54-56).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode;	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8). “It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).
wherein the charging device includes: a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40).
a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 22 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 23 (*568 Patent)	Relevance of Specific Disclosures in Flowerdew
A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40, Fig. 2).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;	“The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40).
(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;	“The rechargeable device includes a receive coil for coupling to the horizontal magnetic field and producing an induced voltage.” (Flowerdew at 3:51-54; Fig. 2). “The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume.” (Flowerdew at 3:30-40).
(c) rectifying the output high frequency AC current to be converted into a DC current;	“The rechargeable device further includes a rectifier for producing a rectified induced voltage to charge the battery in the rechargeable device.” (Flowerdew at 3:54-56).
(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8). “It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.	“Battery 320 serves as a power source for secondary unit 304. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery 320 to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery 320 to limit the charging current.” (Flowerdew at 6:2-8). “It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

Claim 24 ('568 Patent)	Relevance of Specific Disclosures in Flowerdew
The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“It is desirable to provide some communication between the charger 302 and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit 304. A communication system allows the charger 302 to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit 304 can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger 302 and secondary unit 304.” (Flowerdew at 14:30-52).

ii. The Claims Patentably Distinguish over Flowerdew and Flowerdew does Not Raise a Substantial New Question of Patentability

For at least the reasons set forth below, Claims 1-24 are patentably distinct over Flowerdew. Any basis set forth below that applies to one of independent Claims 1, 7, 13, 21, or 23 also provides a patentable distinction for dependent claims 2-6, 8-12, 14-20, 22, or 24

respectively based on the dependent nature of those claims, as well as for the independent elements set forth therein.

1. Flowerdew does not disclose the claimed overvoltage monitoring unit of Claims 1, 3, 4, 6, 7, 9, 10, or 21, or the claimed monitoring of voltages at both ends of the constant voltage/constant current supplier of Claims 13, 20-23

Flowerdew fails to disclose the claimed “overvoltage monitoring unit” that monitors a voltage at both ends of a constant voltage/constant current supplier and fails to disclose any monitoring of voltages at both ends of a constant voltage/constant current supplier by any mechanism. Instead, in Flowerdew, a “regulator circuit is responsive to the **temperature** and **voltage** of battery 320 to limit the charging current.” (Flowerdew at 6:2-8)(emphasis added). This fails to disclose the claimed overvoltage monitoring unit that monitors “voltages at both ends of the constant voltage/constant current supplier.” (*See e.g.*, ‘568 Patent at Claim 1)(emphasis added).

Moreover, Flowerdew is entirely silent with regard to any component that monitors for an overvoltage situation in the receiving end of wireless power transmission. As noted in the ‘568 Patent:

if standards of the constant current/constant voltage supplier 90 are defined using a small high frequency AC current, in case the battery 50 is positioned at a position where a large high frequency AC current is induced, overvoltage exceeding the standards may be applied to both ends of the constant current/constant voltage supplier 90 while charging the battery 10, thereby possibly causing a damage on parts.

(‘568 Patent at 2:42-48). Flowerdew fails to identify, let alone solve, the problems that the overvoltage monitoring unit of the ‘568 Patent solves over the state of the art. (*See* ‘568 Patent at 7:43-55, 9:25-34).

2. Flowerdew does not disclose a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode (Claims 1, 3, 6, 7, 9, 12, 13, 20-24)

Flowerdew fails to disclose a constant voltage/constant current supplier. Instead, it charges using a constant current only. (Flowerdew at 6:5-8). As Flowerdew is entirely silent with regard to any constant voltage supply, it fails to teach or suggest the claimed constant voltage/constant current supplier.

3. Flowerdew does not disclose a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends and the subsequent outputting of the end time point to the microprocessor (Claims 4 and 10)

Flowerdew is silent with regard to any pause detecting unit, and is further silent with regard to the detection, and output, of an end time point. Flowerdew does disclose that “[t]he state of battery charge of a secondary unit 304 can be determined if secondary units with ‘fuel gauge’ monitoring of battery use send data on remaining capacity and/or operating time” of the battery. (Flowerdew at 14:41-44). However, this fails to identify the detection of a time point when the induction of high frequency current ends.

F. Item of Information No. 5 - Berghegger

i. Explanation of the relevance and manner of applying Berghegger to each claim of the ‘568 Patent

The following portions of Berghegger may be considered important to the examiner as these portions may relate to the respective claim limitations presented below. In accordance with MPEP § 2811.01, “[t]hese statements will NOT be construed as an admission of unpatentability .

. . [and] only indicate that the patent owner is requesting that the Office consider whether certain issues may be raised by each item of information with respect to specific claims.”

Claim 1 (‘568 Patent)	Relevance of Specific Disclosures in Berghegger
A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (Lp) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (Lp) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (Lp) on the primary side, a load (RL) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract, Figs. 4-6).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	“Power transmitter according to claim 12, wherein the duty signal of said duty cycle control unit (VOC) is supplied to the frequency-to-voltage converter (f/v) and the frequency-to-voltage converter (f/v) will only change the voltage on the basis of the signal supplied by said pulse detector if said alternating signal of said first oscillator (VCDp) is supplied to said inductor on the primary side and said frequency-to-voltage converter (f/v) keeps the voltage otherwise constant.” (Berghegger at Certificate of Correction Claim 14). “The inductor L_s on the secondary side is magnetically coupled to the inductor L_P on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load R_L. The load R_L can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load R_L is variable in time.” (Berghegger at 6:8-15).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.” (Berghegger at 1:53-57). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load R_L. Typically, the load R_L comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor L_s on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).

Claim 2 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (Lp) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (Lp) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (Lp) on the primary side, a load (RL) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract).

Claim 3 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“A detection means 42 determines the power demand on the secondary side. The detection means 42 can e.g. measure the voltage decreasing on the load, the voltage across the batteries or also the load current. The output signal of the detection means is preferably an analog voltage which is supplied to the modulator 43. Said modulator modulates the voltage supplied by the detection means 42 to a carrier signal and controls the photodiode 44. The light of the photodiode 44 impinges on a photoelement which can e.g. be realized as the phototransistor. The output signal supplied by the photoelement is demodulated in the demodulator 41 and analyzed in the analyzing means 46 and thus converted into the control signal Uc. The demodulation operation takes place in the reverse order compared to the modulation operation.” (Berghegger at 6:16-29).

Claim 4 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.” (Berghegger at 1:53-57). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).

Claim 5 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4).

Claim 6 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4). “The inductor L_s on the secondary side is magnetically coupled to the inductor L_P on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load R_L. The load R_L can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load R_L is variable in time.” (Berghegger at 6:8-15).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (L_p) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (L_p) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (L_p) on the primary side, a load (R_L) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract, Figs. 4-6).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	“Power transmitter according to claim 12, wherein the duty signal of said duty cycle control unit (VOC) is supplied to the frequency-to-voltage converter (f/v) and the frequency-to-voltage converter (f/v) will only change the voltage on the basis of the signal supplied by said pulse detector if said alternating signal of said first oscillator (VCDp) is supplied to said inductor on the primary side and said frequency-to-voltage converter (f/v) keeps the voltage otherwise constant.” (Berghegger at Certificate of Correction Claim 14).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.” (Berghegger at 1:53-57). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).

Claim 8 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (Lp) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (Lp) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (Lp) on the primary side, a load (RL) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract).

Claim 9 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“A detection means 42 determines the power demand on the secondary side. The detection means 42 can e.g. measure the voltage decreasing on the load, the voltage across the batteries or also the load current. The output signal of the detection means is preferably an analog voltage which is supplied to the modulator 43. Said modulator modulates the voltage supplied by the detection means 42 to a carrier signal and controls the photodiode 44. The light of the photodiode 44 impinges on a photoelement which can e.g. be realized as the phototransistor. The output signal supplied by the photoelement is demodulated in the demodulator 41 and analyzed in the analyzing means 46 and thus converted into the control signal Uc. The demodulation operation takes place in the reverse order compared to the modulation operation.” (Berghegger at 6:16-29).

Claim 10 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging circuit module according to claim 9, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.” (Berghegger at 1:53-57). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).

Claim 11 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4).

Claim 12 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4). “The inductor L_s on the secondary side is magnetically coupled to the inductor L_P on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load R_L. The load R_L can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load R_L is variable in time.” (Berghegger at 6:8-15).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (L_p) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (L_p) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (L_p) on the primary side, a load (R_L) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract). “Power transmitter according to claim 12, wherein the duty signal of said duty cycle control unit (VOC) is supplied to the frequency-to-voltage converter (f/v) and the frequency-to-voltage converter (f/v) will only change the voltage on the basis of the signal supplied by said pulse detector if said alternating signal of said first oscillator (VCDp) is supplied to said inductor on the primary side and said frequency-to-voltage converter (f/v) keeps the

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
	voltage otherwise constant.” (Berghegger at Certificate of Correction Claim 14). “The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.” (Berghegger at 1:53-57). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17, Figs. 4-6). “The inductor Ls on the secondary side is magnetically coupled to the inductor LP on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load RL. The load RL can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load RL is variable in time.” (Berghegger at 6:8-15).
a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).
a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).
a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless	“A detection means 42 determines the power demand on the secondary side. The detection means 42 can e.g. measure the voltage decreasing on the load, the voltage across the batteries or also the load current. The output

Claim 13 (*568 Patent)	Relevance of Specific Disclosures in Berghegger
communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	signal of the detection means is preferably an analog voltage which is supplied to the modulator 43. Said modulator modulates the voltage supplied by the detection means 42 to a carrier signal and controls the photodiode 44. The light of the photodiode 44 impinges on a photoelement which can e.g. be realized as the phototransistor. The output signal supplied by the photoelement is demodulated in the demodulator 41 and analyzed in the analyzing means 46 and thus converted into the control signal Uc. The demodulation operation takes place in the reverse order compared to the modulation operation.” (Berghegger at 6:16-29).

Claim 14 (*568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (Lp) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (Lp) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (Lp) on the primary side, a load (RL) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract, Figs. 4-6).

Claim 15 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.	“A detection means 42 determines the power demand on the secondary side. The detection means 42 can e.g. measure the voltage decreasing on the load, the voltage across the batteries or also the load current. The output signal of the detection means is preferably an analog voltage which is supplied to the modulator 43. Said modulator modulates the voltage supplied by the detection means 42 to a carrier signal and controls the photodiode 44. The light of the photodiode 44 impinges on a photoelement which can e.g. be realized as the phototransistor. The output signal supplied by the photoelement is demodulated in the demodulator 41 and analyzed in the analyzing means 46 and thus converted into the control signal Uc. The demodulation operation takes place in the reverse order compared to the modulation operation.” (Berghegger at 6:16-29).

Claim 16 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less chargeable battery according to claim 15, further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes: a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.	“A detection means 42 determines the power demand on the secondary side. The detection means 42 can e.g. measure the voltage decreasing on the load, the voltage across the batteries or also the load current. The output signal of the detection means is preferably an analog voltage which is supplied to the modulator 43. Said modulator modulates the voltage supplied by the detection means 42 to a carrier signal and controls the photodiode 44. The light of the photodiode 44 impinges on a photoelement which can e.g. be realized as the phototransistor. The output signal supplied by the photoelement is demodulated in the demodulator 41 and analyzed in the analyzing means 46 and thus converted into the control signal Uc. The demodulation operation takes place in the reverse order compared to the modulation operation.” (Berghegger at 6:16-29).

Claim 17 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4).

Claim 18 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging device according to claim 16, wherein the constant voltage supplier includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current; a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17). “Power transmitter according to claim 12, wherein the duty signal of said duty cycle control unit (VOC) is supplied to the frequency-to-voltage converter (f/v) and the frequency-to-voltage converter (f/v) will only change the voltage on the basis of the signal supplied by said pulse detector if said alternating signal of said first oscillator (VCDp) is supplied to said inductor on the primary side and said frequency-to-voltage converter (f/v) keeps the voltage otherwise constant.” (Berghegger at Certificate of Correction Claim 14). “The inductor Ls on the secondary side is magnetically coupled to the inductor LP on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load RL. The load RL can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load RL is variable in time.” (Berghegger at 6:8-15).

Claim 19 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).

Claim 20 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
A battery charging set including a contact-less chargeable battery and a contact-less charging device,	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (Lp) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (Lp) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (Lp) on the primary side, a load (RL) which is variable in time, and a detection means (42) for determining a power demand of the load on the secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract, Figs. 4-6).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
wherein the battery includes: a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode;	“Power transmitter according to claim 12, wherein the duty signal of said duty cycle control unit (VOC) is supplied to the frequency-to-voltage converter (f/v) and the frequency-to-voltage converter (f/v) will only change the voltage on the basis of the signal supplied by said pulse detector if said alternating signal of said first oscillator (VCDp) is supplied to said inductor on the primary side and said frequency-to-voltage converter (f/v) keeps the voltage otherwise constant.” (Berghegger at Certificate of Correction Claim 14). “The inductor L_s on the secondary side is magnetically coupled to the inductor L_P on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load R_L. The load R_L can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load R_L is variable in time.” (Berghegger at 6:8-15).
and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,	“The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.” (Berghegger at 1:53-57). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load R_L. Typically, the load R_L comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor L_s on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).
wherein the charging device includes: a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).
a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).

Claim 22 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:	“The present invention relates to an inductive contactless power transmitter having a primary side including a first inductor (Lp) on the primary side and an oscillator for producing an alternating signal which is supplied to the inductor (Lp) on the primary side, and having a secondary side which includes an inductor on the secondary side that can be coupled to the inductor (Lp) on the primary side, a load (RL) which is variable in time, and a detection means (42) for determining a power demand of the load on the

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
	secondary side, the first oscillator being a voltage-controlled oscillator having a frequency that is adjustable in response to the power demand determined by the detection means (42).” (Berghegger at Abstract; <i>see also</i> Figs. 4-6).
(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).
(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18).
(c) rectifying the output high frequency AC current to be converted into a DC current;	“On the secondary side, the AC voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged.” (Berghegger at 1:15-18). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load RL. Typically, the load RL comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor Ls on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).
(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;	“Power transmitter according to claim 12, wherein the duty signal of said duty cycle control unit (VOC) is supplied to the frequency-to-voltage converter (f/v) and the frequency-to-voltage converter (f/v) will only change the voltage on the basis of the signal supplied by said pulse detector if said alternating signal of said first oscillator (VCDp) is supplied to said inductor on the primary side and said frequency-to-voltage converter (f/v) keeps the

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
	voltage otherwise constant.” (Berghegger at Certificate of Correction Claim 14). “The inductor L_s on the secondary side is magnetically coupled to the inductor L_P on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load R_L. The load R_L can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load R_L is variable in time.” (Berghegger at 6:8-15).
(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and	“The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.” (Berghegger at 1:53-57). “The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load R_L. Typically, the load R_L comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor L_s on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.” (Berghegger at 2:7-17).
(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.	“A detection means 42 determines the power demand on the secondary side. The detection means 42 can e.g. measure the voltage decreasing on the load, the voltage across the batteries or also the load current. The output signal of the detection means is preferably an analog voltage which is supplied to the modulator 43. Said modulator modulates the voltage supplied by the detection means 42 to a carrier signal and controls the photodiode 44. The light of the photodiode 44 impinges on a photoelement which can e.g. be realized as the phototransistor. The output signal supplied by the photoelement is demodulated in the demodulator 41 and analyzed in the analyzing means 46 and thus converted into the control signal U_c. The demodulation operation

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
	takes place in the reverse order compared to the modulation operation.” (Berghegger at 6:16-29).

Claim 24 ('568 Patent)	Relevance of Specific Disclosures in Berghegger
The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.” (Berghegger at Claim 4).

ii. The Claims Patentably Distinguish over Berghegger and Berghegger does Not Raise a Substantial New Question of Patentability

For at least the reasons set forth below, Claims 1-24 are patentably distinct over Berghegger. Any basis set forth below that applies to one of independent Claims 1, 7, 13, 21, or 23 also provides a patentable distinction for dependent claims 2-6, 8-12, 14-20, 22, or 24 respectively based on the dependent nature of those claims, as well as for the independent elements set forth therein.

1. Berghegger does not disclose the claimed overvoltage monitoring unit of Claims 1, 3, 4, 6, 7, 9, 10, or 21, or the claimed monitoring of voltages at both ends of the constant voltage/constant current supplier of Claims 13, 20-23

Berghegger fails to disclose the claimed “overvoltage monitoring unit” that monitors a voltage at both ends of a constant voltage/constant current supplier and fails to disclose any monitoring of voltages at both ends of a constant voltage/constant current supplier by any mechanism. Detection means 42 of Berghegger detects load voltage (e.g., battery voltage) (see figs. 4, 5) but fails to detect two voltages, a voltage and both of the ends of the constant

voltage/constant current supplier. There is no teaching in Berghegger of a monitoring of more than one voltage, let alone a voltage at both ends of a constant voltage constant current supply as is required by the claims of the '568 Patent. Berghegger fails to disclose the claimed overvoltage monitoring unit that monitors "voltages at both ends of the constant voltage/constant current supplier." (*See e.g.*, '568 Patent at Claim 1)(emphasis added).

Moreover, Berghegger is entirely silent with regard to any component that monitors for an overvoltage situation in the receiving end of wireless power transmission. As noted in the '568 Patent:

if standards of the constant current/constant voltage supplier 90 are defined using a small high frequency AC current, in case the battery 50 is positioned at a position where a large high frequency AC current is induced, overvoltage exceeding the standards may be applied to both ends of the constant current/constant voltage supplier 90 while charging the battery 10, thereby possibly causing a damage on parts.

('568 Patent at 2:42-48). Berghegger fails to identify, let alone solve, the problems that the overvoltage monitoring unit of the '568 Patent solves over the state of the art. (*See* '568 Patent at 7:43-55, 9:25-34).

2. Berghegger does not disclose a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode (Claims 1, 3, 6, 7, 9, 12, 13, 20-24)

Berghegger fails to disclose the claimed constant voltage/constant current supplier. While it does, in corrected claim 14, disclose keeping a voltage constant without a constant current, this is on the transmitter side of the wireless power system and thus cannot be the claimed constant voltage / constant current supplier which receives "the DC voltage from the rectifier" and has to be located on the receiving end of a wireless power system. Thus, Berghegger fails to disclose the

claimed constant voltage/constant current supplier that receives a DC current from the rectifier and supplies a charging power to the battery cell in a constant voltage/constant current mode.

3. Berghegger does not disclose a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna (Claims 3, 9, 15)

Berghegger only describes the use of a photoelement and photodiode to transmit light signals. (Berghegger at 6:22-37). There is no antenna relied upon to provide any monitoring result as everything is communicated using optical sensors and transmitters that rely upon light.

4. Berghegger does not disclose a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends and the subsequent outputting of the end time point to the microprocessor (Claims 4 and 10)

Berghegger is silent with regard to any pause detecting unit, and is further silent with regard to the detection, and output, of an end time point. Berghegger fails to identify the detection of a time point when the induction of high frequency current ends and fails to output any time to any microprocessor.

G. Item of Information No. 6 - Lanni

i. Explanation of the relevance and manner of applying Lanni to each claim of the '568 Patent

The following portions of Lanni may be considered important to the examiner as these portions may relate to the respective claim limitations presented below. In accordance with MPEP § 2811.01, “[t]hese statements will NOT be construed as an admission of unpatentability . . . [and] only indicate that the patent owner is requesting that the Office consider whether certain issues may be raised by each item of information with respect to specific claims.”

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Lanni
A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:	“Embodiments described herein relate to rechargeable batteries. In particular, the embodiments relate to systems for controlling power supplies to charge rechargeable batteries.” (Lanni at 1:30-32, Figs. 1, 4, and 11A-C).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“FIG. 7 shows a block diagram an embodiment of the power supply 2. All components on the left side of a magnetic core 20 are part of a primary portion 100 and all portions on the right hand side are part of a secondary portion 200 of the power supply 2. The primary portion 100 includes a primary rectifier and input circuit 110, a first primary and drive circuit 120, a second primary and drive circuit 130, a primary feedback circuit 140 and a controller 150. The secondary portion 200 includes a secondary output circuit 210 and a secondary feedback circuit 240.” (Lanni at 8:25-35). “secondary winding 840 is coupled to a rectifier circuit 842 and then to an output filter 844 including a filter choke L2 to provide the regulated DC output at connectors, 846, 848.” (Lanni at 12:55-57, Figs. 7 and 11C).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	“The integrated circuit 15 may determine such a duty factor using an algorithm known to those of ordinary skill in the art and described in the data sheet of the bq2954 integrated circuit sold by Benchmarq. According to an embodiment, charging takes place according to a 2-phase fast charge algorithm. In the first phase, the integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across

Claim 1 ('568 Patent)	Relevance of Specific Disclosures in Lanni
	the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programed threshold. Charging is then complete.” (Lanni at 6:40-52, Fig. 4).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Fig. 12).

Claim 2 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).

Claim 3 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Fig. 12).

Claim 4 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59, Fig. 12).

Claim 5 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.” (Lanni at 4:57-59).

Claim 6 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.	"The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage." (Lanni at 14:20-32).

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Lanni
A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:	"Embodiments described herein relate to rechargeable batteries. In particular, the embodiments relate to systems for controlling power supplies to charge rechargeable batteries." (Lanni at 1:30-32, Figs. 1, 4, and 11A-C).
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;	"The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26)." (Lanni at 8:52-65, Fig. 7).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	"FIG. 7 shows a block diagram an embodiment of the power supply 2. All components on the left side of a magnetic core 20 are part of a primary portion 100 and all portions on the right hand side are part of a secondary portion 200 of the power supply 2. The primary portion 100 includes a primary rectifier and input circuit 110, a first primary and drive circuit 120, a second primary and drive circuit 130, a primary feedback circuit 140 and a

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Lanni
	controller 150. The secondary portion 200 includes a secondary output circuit 210 and a secondary feedback circuit 240.” (Lanni at 8:25-35). “secondary winding 840 is coupled to a rectifier circuit 842 and then to an output filter 84 including a filter choke L2 to provide the regulated DC output at connectors, 846, 848.” (Lanni at 12:55-57, Fig. 7).
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and	“The integrated circuit 15 may determine such a duty factor using an algorithm known to those of ordinary skill in the art and described in the data sheet of the bq2954 integrated circuit sold by Benchmarq. According to an embodiment, charging takes place according to a 2-phase fast charge algorithm. In the first phase, the integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programed threshold. Charging is then complete.” (Lanni at 6:40-52, Fig. 4).
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the

Claim 7 ('568 Patent)	Relevance of Specific Disclosures in Lanni
	output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Fig. 12).

Claim 8 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).

Claim 9 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Fig. 12).

Claim 10 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging circuit module according to claim 9, wherein a magnetic field generated by the contact-less charging device is generated intermittently, wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59, Fig. 12).

Claim 11 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a charging power adjustment request signal.	“Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.” (Lanni at 4:57-59).

Claim 12 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging circuit module according to claim 1, wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.	“The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Lanni
A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:	“Embodiments described herein relate to rechargeable batteries. In particular, the embodiments relate to systems for controlling power supplies to charge rechargeable batteries.” (Lanni at 1:30-32). “The integrated circuit 15 may determine such a duty factor using an algorithm known to those of ordinary skill in the art and described in the data sheet of the bq2954 integrated circuit sold by Benchmarq. According to an embodiment, charging takes place according to a 2-phase fast charge algorithm. In the first phase, the integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programed threshold. Charging is then complete.” (Lanni at 6:40-52). “With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Lanni
	a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Figs. 1, 4, 11A-C, and 12).
a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).
a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).

Claim 13 ('568 Patent)	Relevance of Specific Disclosures in Lanni
a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.” (Lanni at 4:57-59).

Claim 14 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).

Claim 15 (*568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.	“Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.” (Lanni at 4:57-59).

Claim 16 (*568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less chargeable battery according to claim 15, further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes: a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Fig. 12).

Claim 17 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.	“Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.” (Lanni at 4:57-59).

Claim 18 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging device according to claim 16, wherein the constant voltage supplier includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current; a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.	“FIG. 7 shows a block diagram an embodiment of the power supply 2. All components on the left side of a magnetic core 20 are part of a primary portion 100 and all portions on the right hand side are part of a secondary portion 200 of the power supply 2. The primary portion 100 includes a primary rectifier and input circuit 110, a first primary and drive circuit 120, a second primary and drive circuit 130, a primary feedback circuit 140 and a controller 150. The secondary portion 200 includes a secondary output circuit 210 and a secondary feedback circuit 240.” (Lanni at 8:25-35). “secondary winding 840 is coupled to a rectifier circuit 842 and then to an output filter 84 including a filter choke L2 to provide the regulated DC output at connectors, 846, 848.” (Lanni at 12:55-57). “The integrated circuit 15 may determine such a duty factor using an algorithm known to those of ordinary skill in the art and described in the data sheet of the bq2954 integrated circuit sold by Benchmarq. According to an embodiment, charging takes place according to a 2-phase fast charge algorithm. In the first phase, the integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programed threshold. Charging is then complete.” (Lanni at 6:40-52, Figs. 4 and 7).

Claim 19 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).

Claim 20 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Lanni
A battery charging set including a contact-less chargeable battery and a contact-less charging device,	“Embodiments described herein relate to rechargeable batteries. In particular, the embodiments relate to systems for controlling power supplies to charge rechargeable batteries.” (Lanni at 1:30-32, Figs. 1, 4, and 11A-C).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Lanni
wherein the battery includes: a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;	“FIG. 7 shows a block diagram an embodiment of the power supply 2. All components on the left side of a magnetic core 20 are part of a primary portion 100 and all portions on the right hand side are part of a secondary portion 200 of the power supply 2. The primary portion 100 includes a primary rectifier and input circuit 110, a first primary and drive circuit 120, a second primary and drive circuit 130, a primary feedback circuit 140 and a controller 150. The secondary portion 200 includes a secondary output circuit 210 and a secondary feedback circuit 240.” (Lanni at 8:25-35). “secondary winding 840 is coupled to a rectifier circuit 842 and then to an output filter 84 including a filter choke L2 to provide the regulated DC output at connectors, 846, 848.” (Lanni at 12:55-57, Fig. 7).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Lanni
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode;	“The integrated circuit 15 may determine such a duty factor using an algorithm known to those of ordinary skill in the art and described in the data sheet of the bq2954 integrated circuit sold by Benchmarq. According to an embodiment, charging takes place according to a 2-phase fast charge algorithm. In the first phase, the integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programed threshold. Charging is then complete.” (Lanni at 6:40-52, Fig. 4).
and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Fig. 12).

Claim 21 ('568 Patent)	Relevance of Specific Disclosures in Lanni
wherein the charging device includes: a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).
a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).
a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.	“Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.” (Lanni at 4:57-59).

Claim 22 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lanni
A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:	“Embodiments described herein relate to rechargeable batteries. In particular, the embodiments relate to systems for controlling power supplies to charge rechargeable batteries.” (Lanni at 1:30-32, Figs. 1, 4, and 11A-C).
(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lanni
(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;	“The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).” (Lanni at 8:52-65, Fig. 7).
(c) rectifying the output high frequency AC current to be converted into a DC current;	“FIG. 7 shows a block diagram an embodiment of the power supply 2. All components on the left side of a magnetic core 20 are part of a primary portion 100 and all portions on the right hand side are part of a secondary portion 200 of the power supply 2. The primary portion 100 includes a primary rectifier and input circuit 110, a first primary and drive circuit 120, a second primary and drive circuit 130, a primary feedback circuit 140 and a controller 150. The secondary portion 200 includes a secondary output circuit 210 and a secondary feedback circuit 240.” (Lanni at 8:25-35). “secondary winding 840 is coupled to a rectifier circuit 842 and then to an output filter 84 including a filter choke L2 to provide the regulated DC output at connectors, 846, 848.” (Lanni at 12:55-57, Fig. 7).

Claim 23 ('568 Patent)	Relevance of Specific Disclosures in Lanni
(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;	“The integrated circuit 15 may determine such a duty factor using an algorithm known to those of ordinary skill in the art and described in the data sheet of the bq2954 integrated circuit sold by Benchmarq. According to an embodiment, charging takes place according to a 2-phase fast charge algorithm. In the first phase, the integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programed threshold. Charging is then complete.” (Lanni at 6:40-52, Fig. 4).
(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and	“With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.” (Lanni at 13:23-37, <i>see also</i> 13:44-14:19, 4:35-59). “The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32, Fig. 12).
(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.	“Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.” (Lanni at 4:57-59).

Claim 24 ('568 Patent)	Relevance of Specific Disclosures in Lanni
The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.	“The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.” (Lanni at 14:20-32).

i. The Claims Patentably Distinguish over Lanni and Lanni does Not Raise a Substantial New Question of Patentability

For at least the reasons set forth below, Claims 1-24 are patentably distinct over Lanni. Any basis set forth below that applies to one of independent Claims 1, 7, 13, 21, or 23 also provides a patentable distinction for dependent claims 2-6, 8-12, 14-20, 22, or 24 respectively based on the dependent nature of those claims, as well as for the independent elements set forth therein.

1. Lanni is not contactless (Claims 1-24)

Lanni is a hard-wired connector with an inductor located within the circuitry of the charging system. (Lanni at 8:1-13). Indeed, there must be a “mating” via a charging cable between the power supply and the battery. (Lanni at 8:1-13). There is no teaching in Lanni of any contactless charging, and for this reason, its teachings are entirely inapposite to the claims of the ‘568 Patent.

2. Lanni does not disclose the claimed overvoltage monitoring unit of Claims 1, 3, 4, 6, 7, 9, 10, or 21, or the claimed monitoring of voltages at both ends of the constant voltage/constant current supplier of Claims 13, 20-23

Lanni also fails to disclose the claimed “overvoltage monitoring unit” that monitors a voltage at both ends of a constant voltage/constant current supplier and fails to disclose any monitoring of voltages at both ends of a constant voltage/constant current supplier by any mechanism. Instead, “over voltage protection circuit 830” only monitors a single voltage, “the output voltage DC Output” and compares that monitored voltage to “a predetermined threshold.” (Lanni at 14:20-32). This fails to disclose the claimed overvoltage monitoring unit that monitors “voltages at both ends of the constant voltage/constant current supplier.” (*See e.g.*, ‘568 Patent at Claim 1)(emphasis added).

Moreover, Lanni is entirely silent with regard to any component that monitors for an overvoltage situation in the receiving end of wireless power transmission. As noted in the ‘568 Patent:

if standards of the constant current/constant voltage supplier 90 are defined using a small high frequency AC current, in case the battery 50 is positioned at a position where a large high frequency AC current is induced, overvoltage exceeding the standards may be applied to both ends of the constant current/constant voltage supplier 90 while charging the battery 10, thereby possibly causing a damage on parts.

(‘568 Patent at 2:42-48). Lanni fails to identify, let alone solve, the problems that the overvoltage monitoring unit of the ‘568 Patent solves over the state of the art. (*See* ‘568 Patent at 7:43-55, 9:25-34).

3. Lanni does not disclose a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna (Claims 3, 9, 15)

Lanni fails to identify any wireless transmission of a monitoring result (or any other wireless communication for that matter) and further fails to identify any antenna or other similarly suitable transmission mechanism.

4. Lanni does not disclose a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends and the subsequent outputting of the end time point to the microprocessor (Claims 4 and 10)

Lanni is silent with regard to any pause detecting unit, and is further silent with regard to the detection, and output, of an end time point. Indeed, Lanni describes no time detection and fails to tie any of its disclosure to any measured or otherwise detectable time.

H. Item of Information No. 7 - Declaration of Jaeyong Jung

Item of Information No. 7 is an explanatory declaration of Mr. Jaeyong Jung, the General Manager of the IP Center of Patent Owner, LS Cable & System Ltd, along with, by exhibit, a copy of the supplemental declaration under 37 C.F.R. § 1.63 of the six named inventors (Dong-Young Park, Sung-Wook Moon, Sung-Wook Choi, Gwang-Hee Gwon, Sub Han, and Jung-Bum Kim) filed August 4, 2020. Applicant believes that Item of Information No. 7 is relevant to each of Claims 1-24 of the '568 Patent. The Item is submitted to confirm the inventorship status of the subject matter claimed in the '568 Patent. As explained in the Declaration of Jaeyong Jung, certain signatures affixed to the original oath were inadvertently erroneous, and Exhibit 1 to Item No. 7 corrects any error that may have existed.

Because Item No. 7 is submitted to provide clarity and merely confirm that the inventorship understanding that existed during the prosecution of the '568 Patent was proper, Applicant submits that Item No. 7 does not raise a substantial new question of patentability.

VII. 37 C.F.R. § 1.610(b)(6)

A copy of the '568 Patent is submitted herewith as Exhibit G.

VIII. 37 C.F.R. § 1.610(b)(7)

A copy of Chung-Sik, Korean Patent No. 950005819B1, is submitted herewith as Exhibit A. A certified translation of Exhibit A is submitted herewith as Exhibit I. A copy of Kim, PCT Publication No. WO 02/15320 A1, is submitted herewith as Exhibit B. A copy of Lyon, U.S. Patent Publication No. 2004/0145342, is submitted herewith as Exhibit C. A copy of Flowerdew, U.S. Patent No. 7,211,986, is submitted herewith as Exhibit D. A copy of Berghegger, U.S. Patent No. 6,912,137, is submitted herewith as Exhibit E. A copy of Lanni, U.S. Patent No. 5,949,213, is submitted herewith as Exhibit F. A copy of the Declaration of Jaeyong Jung is submitted herewith as Exhibit H.

IX. 37 C.F.R. § 1.610(b)(8)

None of Exhibits A, B, C, D, E, F, H, or I are over 50 pages in length. Nor is the combination of Exhibit A and I. No summary is necessary.

X. 37 C.F.R. § 1.610(b)(9)

A statement under 37 CFR§ 3.73(c) is submitted herewith as Exhibit J, identifying LS Cable and System Ltd., as the owner of the entire right, title, and interest in the '568 Patent.

XI. Conclusion

For the foregoing reasons, the Items identified herein do not raise a substantial new question of patentability. For such reasons, Requestor respectfully requests the Director issue a certificate indicating that the information presented in the Request for Supplemental Examination does not raise a substantial new question of patentability of Claims 1-24 of the '568 Patent, and refund the 37 C.F.R. § 1.20(k)(2) fee for Reexamination Ordered as a Result of Supplemental Examination.

Respectfully submitted,

K&L GATES LLP

BY /Matthew S. Dicke/

Matthew S. Dicke

Reg. No. 58,819

Customer No. 24573

Telephone No. (312) 578-5415

70 W Madison St., Suite 3300

Chicago, IL 60602

matthew.dicke@klgates.com

Dated: March 12, 2021

EXHIBIT C



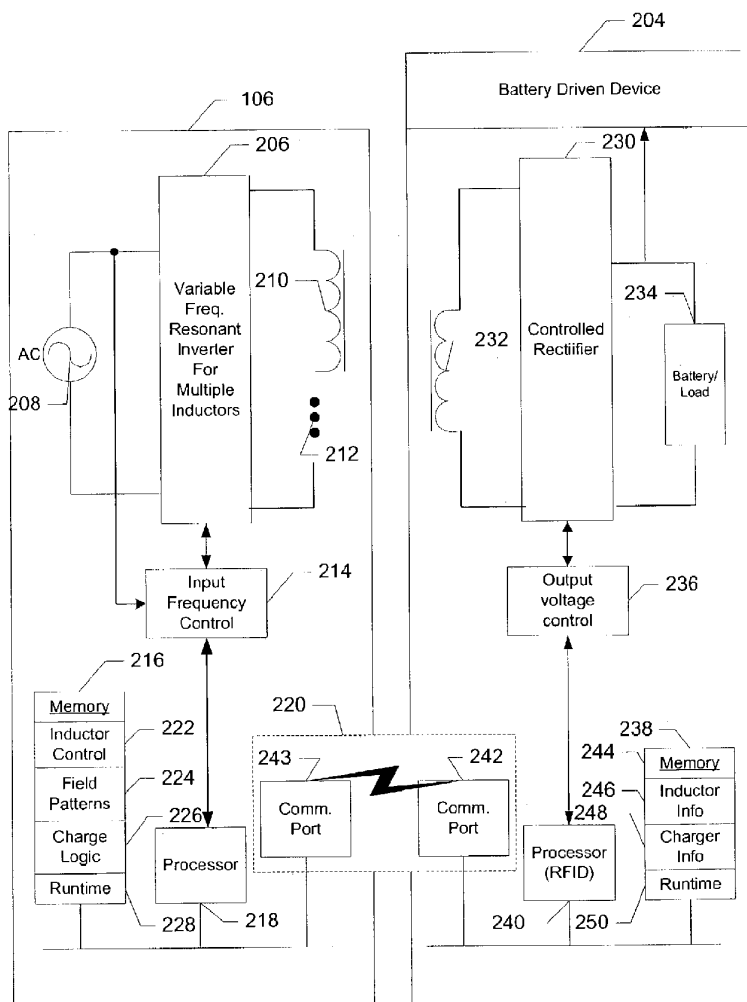
US 20040145342A1

(19) **United States**(12) **Patent Application Publication****Lyon**(10) **Pub. No.: US 2004/0145342 A1**(43) **Pub. Date:****Jul. 29, 2004**(54) **ADAPTIVE CHARGER SYSTEM AND METHOD**(76) **Inventor: Geoff M. Lyon, Menlo Park, CA (US)**

Correspondence Address:

**HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, CO 80527-2400 (US)**(21) **Appl. No.: 10/353,540**(22) **Filed: Jan. 28, 2003****Publication Classification**(51) **Int. Cl.⁷ H02J 7/00**(52) **U.S. Cl. 320/108**(57) **ABSTRACT**

A method and apparatus is used for adaptive inductive charging of a device. Charging includes detecting the presence of a device capable of receiving an inductive charge, determining a set of parameters for inductively charging the device, and transmitting an inductive charge corresponding to the set of parameters for charging the device. Another aspect of charging includes combining at least two inductive fields transmitted at different angles to each other, delivering the combined inductive field at an orientation to the device, measuring the load on the device to determine the effectiveness of the orientation of the inductive field when charging the device, and charging the device at the orientation of the inductive field when the measured load on the device exceeds a threshold load level.



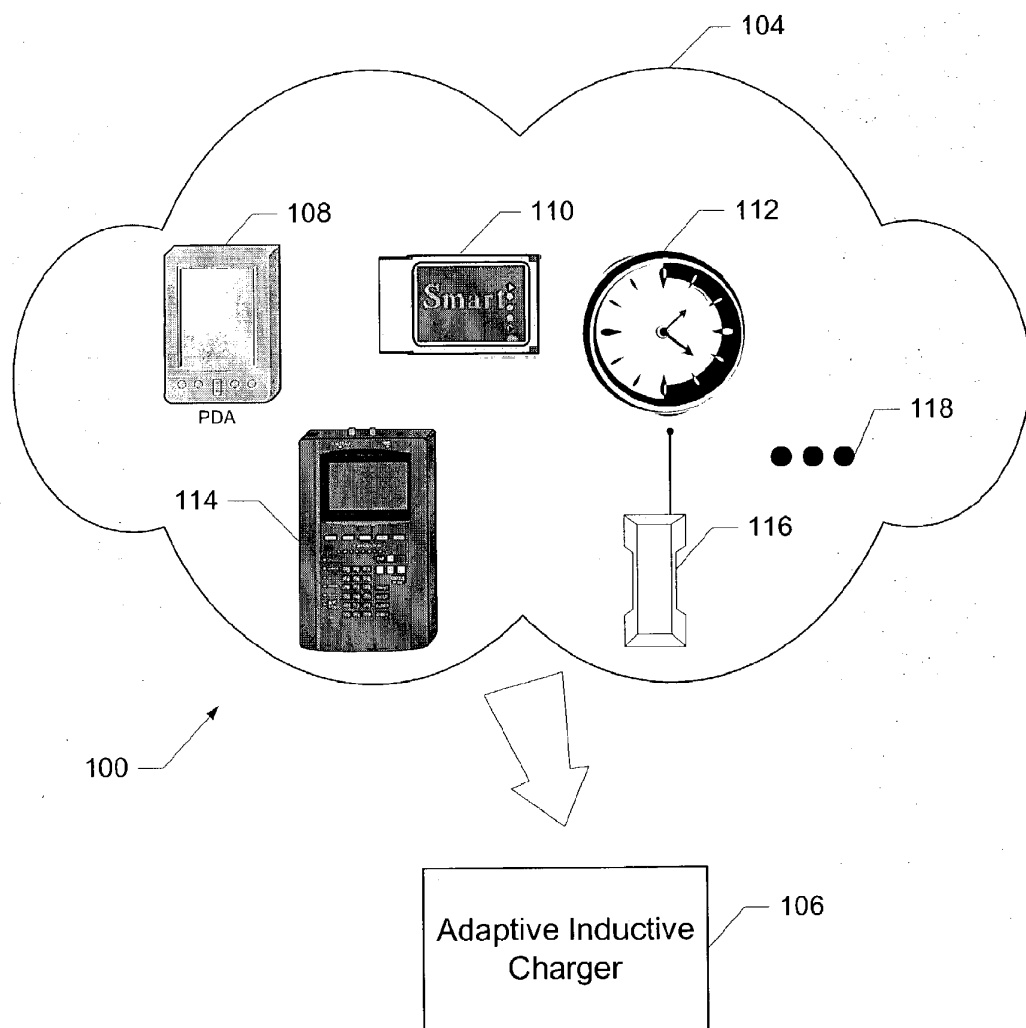


FIG. 1

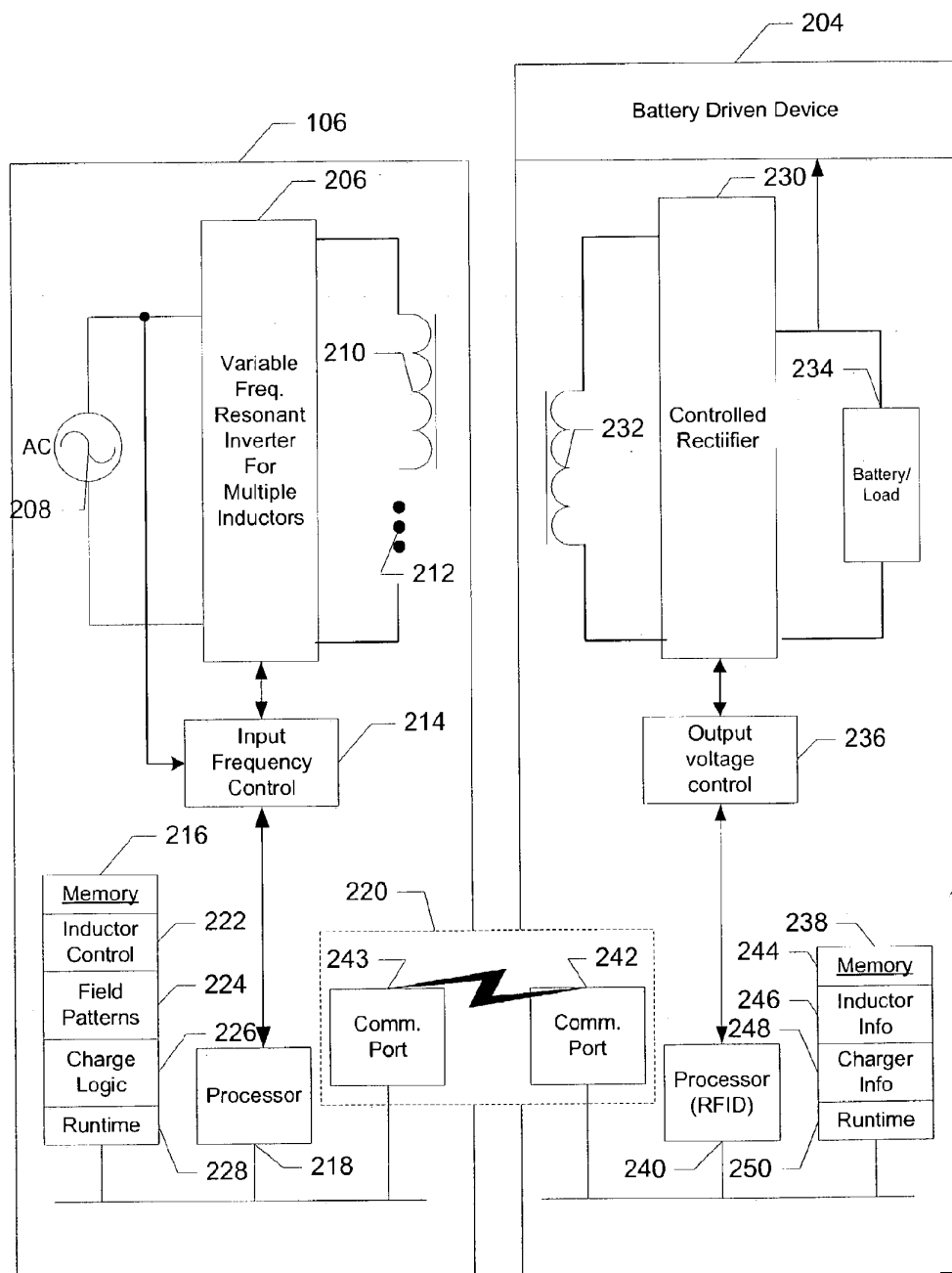


FIG. 2

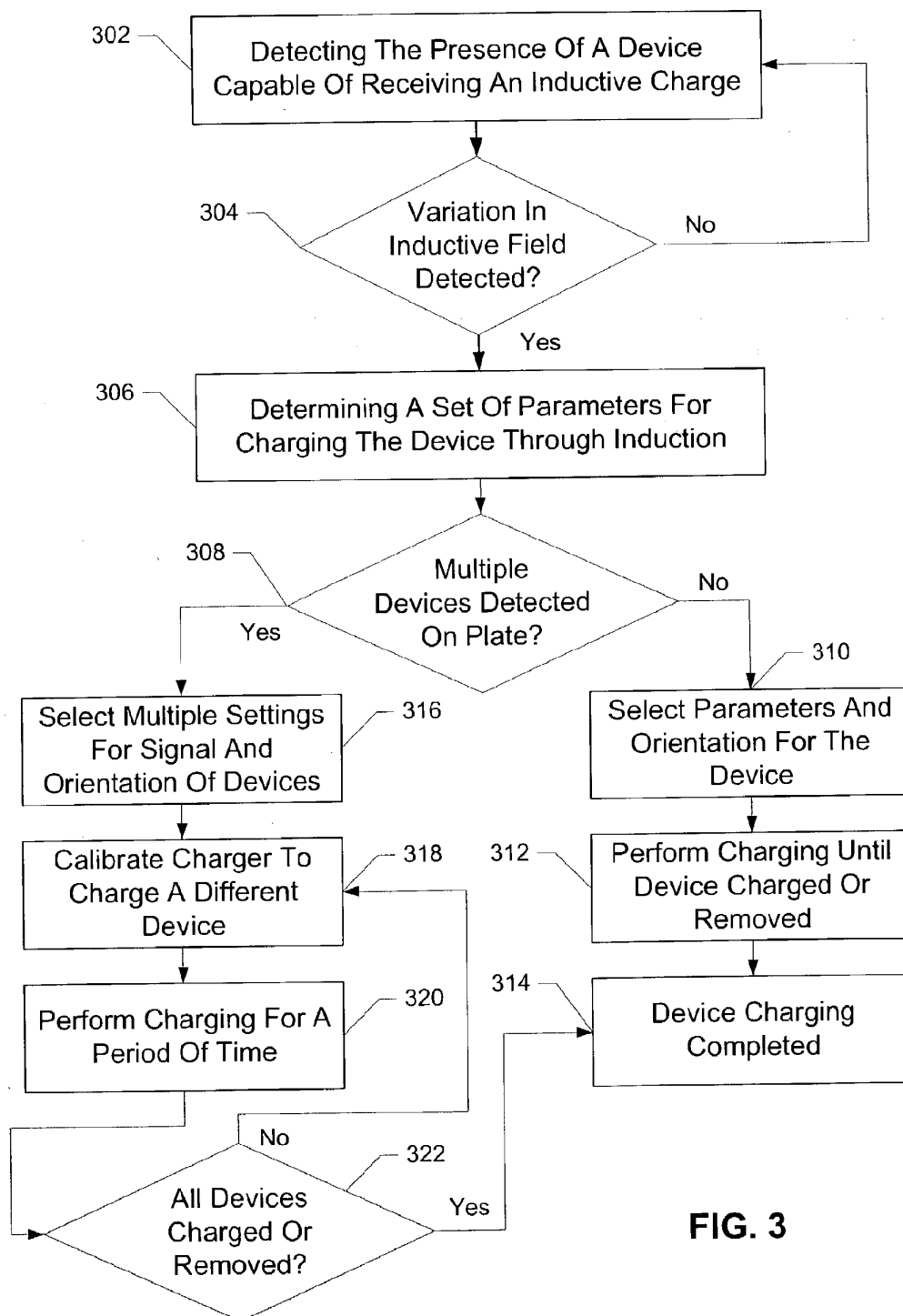
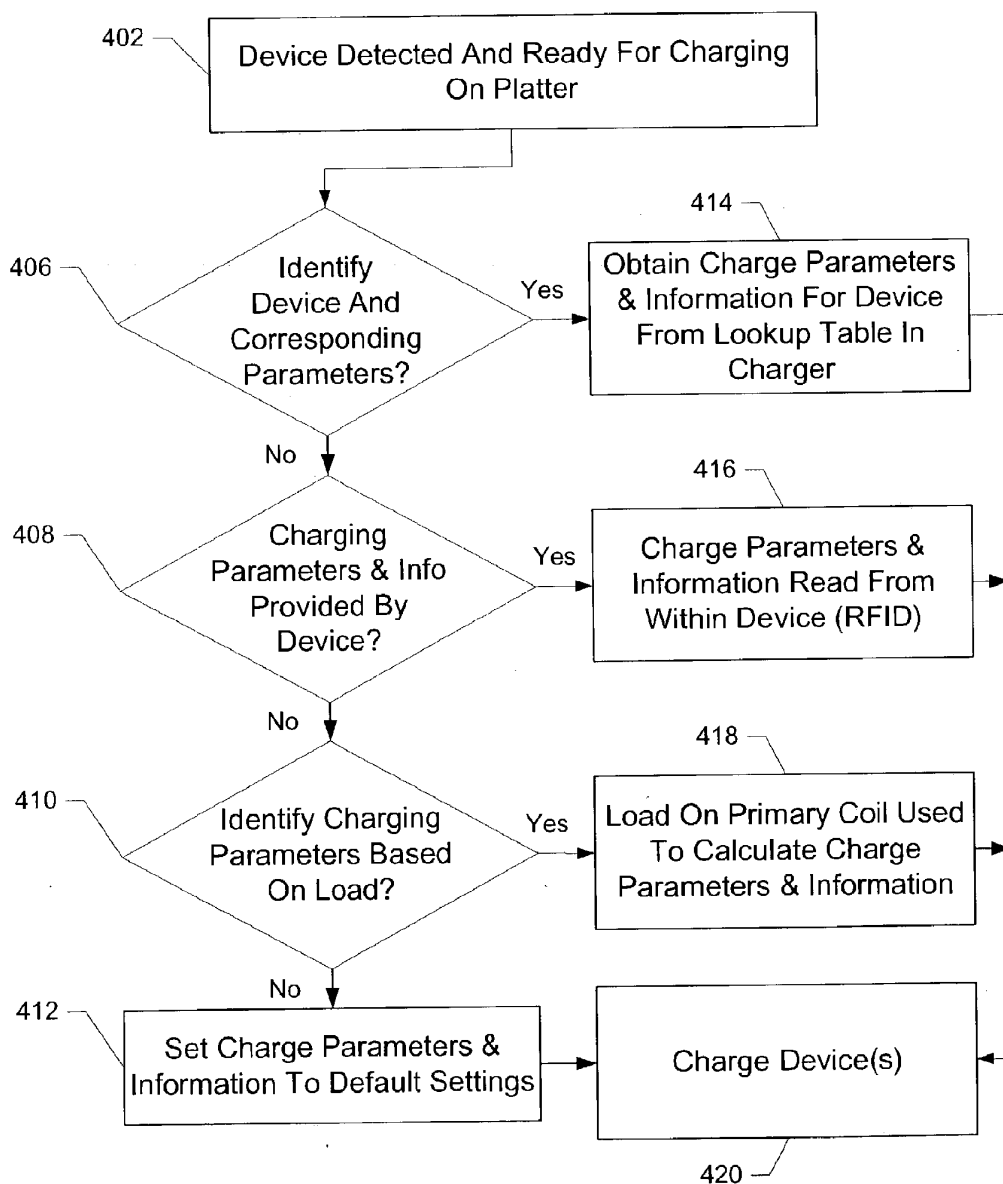
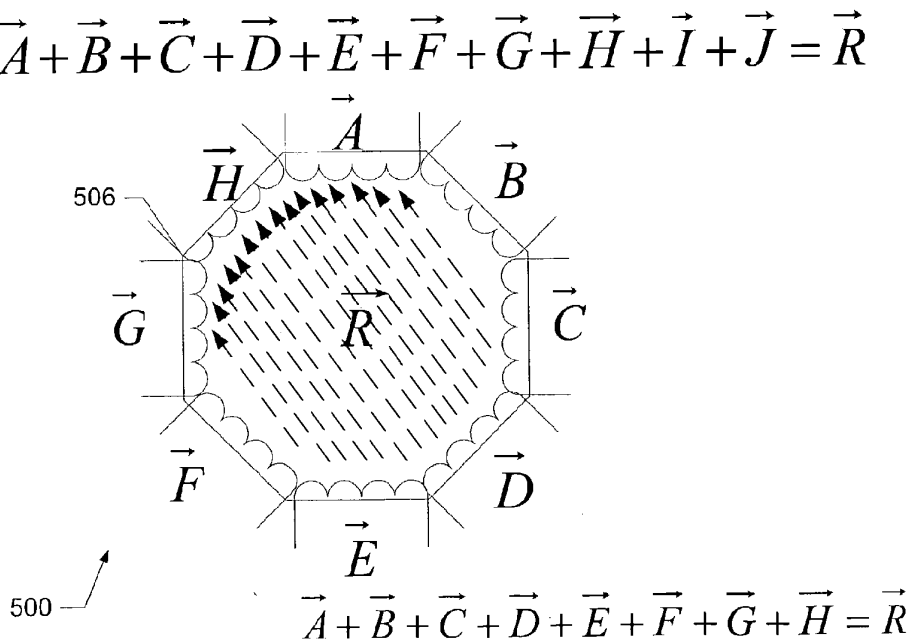
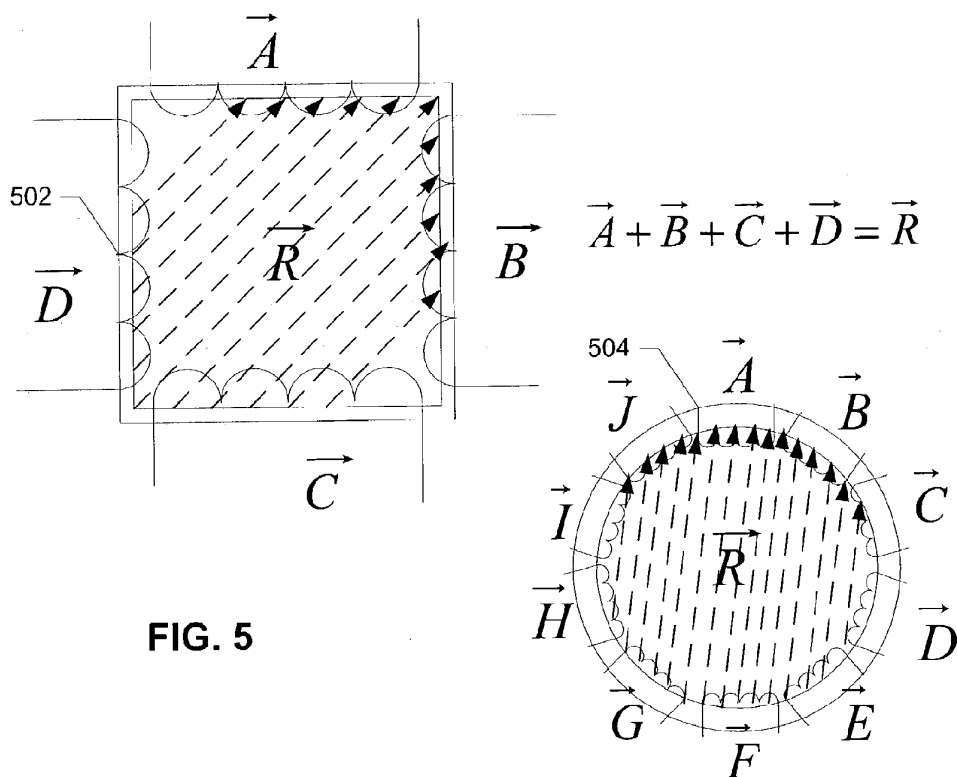


FIG. 3



306 ↗

FIG. 4



ADAPTIVE CHARGER SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

[0001] The present invention relates to transmitting a charge to a device using inductive coils. Portable devices need a source of energy for operation. Generally, a rechargeable battery located within the device serves to power the device for a reasonable usage period and is then recharged during the evening or when the device is no longer in use. Users may effectively use these devices (i.e., phones, personal digital assistants, portable computers, diagnostic equipment) without running out of energy if the battery capacity is large enough and regularly charged in the battery charger.

[0002] Generally, a separate charger is provided with each portable device designed to meet the charging requirements of the battery and shape of the particular device. Unfortunately, the number of charging devices becomes unwieldy as the number of portable devices used by consumers and professionals continues to grow. Each charger requires a separate physical power source or wall-socket to supply the charge; wall-sockets are sometimes in limited supply in hotels, offices, or small apartments. Moreover, professionals traveling from home, to work, and to remote locations must also carry with them the appropriate chargers for each of the portable devices they use and rely upon.

[0003] Even if carrying these chargers were feasible, conventional chargers are sometimes problematic to use. Fixed wire cables or charging cradles used to charge some devices may lack sufficient mechanical and/or electrical contact with the device as the contacts on the cables or charging cradles wear out over time. This decrease in reliability of the charging device can negatively affect the user experience and also be costly for the manufacturer to repair and maintain through a warranty period.

[0004] Using fixed inductive couplings between the charger and the portable device addresses some but not all of the above failings. These chargers do not have mechanical or electrical contact with the device so are less prone to mechanical or electrical failures. They are also useful in situations where a conventional electrical contact would be dangerous in the particular environment (i.e., pacemakers embedded within the body or toothbrushes exposed to water during brushing). Nonetheless, even conventional inductive chargers require good positional matching between the shape of the charger and the device being charged. Consequently, portable devices charged inductively still require having multiple corresponding chargers uniquely designed for the particular battery being charged and device shape. These electrical, mechanical, and positional requirements for the inductive chargers may also restrict or compromise the design styling of the devices being charged.

SUMMARY OF THE INVENTION

[0005] One aspect of the invention features adaptive inductive charging of a device. Charging includes detecting the presence of a device capable of receiving an inductive charge, determining a set of parameters for charging the device through induction, and transmitting an inductive charge corresponding to the set of parameters for charging the device.

[0006] Another aspect of the invention describes charging a device through mutual inductance. In this aspect of the invention, charging includes combining at least two inductive fields transmitted at different angles to each other, delivering the combined inductive field at an orientation to the device, measuring the load on the device to determine the effectiveness of the orientation of the inductive field when charging the device, and charging the device at the orientation of the inductive field when the measured load on the device exceeds a threshold load level.

[0007] The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features and advantages of the invention will become apparent from the description, the drawings, and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a block diagram depicting a set of devices and an adaptive inductive charger designed in accordance with one implementation of the present invention;

[0009] FIG. 2 provides a block diagram of an inductive charger and a device compatible with one implementation of the present invention;

[0010] FIG. 3 is a flowchart diagram used by the inductive charger when charging one or more devices in accordance with one implementation of the present invention;

[0011] FIG. 4 is a flowchart diagram of the operations for selecting parameters and settings for the inductive charger in accordance with one implementation of the present invention; and

[0012] FIG. 5 is a block diagram illustrating various geometric configurations for arranging inductive coils in accordance with implementations of the present invention.

DETAILED DESCRIPTION

[0013] Aspects of the present invention are advantageous in at least one or more of the following ways. An inductive charger device designed in accordance with the present invention can be used to charge multiple different portable devices. The charger device identifies the presence of one or more devices on the charger plate and determines the appropriate parameters for charging each of the devices including the orientation, strength, phase, amplitude, and frequency of the magnetic inductive field. Multiple devices placed on the charger device each automatically receive an inductive field oriented to efficiently charge each device. The proper orientation of the magnetic field improves mutual magnetic coupling between the charger and device necessary for charging.

[0014] Implementations of the present invention are also advantageous as compatible devices can communicate charge levels and other information over a bi-directional channel to improve charging efficiency and automate operation of the charger. The bi-directional channel can be carried over the charging channel to communicate this information without the added costs of adding a separate dedicated data channel. In general, the inductive charger designed in accordance with the present invention not only accommodates multiple different devices automatically but also obviates the need to have an individual charger for each inductively charged device.

[0015] FIG. 1 is a block diagram depicting a set of devices 104 and an adaptive inductive charger 106, hereinafter inductive charger 106, designed in accordance with one implementation of the present invention. Inductive charger 106 is capable of charging one or more devices 104 simultaneously or in series depending on the options selected for charging. Devices 104 can include, for example, a personal digital assistant (PDA) 108, smart device/card 110, timer devices 112, instruments 114, telephony devices 116, and other devices 118 that receives an inductive charge.

[0016] In operation, a user places one or more of devices 104 on the surface of inductive charger 106. The surface of inductive charger 106 accommodates different shapes, sizes, and orientations of devices 104 and does not have a specific surface for receiving one device in particular. Instead, inductive charger 106 operates multiple inductive coils in accordance with implementations of the present invention to present each of the one or more devices with the proper magnetic field to charge each device. In one implementation, inductive charger 106 can charge devices 104 in a round-robin scheme that incrementally charges each of the devices on the platter using a magnetic field best suited for each device. Inductive charger 106 sequences through devices 104 providing each device a charge for a fixed or variable time period before switching to and charging another device.

[0017] Alternatively, inductive charger 106 charges each device in devices 104 sequentially in their entirety in a first-in-first-out (FIFO) sequence. In this latter approach, the first device placed on inductive charger 106 may be charged more quickly as it would not stop receiving the inductive charge until it was fully charged. Other devices subsequently placed on inductive charger 106 would be delayed by the time it takes to completely charge the preceding devices.

[0018] FIG. 2 provides a block diagram of inductive charger 106 and a device 204 compatible with one implementation of the present invention. Inductive charger 106 includes a variable frequency resonant inverter for multiple inductors 206, a alternating current source 208, a set of inductors 210 through 212, an input frequency control 214, a memory 216, a processor 218, and a communication port 243 used to communicate over a separate data communication channel 220.

[0019] Variable frequency resonant inverter for multiple inductors, hereinafter inverter 206, senses input voltage changes over power source 208 and controls switching frequency of the inverter to provide a relatively constant power over inductors 210 through 212. Input frequency control 214 maintains an input frequency to inverter 206 as needed by the particular device and above the resonant frequency of the circuit.

[0020] Processor 218 executes instructions and programs stored in memory 216 in accordance with one implementation of the present invention. Inductor control 222 specifies the amount of power delivered to each of the two or more inductor coils used to generate magnetic fields for charging. Vector operations are calculated and used by inductor control 222 to combine the various fields provided by individual inductors 210 through 212 when charging the various devices on inductive charger 106. Different vector operations are performed depending on the geometry of the inductor coils and their relative positions to each other. Also, inductor control 222 takes into account the particular param-

eters used to inductively charge a device including orientation, strength, phase, amplitude, and frequency of the magnetic inductive field.

[0021] Both predetermined field patterns as well as learned patterns for the magnetic inductive field are managed and stored by field patterns component 224. In one implementation, field patterns components 224 stores predetermined profiles and parameters for charging devices designed in accordance with implementations of the present invention. Alternatively, profiles for charging certain devices are not predetermined but discovered in accordance with the present invention prior to charging and also stored in field patterns component 224. In another implementation, profiles stored in the device are transmitted to charger device 106 prior to being charged and stored in field patterns component 224.

[0022] Charge logic component 226 includes logic for charging multiple devices and determines the profiles to be used for charging each of the devices placed on inductive charger 106. In addition, charge logic component 226 processes information to determine when a particular device is fully charged or having difficulties being charged and notifies an operator or user of the same. For example, charge logic component 226 may receive signal from a device being charged indicating the charging status of the device (e.g., fully charged, no charge, or battery failure). Signals can be modulated over the charging channel or over the separate data communication channel 220. Runtime component 228 is a real-time or preemptive operating system used to manage allocation of resources and overall operation of inductive charger 106.

[0023] Device 204 includes a controlled rectifier 230, a secondary coil 232, a battery/load 234, an output voltage control 236, a memory 238, a processor (RFID) 240, and communication port 242 for communicating over data communication channel 220. Alternatively, communication port 242 can communicate charge information and status over secondary inductor 232 and through inductors 210 to 212 rather than a separate data communication channel 220.

[0024] Controlled rectifier 230 receives charge over secondary coil 232 and regulates the output in view of any load changes that may occur. To a lesser extent, controlled rectifier 230 may also regulate input voltage changes from the one or more inductors 210 through 212. Mutual inductance between secondary coil 232 and inductors 210 through 212 charges battery/load 234 when the magnetic field is provided with the proper orientation, strength, phase, amplitude, frequency and other charging parameters in accordance with implementations of the present invention.

[0025] Output voltage control 236 utilizes pulse-width modulation (PWM), voltage sensing, scaling, level shifting circuitry and other measures to ensure that processor (RFID) 240 and other components receive proper output levels. Processor (RFID) 240 optionally also has radio-frequency identification (RFID) capabilities for "tagging" device 204 and providing charging information, parameters, and charge status. In this context, processor (RFID) 240 receives commands and power from inductive charger 106 and responds by sending data, clock, and power information back over the same charging channel. Without RFID capabilities, inductive charger 106 can also determine charging information, parameters, and status of device 204 by monitoring load levels and interpreting the results.

[0026] Memory 238 in device 204 includes inductor information 246, charger information 248, and also includes a runtime 248 that manages resources on device 204. Inductor information 246 can include various technical and operational specifications of secondary inductor 232 receiving magnetic charge and generating a current. Charger information 248 includes charge history for device 204 as well as charge status, and other information useful when inductive charger 106 is charging.

[0027] FIG. 3 is a flowchart diagram used by the inductive charger when charging one or more devices in accordance with one implementation of the present invention. Periodically, the inductive charger checks to see if one or more devices have been placed on the plate for charging (302). In one implementation, the inductive charger measures a change in the load being drawn through the inductors to determine if a device has been set on the inductive charger (304). Alternatively, an RFID tag on the device notifies the inductive charger that it needs inductive charging. The inductive charger may also receive notification that a device needs charging over a separate wireless data channel being polled by the inductive charger.

[0028] Once the one or more devices have been detected, implementations of the present invention sweep through various parameters for an array of inductors based on predetermined settings and device information. The inductive charger selects a set of parameters to best charge the device through induction (306). The parameters for charging include orientation, strength, phase, amplitude, and frequency of the magnetic inductive field. Load measurements are used to associate the combination of parameters with each detected device. For example, larger load measurement indicates greater mutual magnetic coupling between the inductive charger and a device and a more optimal combination of charging parameters.

[0029] The inductive charger operates differently depending on whether a single device or multiple devices needs charging (308). If a single device is detected, the inductive charger selects the optimal parameters and orientation for charging the device (310). These parameters activate one or more inductive coils creating a magnetic field oriented to charge the detected device. In addition, the parameters may also specify strength, phase, amplitude, and frequency of the magnetic inductive field. Using these settings, the inductive charger continues charging the device until the device is charged or removed from the proximity of the charger (312). In one implementation, the inductive charger monitors the load to determine when the device has been completely charged and then terminates the charging process (314). Alternatively, the device can transmit a signal over a separate data communication channel or over the charging channel indicating that the device has received a sufficient charge. Yet another implementation can signal a completed charge using an RFID tag embedded in the device communicating to an RFID reader within the inductive charger.

[0030] When multiple devices are detected, the inductive charger selects multiple sets of parameters and orientations for charging the multiple respective devices (316). Depending on the device receiving the charge, the inductive charger calibrates the one or more inductors and charging circuitry to deliver a magnetic field to the first device (318). These parameters activate one or more inductive coils creating a

magnetic field oriented to charge the first device. Additionally, the parameters may also specify strength, phase, amplitude, and frequency of the magnetic inductive field.

[0031] The inductive charger charges the device for a fixed or variable period of time to facilitate charging multiple devices in a round-robin manner. At the end of the elapsed time interval, the inductive charger determines if the other devices still need charging or have been removed from the inductive charger (322). If one or more devices needed charging, the inductive charger then calibrates the inductive coils and circuitry for the subsequent device to be charged and continues the charging process in accordance with implementations of the present invention (318). Over time, multiple devices are charged (314) by time-sharing the inductive charger in this round-robin sharing arrangement. Alternatively, the inductive charger can charge multiple devices in a FIFO queue according to their placement on the inductive charger. Accordingly, the first device is charged in the entirety before subsequent devices receive any charge. This alternate scheme would likely charge the first device more quickly while subsequently queued devices would have to wait until each of the preceding devices in the queue completes their charging cycle.

[0032] FIG. 4 is a flowchart diagram of the operations for selecting parameters and settings for the inductive charger in accordance with one implementation of the present invention. To accommodate different devices, the inductive charger can be calibrated or setup for charging in several different ways. As previously described, the inductive charger detects presence of one or more devices before determining the charging parameters for each device (402). This can be done by detecting a sudden change in the load on the inductive charger or by monitoring the charging or data communication channel for a device requesting a charge. In one implementation of the present invention, the device is designed in accordance with the present invention and is registered in advance with the inductive charger. Accordingly, if the inductive charger recognizes and uniquely identifies the parameters associated with the device (406), charging parameters and information for the device can be obtained from a look-up table (LUT) embedded within the inductive charger. An RFID tag may transmit the device model and type enabling the inductive charger to then determine the optimal charging parameters for the device in the locally stored LUT.

[0033] Alternatively, the inductive charger can receive charging parameters and information transmitted from the device (408). The RFID tag on a device designed in accordance with the present invention can include the appropriate charging parameters and information for the device. This RFID tag transmits the information to the RFID reader associated with the inductive charger (416) which, in turn, uses the information to calibrate the inductive coils and circuitry for charging the particular device.

[0034] Yet another alternative, the inductive charger monitors the load to determine the appropriate parameters and charging information for the particular device (410). As previously described, the inductive charger cycles through various combinations for calibrating the inductive coils and circuitry to determine the most optimal setting (418). For example, a larger load would indicate greater mutual inductive coupling and more efficient charging between the induc-

tive charger and the device. In each of the above examples of calibrating by a look-up table (414), RFID tag information (416), or measuring load characteristics (418), implementations of the present invention also try different orientations of the magnetic field before charging the device (420).

[0035] FIG. 5 is a block diagram illustrating various geometric configurations for arranging inductive coils in accordance with implementations of the present invention. Square configuration 502, round configuration 504, and polygon 506 are example geometric arrangements of the inductive coils for use with the present invention. Each geometric configuration of inductive coils produces different magnetic fields during charging calculated using vector operations. In square configuration 502, up to four vectors can be used when determining the magnetic field produced by each of the four inductive coils as illustrated. For example, a resultant vector $\vec{R}$ is produced by the vector combination of $\vec{A} + \vec{B} + \vec{C} + \vec{D}$ vectors. Alternatively, square configuration 502 could also use only two vectors and resultant vector $\vec{R}$ would be calculated from a pair of orthogonal vectors $\vec{A} + \vec{B}$ or $\vec{C} + \vec{D}$.

[0036] Round configuration 504 includes many more coils and can be used for a wider range of charging conditions including improved control over the orientation of the magnetic field. In this example, resultant vector $\vec{R}$ is produced by the vector combination of $\vec{A} + \vec{B} + \vec{C} + \vec{D} + \vec{E} + \vec{F} + \vec{G} + \vec{H} + \vec{I} + \vec{J}$ vectors. Alternatively, fewer or greater inductive coils and corresponding vectors could be used in round configuration 504. Similarly, polygon 506 represents a geometric configuration having more sides than square 502 and fewer than perhaps round configuration 504. In this implementation, the resultant vector $\vec{R}$ is produced by the combination of $\vec{A} + \vec{B} + \vec{C} + \vec{D} + \vec{E} + \vec{F} + \vec{G} + \vec{H}$ vectors. Yet other implementations of the present invention could combine inductive coils in geometric shapes that are asymmetric, non-regular, contain fewer than four sides, and circumscribe or surround other predetermined shapes in two-dimensional or three-dimensional space. For example, inductive coils can be positioned relative to each other in obtuse angles, acute angles, or combinations thereof in two-dimensional or three-dimensional configurations.

[0037] While examples and implementations have been described, they should not serve to limit any aspect of the present invention. Accordingly, implementations of the invention can be implemented in digital electronic circuitry, or in computer hardware, firmware, software, or in combinations of them. Apparatus of the invention can be implemented in a computer program product tangibly embodied in a machine-readable storage device for execution by a programmable processor; and method steps of the invention can be performed by a programmable processor executing a program of instructions to perform functions of the invention by operating on input data and generating output. The invention can be implemented advantageously in one or more computer programs that are executable on a program-

mable system including at least one programmable processor coupled to receive data and instructions from, and to transmit data and instructions to, a data storage system, at least one input device, and at least one output device. Each computer program can be implemented in a high-level procedural or object-oriented programming language, or in assembly or machine language if desired; and in any case, the language can be a compiled or interpreted language. Suitable processors include, by way of example, both general and special purpose microprocessors. Generally, a processor will receive instructions and data from a read-only memory and/or a random access memory. Generally, a computer will include one or more mass storage devices for storing data files; such devices include magnetic disks, such as internal hard disks and removable disks; magneto-optical disks; and optical disks. Storage devices suitable for tangibly embodying computer program instructions and data include all forms of non-volatile memory, including by way of example semiconductor memory devices, such as EPROM, EEPROM, and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM disks. Any of the foregoing can be supplemented by, or incorporated in, ASICs.

[0038] Furthermore, while specific embodiments have been described herein for purposes of illustration, various modifications may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not limited to the above-described implementations, but instead is defined by the appended claims in light of their full scope of equivalents.

What is claimed is:

1. A method of adaptively charging a device, comprising:
 - detecting the presence of a device capable of receiving an inductive charge;
 - determining a set of parameters for charging the device through induction; and
 - transmitting an inductive charge corresponding to the set of parameters for charging the device.
2. The method of claim 1 further comprising,
 - terminating the transmission of the inductive charge once the device is adequately charged.
3. The method of claim 2 wherein the terminating further comprises:
 - receiving a signal from the device identifying a level of charge; and
 - determining the device has completed charging based on the level of charge identified.
4. The method of claim 3 wherein the signal causes a change in the load over the same channel used to charge the device.
5. The method of claim 3 wherein the signal is transmitted over a signal channel separate from the channel used to charge the device.
6. The method of claim 3 wherein the signal is transmitted from the device using radio frequency identification device (RFID) compatible technology.

7. The method of claim 1 wherein the set of parameters determined to charge the device provides a substantial load on a primary coil used for charging.

8. The method of claim 7 wherein the providing the substantial load further comprises,

varying combinations of the parameters for charging the device during a time interval; and

measuring the load on the primary coil for each of the various combinations of the parameters; and

selecting the parameters causing the greatest increase in the load on the primary coil.

9. The method of claim 8 wherein at least one of the parameters includes an orientation of the inductive field.

10. The method of claim 9 wherein the orientation of the inductive field is determined by combining inductive fields of one or more elements positioned at different angles to each other.

11. The method of claim 8 wherein at least one of the parameters are selected from a set of parameters including a phase, an amplitude, and a frequency of an inductive field.

12. The method of claim 1 wherein the set of parameters determined to charge the device are set according to a lookup table (LUT) with predetermined parameters for the particular device.

13. The method of claim 1 wherein the device provides the set of parameters to be used for charging the device.

14. The method of claim 1 wherein the device provides the set of parameters over the charging channel using a radio-frequency identification device (RF-ID).

15. The method of claim 1 wherein the device provides the set of parameters using a communication link separate from the channel used to charge the device.

16. A method of charging a device through mutual inductance:

combining at least two inductive fields transmitted at different angles to each other;

delivering the combined inductive field at an orientation to the device;

measuring the load on the device to determine the effectiveness of the orientation of the inductive field when charging the device; and

charging the device at the orientation of the inductive field when the measured load on the device exceeds a threshold load level.

17. The method of claim 16 further comprising:

charging additional devices at different orientations of the inductive field when the measured load on each of the multiple devices exceeds a threshold load level.

18. The method of claim 16 wherein the at least two inductive fields are combined using vector operations.

19. The method of claim 16 wherein the angles between the inductive fields are obtuse.

20. The method of claim 16 wherein the angles between the inductive fields are acute.

21. The method of claim 16 wherein the threshold load level selected is at least large enough to charge the device over a time interval.

22. A computer program product, tangibly stored on a computer-readable medium, for adaptively charging a device, comprising instructions operable to cause a programmable processor to:

detect the presence of a device capable of receiving an inductive charge;

determine a set of parameters for efficiently charging the device through induction; and

transmit an inductive charge corresponding to the set of parameters for charging the device.

23. A computer program product, tangibly stored on a computer-readable medium, for charging a device through mutual inductance, comprising instructions operable to cause a programmable processor to:

combine at least two inductive fields transmitted at different angles to each other;

deliver the combined inductive field at an orientation to the device;

measure the load on the device to determine the effectiveness of the orientation of the inductive field when charging the device; and

charge the device at the orientation of the inductive field when the measured load on the device exceeds a threshold load level.

24. An apparatus that inductively charges one or more devices, comprising:

a sensor that receives signals indicating a charge level of the one or more devices;

a set of two or more induction coils positioned at different angles and capable of charging the one or more devices through mutual inductance; and

a power source designed to deliver energy to the set of two or more induction coils and create an inductive field at different orientations to the one or more devices.

25. The apparatus of claim 24 further comprising:

a memory having parameters for controlling the inductive field of the two or more induction coils; and

a processor that selectively combines the parameters and delivers the parameters to the power source for control of the two or more induction coils.

26. The apparatus of claim 24 further comprising:

a communication port that exchanges charging information and status with the one or more devices over a communication channel separate from the charging channel.

27. The apparatus of claim 24 further comprising: a load sensor that monitors the load when charging the one or more devices and determines when at least one of the one or more devices has completed charging based on an information modulated through a variation in the load characteristic by the one or more devices.

28. An apparatus for adaptively charging a device, comprising:

means for detecting the presence of a device capable of receiving an inductive charge;

means for determining a set of parameters for efficiently charging the device through induction; and

means for transmitting an inductive charge corresponding to the set of parameters for charging the device.

29. An apparatus for charging a device through mutual inductance, comprising:

means for combining at least two inductive fields transmitted at different angles to each other;

means for delivering the combined inductive field at an orientation to the device;

means for measuring the load on the device to determine the effectiveness of the orientation of the inductive field when charging the device; and

means for charging the device at the orientation of the inductive field when the measured load on the device exceeds a threshold load level.

* * * * *

EXHIBIT D



US007211986B1

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Flowerdew et al.

(10) **Patent No.:** **US 7,211,986 B1**
(45) **Date of Patent:** **May 1, 2007**

(54) **INDUCTIVE CHARGING SYSTEM**

(75) Inventors: **Peter M. Flowerdew**, Brentry (GB);
David Huddart, Westbury-on-Trym
(GB)

(73) Assignee: **Plantronics, Inc.**, Santa Cruz, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 106 days.

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(51) **Int. Cl.**
H02J 7/00 (2006.01)

(52) **U.S. Cl.** **320/108**

(58) **Field of Classification Search** 320/107,
320/108, 110, 112, 113, 114, 115, 116
See application file for complete search history.

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Primary Examiner—Karl Easthom

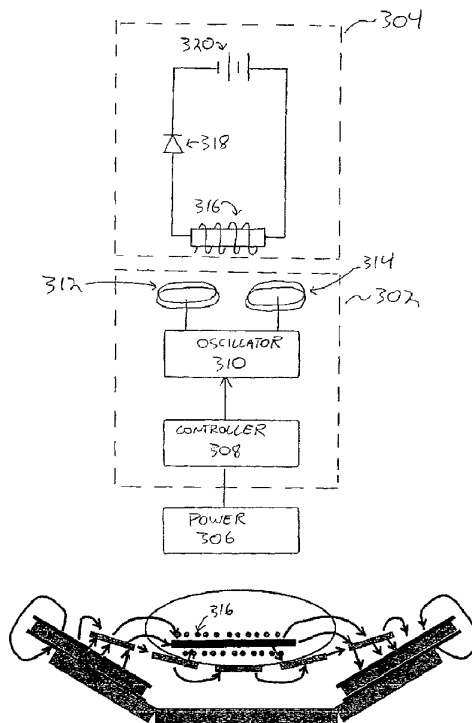
Assistant Examiner—Samuel Berhanu

(74) *Attorney, Agent, or Firm*—Thomas Chuang

(57) **ABSTRACT**

An apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume of space above the charging surface.

52 Claims, 12 Drawing Sheets



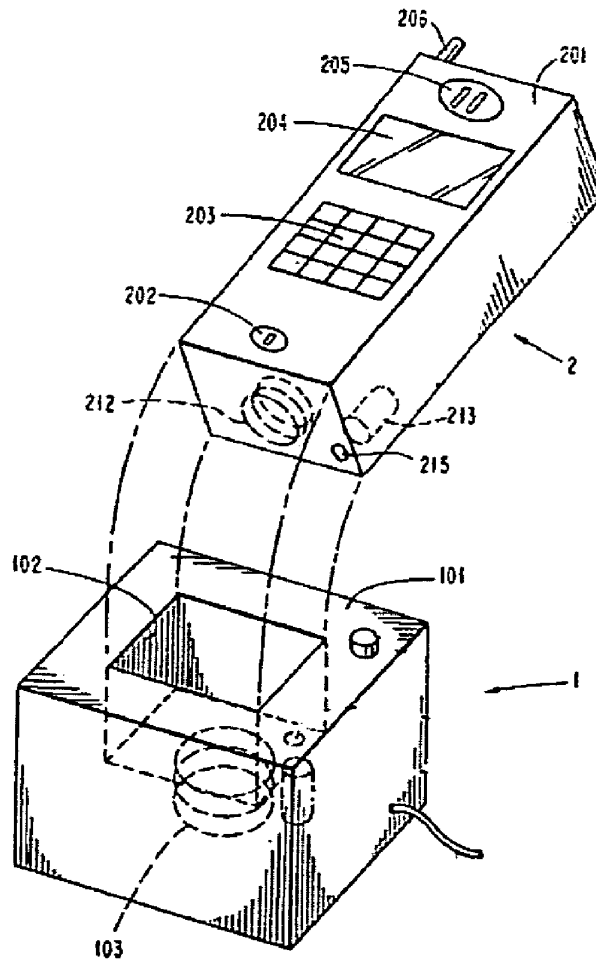


FIGURE 1

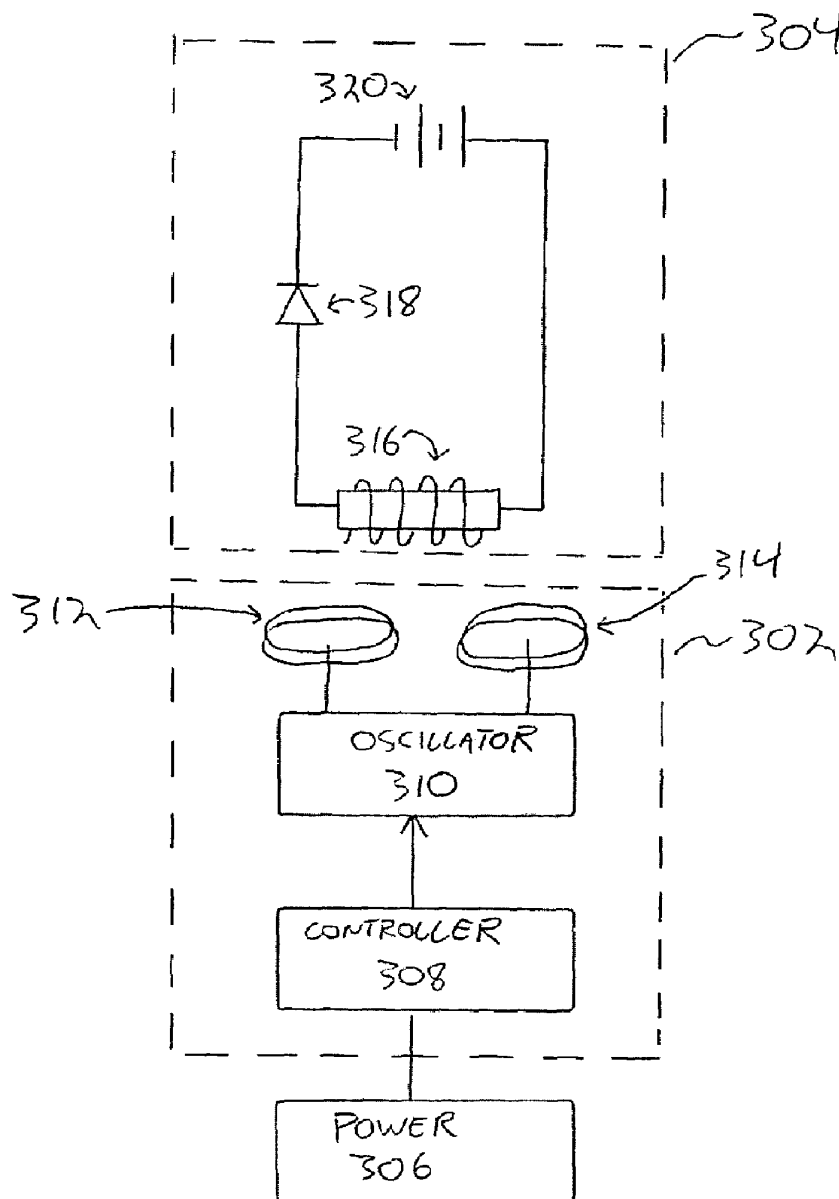


FIGURE 2

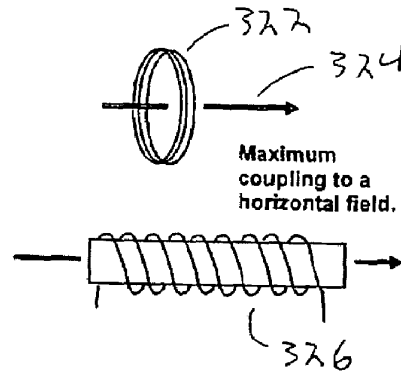


FIGURE 3A

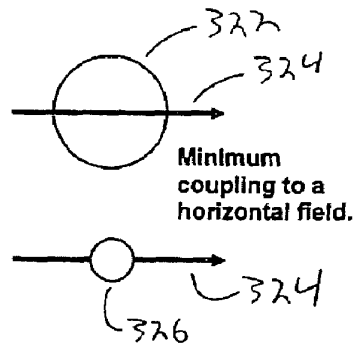


FIGURE 3B

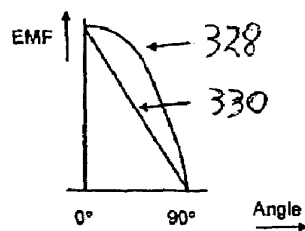


FIGURE 3C

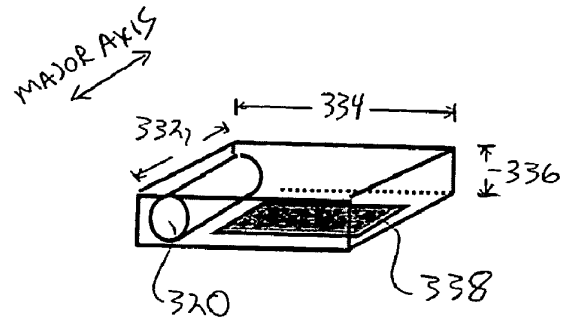


FIGURE 4A

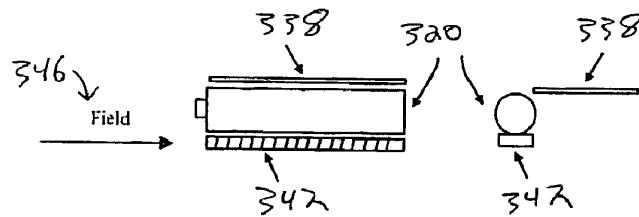


FIGURE 4B

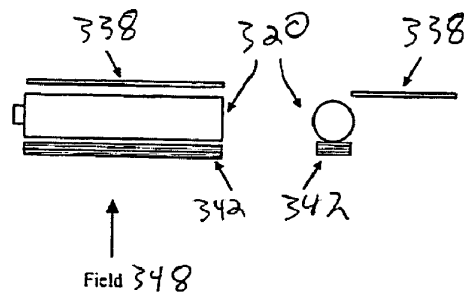


FIGURE 4C

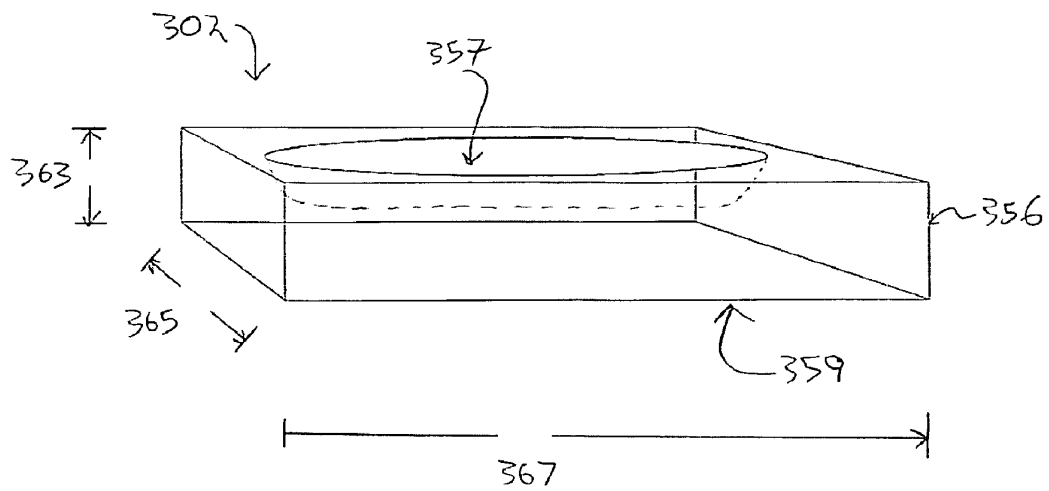


FIGURE 5

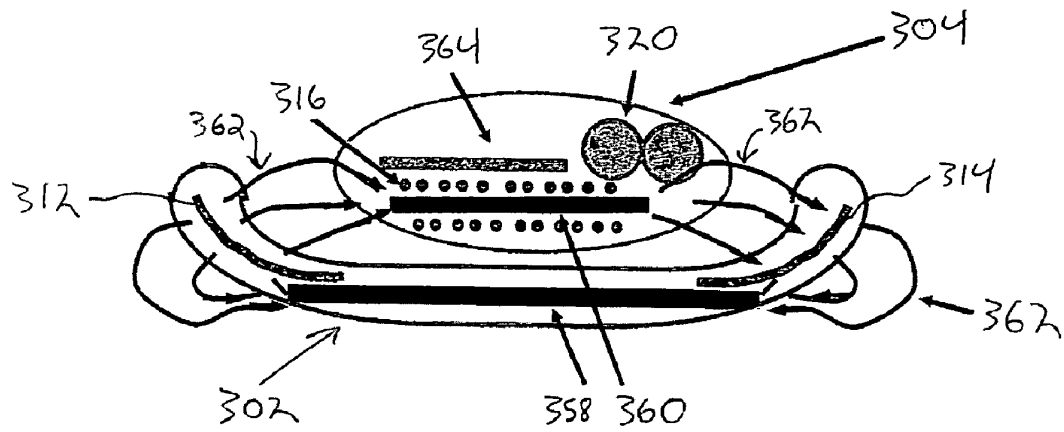


FIGURE 6

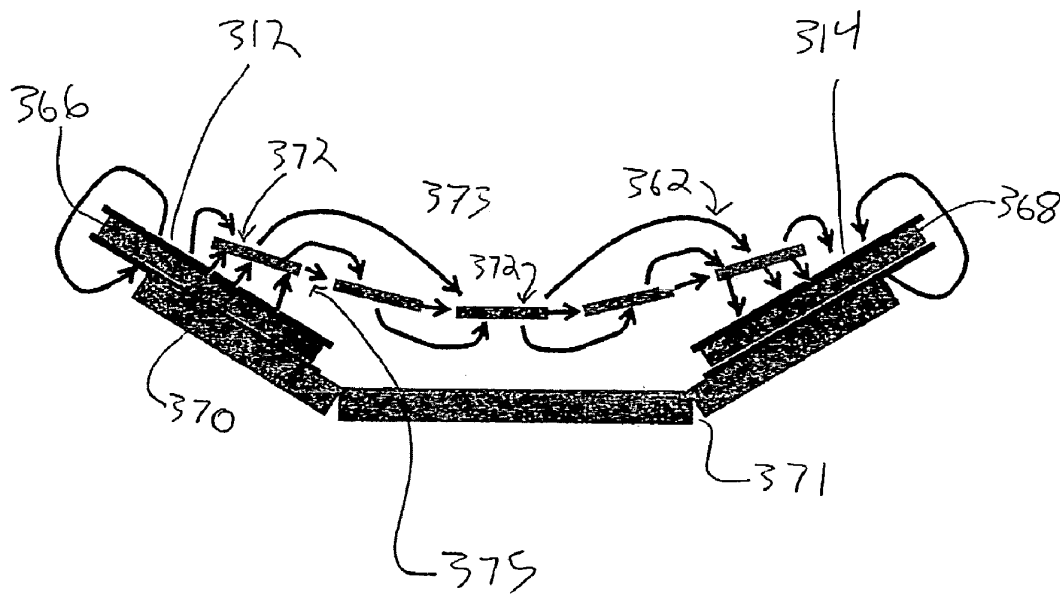


FIGURE 7

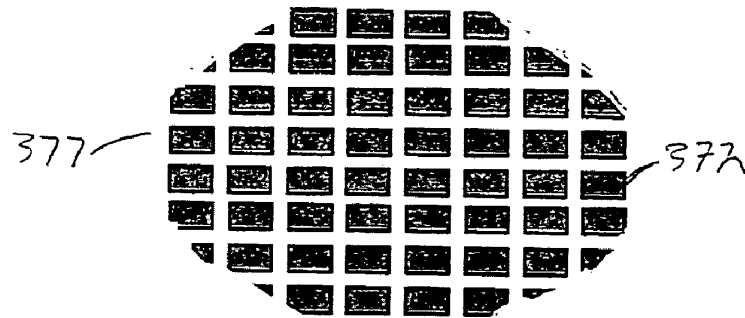


FIGURE 8A

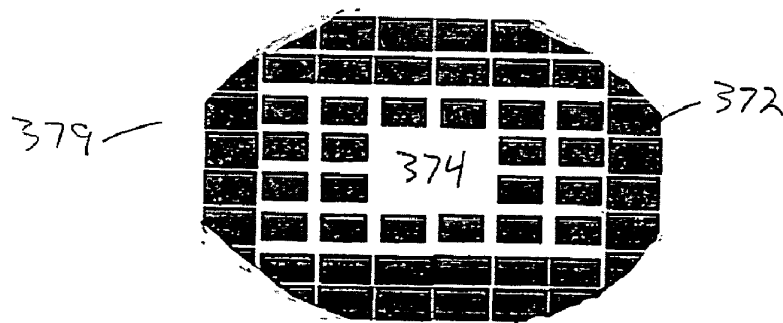


FIGURE 8B



FIGURE 8C

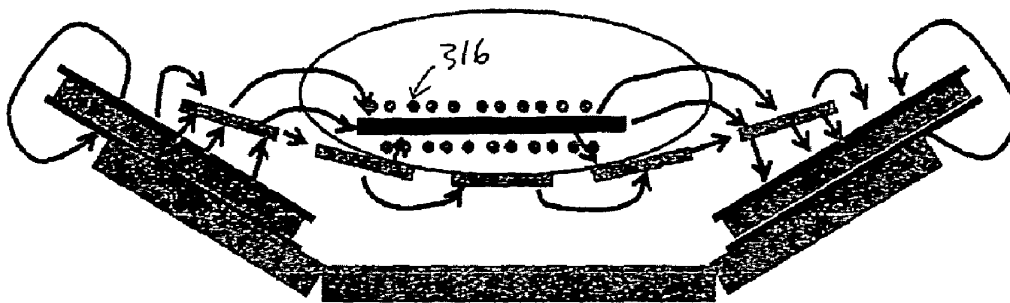


FIGURE 9

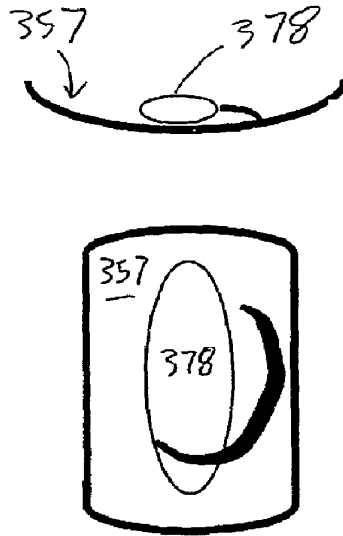


FIGURE 10

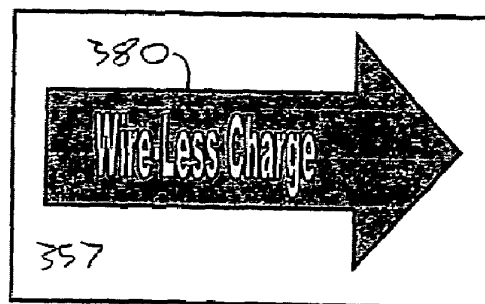


FIGURE 11

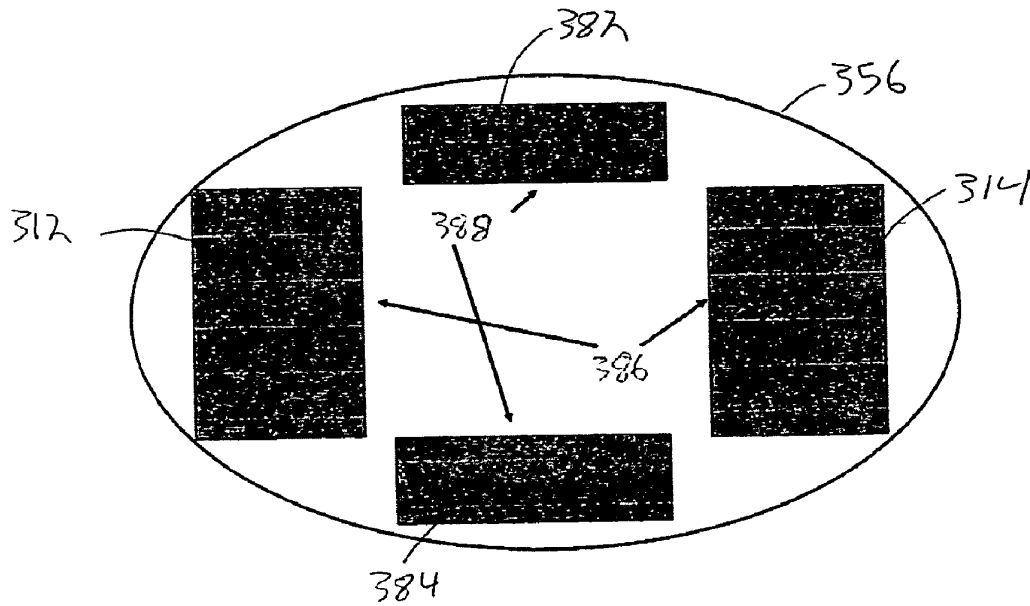


FIGURE 12A

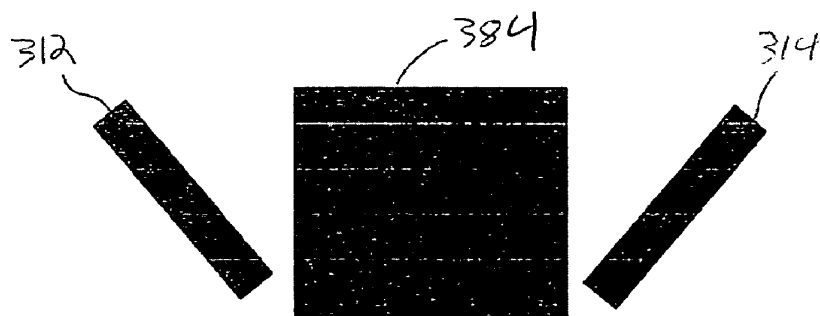


FIGURE 12B

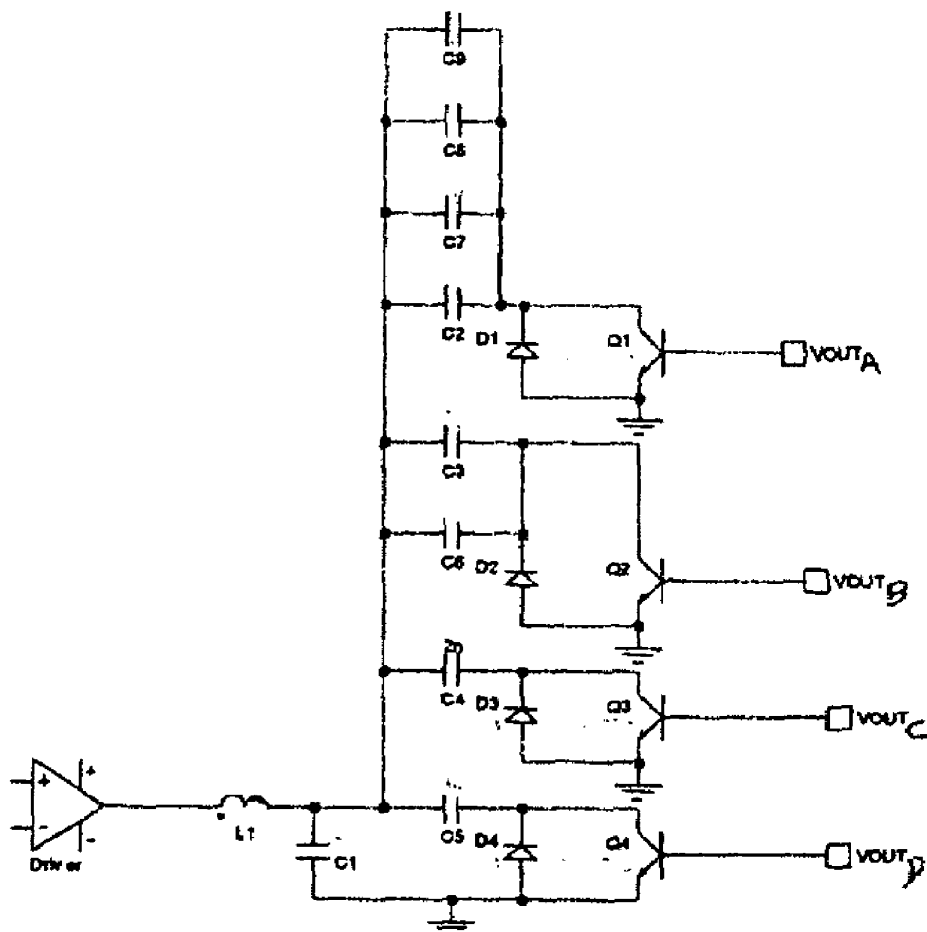


FIGURE 13

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INDUCTIVE CHARGING SYSTEM**TECHNICAL FIELD**

The present invention relates to the general field of charging interfaces. More specifically the invention relates to inductive battery chargers.

BACKGROUND

Wireless headsets and other portable communications devices are often battery powered such that a user can use the wireless headset or other such device without being directly connected to larger power source such as an a/c outlet or automobile battery. This allows wireless headset users flexibility and convenience to move about without being tied to a power cord. Wireless headset batteries are generally rechargeable so that the batteries can be recharged and need not be discarded after use.

Recharging of device batteries has generally achieved by a wired connection. In the prior art, devices employing rechargeable batteries typically have charging contacts so that charging current power can be supplied to recharge the batteries without removing the batteries from the device. In one typical setup, the portable device is inserted into a base charger which has spring loaded contacts that correspond to and couple with the contacts on the portable device. For example, such a setup is used with remote handset phones used in the home. The base charger is connected to a power source, and supplies charging current through the coupled contacts to recharge the batteries located within the device. Spring-loaded surface wiping contacts are generally used with charging bases. This is a convenience feature as users can simply drop the portable device into a cradle without fumbling with a plug. Surface contacts can be placed on the side of a taper form headset or other portable rechargeable device, making docking into a cradle much easier than a plug.

However, use of surface contacts and a charging base station with a headset presents problems due to the smaller physical size and design of headsets. Exposed metal contacts on headsets also risk contamination by oils and moisture from the skin of the wearer. This may cause corrosion and hence poor contact with the base station. Contamination also may cause an electrical leakage path that may cause power loss from the battery and electrolytic activity. Exposed metal contacts may also result in an allergic reaction to the user if in prolonged contact with the user's skin. During the rechargeable device docking process, the formed ends of the base station charging contacts often come into contact with the plastic housing of the rechargeable device and can scratch the housing and pick up contamination which can cause intermittent electrical contact. One potential solution is to cut the rechargeable device housing away to fully expose the rechargeable device stationary contacts so that the spring loaded contacts of the base station never touched the plastic housing during docking. However, this solution may compromise the rechargeable device industrial design, aesthetics, and possibly weaken the rechargeable device structural integrity.

Furthermore, the headset or other rechargeable device may not be firmly detented with the charging base, which may also cause intermittent electrical contact. One potential solution to the weak coupling between the portable rechargeable device and charging base to dish the stationary contacts in the rechargeable device so that the rechargeable device detents when the ends of the spring loaded base

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station contacts press into the depressions in the rechargeable device contacts. However, this solution compromises the industrial design of the rechargeable device, and in addition the detent force is less than robust.

As electronic items become smaller and the regulatory requirements become more stringent, the charging port becomes more noticeable as a relatively large unattractive feature of the housing, as an ESD weakness, as a relatively unreliable element in the system.

In the prior art, contactless battery chargers have also been utilized. The use of inductive coupling used for contactless power transfer between electrical items is described in the prior art. The magnetic field generated by one coil is made to couple closely with that of a second coil. Changes in the field induce a voltage in the second coil hence power transfer is possible. Inductive charging is discussed in U.S. Pat. No. 3,840,795, Electric Toothbrush, U.S. Pat. No. 3,938,018, Charger for electronic items, U.S. Pat. No. 4,873,677, Rechargeable watch. Basic inductive charging components are available from companies such as Panasonic and TDK.

FIG. 1 illustrates a typical prior art arrangement to ensure close coupling as disclosed in U.S. Pat. No. 5,600,225. In this arrangement, mechanical coupling between the charger and radiotelephone is required. The charger 1 for supplying power for charging to the radiotelephone is installed within a base case 101. A depression 102 into which the radiotelephone may be inserted is provided on the upper surface of the base case 101, and a primary coil 103 is provided in the base case 101 for producing magnetic flux which runs around the side walls of the depression 102 in a vertical plane. This primary coil 103 is connected to an oscillating circuit for supplying alternating current to the coil.

The radiotelephone 2 is provided with a microphone 202, a console keyboard 203, a display 204, a receiver 205, and an antenna 206 mounted on a slender telephone case 201. Inside the telephone case 201 is a storage battery. The storage battery is connected to a secondary coil 212 by way of an AC-DC conversion circuit.

The base of the telephone case 201 is constructed to allow insertion into the depression 102 provided in the base case 101, and in this way the radiotelephone 2 may be placed on the charger 1 in an erect state. The secondary coil 212 is provided within the base portion of the case 201 of the radiotelephone 2.

To operate, the radiotelephone 2 is placed upon the charger 1 when the storage battery is to be charged. At this time, the radiotelephone 2 is held in an erect state by means of insertion of the base portion of the telephone case 201 of the radiotelephone 2 into the depression 102 provided in the base case 101 of the charger 1. An alternating current signal of prescribed frequency generated in this oscillating circuit is supplied to the primary coil 103. As a result, an alternating magnetic field is generated by the primary coil 103 within the depression 102 in the base case 101 of the charger 1. This alternating magnetic field generates an induced electromotive force in the secondary coil 212 arranged in the base portion of the telephone case 201 of the radiotelephone 2.

The prior art device described in reference FIG. 1 as well as other prior art solutions require mechanical coupling between the charger and device to be charged. To make the efficiency of power transfer as high as possible it is necessary to contain the magnetic field so that all, or most, of the field in the first coil is linked to the second. To achieve this it is typically necessary to provide some close mechanical coupling such that there is a form of "plug" and "receptacle" arrangement. Contactless charging has been restricted to

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'mating pairs' in that the item to be charged and the charger are designed as a pair to achieve a closely controlled mechanical alignment of the coils in each unit, to maximize efficiency. This means that generally these charging methods are custom designed for the appliance due to non standardization of the interface and can require dexterity to use. The costs of the design of the charging system and the additional mechanical design have to be born by the individual product. This has restricted the adoption of contactless charging systems. Removing the requirement for accurate mechanical alignment would allow one charger design to be used across a range of products, allowing the development costs to be born by the range of products and reducing the design time for the introduction of a new product

Furthermore, prior art solutions often allow charging of only one item at a time. Generally, a user has multiple rechargeable devices which require charging power. As a result, the user must transport or use a number of chargers, generally one for each item. As the number of devices used by an individual increases, the multiplicity of chargers becomes problematic.

Thus, improved charging interfaces between charging base stations and rechargeable devices are needed.

SUMMARY OF THE INVENTION

The present invention provides a solution to the needs described above through an inventive inductive battery charger.

The present invention provides an apparatus for inductive charging a battery. The apparatus includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The apparatus further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume of space above the charging surface.

The present invention further provides a system for inductive charging which includes a charger. The charger includes a housing with a lower surface and a charging surface. A rechargeable device with a rechargeable battery may be placed on the charging surface. The charger further includes a controller for driving an oscillator, wherein the controller receives power from a power source. A first charger coil and second charger coil are disposed within the housing and are coupled to the oscillator. The first charger coil and second charger coil create a substantially horizontal magnetic field in the volume of space above the charging surface. The rechargeable device includes a receive coil for coupling to the horizontal magnetic field and producing an induced voltage. The rechargeable device further includes a rectifier for producing a rectified induced voltage to charge the battery in the rechargeable device.

DESCRIPTION OF THE DRAWINGS

The features and advantages of the apparatus and method of the present invention will be apparent from the following description in which:

FIG. 1 is an illustration of a prior art induction charging system

FIG. 2 is a circuit diagram partly in block form of a charging system in accordance with an embodiment of the invention.

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FIGS. 3A, 3B, and 3C are an illustration of horizontal coupling between a pancake coil and solenoidal coil.

FIGS. 4A, 4B, and 4C are an illustration of a potential configuration of the components of a secondary unit containing a battery to be recharged.

FIG. 5 illustrates a perspective view of an embodiment of the charging device of the present invention.

FIG. 6 is a diagrammatic view of the charger and the secondary unit.

FIG. 7 is a diagrammatic view of a further embodiment of the charger.

FIGS. 8A, 8B, and 8C illustrate controllable permeability of the housing top surface of the charger.

FIG. 9 is a diagrammatic view of the charger with a controlled permeability housing top surface and the secondary unit.

FIG. 10 illustrate placement of the secondary unit on the surface of the charger.

FIG. 11 illustrate the use of a directional logo on the charger.

FIGS. 12A and 12B illustrate a charger utilizing a rotating horizontal field.

FIG. 13 is a circuit schematic illustrating variable tuning of a drive coil.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a solution to the needs described above through an inventive inductive battery charger.

Other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, wherein is shown and described only the embodiments of the invention by way of illustration of the best modes contemplated for carrying out the invention. As will be realized, the invention is capable of modification in various obvious aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

The present invention provides a contactless charging system utilizing induction which does not require a housing with a compartment or recess that must be mechanically matched to the item being charged. This creates the opportunity to charge a variety of battery powered electronic items from a single charger. Further, the charging system lends itself to the simultaneous charging of dissimilar items.

In an embodiment of the invention, the charger takes the form of a shallow concave (herein also referred to as "dished" or a "dish") or similarly shaped upper charging surface, which whilst substantially flat and thin, develops a magnetic field which is substantially horizontal rather than perpendicular to its surface, which is typically the case if a coil were wound in the same plane as a plate. By developing an angled field that is substantially horizontal, it is possible to couple energy to a receiver coil comprising a long solenoid, lying horizontally on the upper surface of the charger.

Referring to FIG. 2, a circuit diagram partly in block form of a charging system including a charger 302 (also referred to herein as a primary unit or base unit) and secondary unit 304 (also referred to herein as a device to be charged or unit under charge) are shown. Circuit diagram elements are mounted on a printed circuit board disposed within charger 302 and secondary unit 304. Secondary unit 304 includes a rechargeable battery 320 to be charged by charger 302.

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Secondary unit **304** may be any small electronic device with a battery to be recharged. For example, secondary unit **304** may include wireless headsets, mobile telephones, personal digital assistants (PDAs), cameras, or other such devices.

Charger **302** is designed to draw power from a power source **306** such as a standard electrical wall outlet. In a further embodiment power source **306** may be an auxiliary power source from another piece of electronic equipment, such as through a USB port on a personal computer. Charger **302** may be linked to the personal computer via the USB port to provide data derived from communication with one or more secondary units **304** to the computer for display. Where secondary unit **304** is a small item such as a wireless headset or cordless mouse, an auxiliary power source can provide sufficient charging power.

Referring to FIG. 2, there is shown power source **306** connected to a controller **308** for driving an oscillator **310**. Controller **308** may include a rectifier. Oscillator **310** provides a high frequency A.C. signal to drive a charger coil. The frequency of the A.C. signal may vary. The lower limit for a practical operating frequency is determined by the higher field strength and/or larger coils required in the primary and secondary units. A higher frequency desirably facilitates the use of a smaller coil in the unit being charged. The upper limit on a practical operating frequency is determined by either the energy dissipated in the metallic content of the unit being charged, primarily the copper layers of a PCB, or by reaching the self-resonant frequency of any of the coils. These limits are therefore defined in practice by the volumes available for the coils, the power that must be transferred, the allowable internal temperature of the unit being charged and the efficiency required in the system. The frequency representing the best compromise between these different criteria is approximately in the range from 8 kHz to 300 kHz. In an embodiment of the invention, the preferred operating range is between 10 kHz and 40 kHz. The high frequency signal may be raised or lower depending upon the specific application. A charger coil (also referred to herein as a drive coil) takes the form in the particular embodiment illustrated of charging coil **312** and charging coil **314** connected to oscillator **310**. As described in further detail below, charging coil **312** and charging coil **314** are disposed at an angle to each other to direct the path of the generated electromagnetic field in a desired manner to enable horizontal coupling.

Shown in proximity to charger **302** is secondary unit **304**. Secondary unit **304** includes a secondary unit coil **316** (also referred to herein as a receive coil), which may include a permeable material core. During charging, secondary unit **304** is placed near charger **302** so that the magnetic flux from the magnetic field created by charging coil **312** and charging coil **314** passes through the secondary unit coil **316**. The positioning of secondary unit coil **316** is such as to provide for maximum flux coupling of the electromagnetic field provided from the angular arrangement of the charging coil **312** and charging coil **314**. Consequently, the magnetic flux induces a voltage across coil **316** resulting in an induced current to charge battery **320**. A meter may be connected across the secondary unit coil **316** to provide a visual indication of the degree of coupling.

Within secondary unit **304**, the secondary unit coil **316** connects to a rectifier which serves as an A.C. to D.C. converter. Although illustrated as a rectifying diode **318**, the rectifier may be implemented by other means. For example, a custom ASIC providing synchronous rectification to minimize voltage drops may be used. Rectifying diode **318** provides a D.C. charging signal to battery **320**, which is

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connected in series between secondary unit coil **316** and rectifying diode **318**. Battery **320** serves as a power source for secondary unit **304**. Charging is accomplished with a constant current. A regulator circuit may be employed to charge battery **320** to a certain capacity and then convert the charging current to a trickle type charge. The regulator circuit is responsive to the temperature and voltage of battery **320** to limit the charging current. The description of charger **302** and secondary unit **304** has been described in reference to the simplified circuit diagram shown in FIG. 2 for clarity. Other circuit elements and arrangements may be utilized by charger **302** in order to provide alternating current flow to charging coil **312** and charging coil **314**.

One feature of the invention is a charger **302** which generates an essentially horizontal magnetic field and the use of a long solenoidal coil **326** to receive this field. FIGS. 3A, 3B, and 3C are an illustration of horizontal coupling between a pancake coil **322** and solenoidal coil **326**. The EMF induced in a coil depends strongly on the angle that it makes to the magnetic field. Referring to FIG. 3A, the maximum possible induction (coupling) occurs when the field passes through the coil. This occurs when the direction of the field is orthogonal to the plane of the coil. Illustrated in FIG. 3A is maximum induction for a pancake coil **322** and a solenoidal coil **322** from a horizontal field **324**. This arrangement forms the basic geometry of a charger **302** utilizing a horizontal field.

Referring to FIG. 3B, if the pancake coil **322** or solenoidal coil **322** is rotated by 90° around a vertical axis, there is no flux through the coil, and no induced EMF. With a pancake coil **322** the decrease from full coupling to zero coupling follows a sinusoidal curve. The change in coupling for a cored solenoidal coil **326** is less well defined but tends to be more linear. A 30° rotation from maximum coupling results in approximately 14% reduction in induced EMF for a short coil and 30% reduction in the output of a winding on a long thin core. Referring to FIG. 3C, the induced voltage as a function of angle to the field for a pancake coil **328** and long solenoid coil **330** is shown.

FIGS. 4A, 4B, and 4C are an illustration of a potential configuration of the components of a secondary unit containing a battery to be recharged. The configuration is advantageously arranged to allow for easy placement of the secondary unit on charger **302** while still providing for the desired horizontal field coupling.

Referring to FIG. 4A, hand held secondary units having a housing **340** with length **334**, width **332** and thickness **336** would normally be placed on a flat surface, such as a desk, with the dimension indicated as thickness **336** in the vertical plane. For ergonomic reasons it is usual to arrange a battery **320** in such a secondary unit such that the battery major axis is in the horizontal plane and a PCB **338** carrying the electronic circuits would also generally be in the horizontal plane. The inventive system advantageously utilizes a coil wound on a long, thin permeable core (a solenoidal winding) as the inductive element to receive energy from a horizontal field in the secondary unit being charged. Use of a solenoidal winding is possible because the charger generates a substantially horizontal field. With some shapes of housing there may be advantage to rotating the coil in the horizontal plane and/or translating it vertically.

FIG. 4B illustrates the geometry associated with charging with a singular direction horizontal field **346** whilst FIG. 4C illustrates the implications of using a singular direction vertical field **348**. Coil windings are placed under the battery in an embodiment of the invention. Referring to FIG. 4B, when charging is conducted with a horizontal field **346**, a

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solenoidal winding on a high permeability core 342 may be utilized. The use of a high permeability core advantageously allows a high induced voltage in the solenoidal coil. The effective permeability of a magnetic core is a direct function of the ratio of its length to its diameter, so a long thin core couples more effectively to a field than a short flat one. Also advantageously, battery 320 and PCB 338 are in a separate magnetic flux path, thereby minimizing the effect on the coil Q. However, in a singular direction horizontal field 346, a rotation of solenoidal winding on permeable core 342 in the horizontal plane will produce a coupling null.

Referring to FIG. 4C, when charging is conducted with a singular direction vertical field 348, a low permeability core is utilized resulting disadvantageously in a low induced voltage. Furthermore, battery 320 and PCB 338 are in the same magnetic flux path, producing the potential for high loss. Advantageously, when a vertical field 348 is used, there is no coupling null with rotation of the coil in the horizontal plane.

Neither the singular direction vertical field 348 nor the singular direction horizontal field 346 delivers the ideal set of characteristics. However, since efficient coupling is the most important requirement in a charger, a horizontal field is preferred. Furthermore, as described below, charger 302 generates a horizontal field and advantageously is designed with a rotating horizontal field so that a coupling null does not result with horizontal rotation of the secondary unit. The charging system of the present invention advantageously provides for a high permeability core so high induced voltage in charging coil, no null with rotation in the horizontal plane, and a battery and PCB in a separate flux path so there is a low effect on coil Q.

FIG. 5 is a perspective view of charger 302 showing a housing 356 with a lower surface 359 and a charging surface 357 on which secondary units are placed for charging. Although illustrated in a block housing in FIG. 5, lower surface 359 and charging surface 357 may be incorporated into a variety of housing shapes, including a configuration with raised sides as illustrated in FIG. 7. Lower surface 359 is designed to act as a base when the unit is placed on a horizontal surface. Charging surface 357 is designed to receive items which will receive power from charger 302. In an embodiment of the invention, charging surface 357 is a shallow concave surface in the vertical dimension 363. Charging surface 357 is concave along the length dimension 367 and along the width dimension 365, forming a dish or bowl like structure with a base surface parallel to the lower surface 359. The depth of the dish is smaller than the dimensions of length dimension 359 or width dimension 365. In further embodiments, charging surface 357 is concave in only the length dimension 367 or width dimension 365 or flat. Charging surface 357 may include a plurality of dished recesses to permit the secure and defined location of a plurality of items placed on the surface. The dished recesses may be optimized for the alignment of some subset of items that are placed on the surface to receive power from charger 302. In a further embodiment of the invention, charging surface 357 possesses one or more markers indicating a preferred alignment and/or orientation for items that may be placed on that part of the surface to receive power from charger 302.

A feature of the invention is the provision of a shaped electromagnetic field to optimize coupling between charger 302 and secondary unit 304. As shown in FIG. 6, in an embodiment of the invention, a horizontal field is generated using angled paired coils embodied in charging coil 312 and charging coil 314. By utilizing a concave surface in the

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vertical dimension, discrete charging coils 312 and 314 may be positioned adjacent to the concave surface at varying inward angles with respect to a vertical axis to generate the desired horizontal field. Raising and angling charging coil 312 and charging coil 314 places the coil center-lines closer to the axis of the solenoid, thereby providing for improved coupling.

FIG. 6 is a diagrammatic view of a charger 302 and secondary unit 304. FIG. 6 illustrates an exemplary physical arrangement of a charger 302 of the inductive charging system. Charger 302 includes a housing structure 356 defining a charging surface 357 advantageously shaped to receive a secondary unit 304 incorporating a rechargeable battery 320. Controller 308 and oscillator 310 described in reference to FIG. 2 are disposed within housing structure 356 (not shown).

Charger 302 may also contain additional components typical of battery charging devices. For example, charger 302 may always be in a power on status, or alternatively may include a manually operated on/off button for turning the charger power on and off. Charger 302 may also include an indicator light such as a light emitting diode which serves as an indicator of the power status. Secondary unit 304 may also include an indicator light coupled to a secondary unit 304 control circuit which indicates charging status.

To operate, the secondary unit 304 is placed upon charger 302 when the battery 320 in secondary unit 304 is in need of charging. The secondary unit 304 is placed on charging surface 357 provided on charger 302. Charger 302 is then connected by way of a power cord to an external power source 306. When charger 302 is in a power on state, power controlled by controller 308 is supplied to oscillator 310. An alternating current signal of prescribed frequency generated in oscillator 310 is supplied to charging coil 312 and charging coil 314. As a result, an alternating magnetic field is generated by charging coil 312 and charging coil 314 above charging surface 357 of charger 302.

The alternating magnetic field generates an induced electromotive force in the secondary unit coil 316 arranged in the secondary unit 304. The alternating current arising from this induced electromotive force is converted to direct current in an AC-DC conversion circuit including rectifying diode 318. The direct current power outputted from the AC-DC conversion circuit constitutes a DC power source which may be applied to the battery 320 directly or, more usually, through a charge control circuit, so causing the battery to be charged. As a result, battery 320 built into the secondary unit 304 is charged without being electrically connected to charger 302, i.e., while in an electrically contactless state. The charger power may be turned off to interrupt the magnetic circuit so that the secondary unit 304 may be easily removed from charger 302 when the charging is complete or when use of secondary unit 304 is desired. The arrangement is such that when secondary unit 304 is placed on charging surface 357, the coil 316 within secondary unit 304 will be in flux coupling relationship with charging coil 312 and charging coil 314.

Referring to FIG. 6, disposed in the base of housing 356 is a permeable material 358. Permeable material 358 serves several functions. Permeable material 358 increases the flux density in the area where secondary unit 304 is placed on housing 356 and prevents flux from passing to metal structures on which charger 302 is placed and introducing losses, such as a filing cabinet or the metal frame of a bench. Permeable material 358 makes charger 302 less susceptible to other items introduced into the environment, such as cables, keys and other metallic objects. Furthermore, per-

meable material 358 contains the fields to the volume of space where it is used and reduces the potential for interference with proximate electronic equipment, as well as provides mass for mechanical stability.

In operation, a magnetic flux linkage 362 propagates along a flux path between the coils in charger 302 and secondary unit 304. The use of a horizontal field minimizes the cross-sectional area of metal in the PCB and batteries exposed to the magnetic fields, thereby minimizing the energy losses associated with eddy currents induced in the items. One or more secondary units 304 receives power from charger 302. The secondary unit 304 including at least one coil 316 designed to couple to the magnetic field generated by charger 302 and thereby have a voltage induced in it. The induced voltage is rectified and used to augment the battery 320 of the secondary unit 304.

Charging coil 312 and charging coil 314 are physically distinct and electrically connected in series, providing a magnetic field with a substantial horizontal component through a substantial percentage of the volume that may be occupied by a secondary unit 304 placed on charging surface 357 to receive power from charger 302. Charging coil 312 and charging coil 314 are thin air-cored coils (also referred to herein as a "pancake" coil or winding) or formed on non-permeable material. In a further embodiment of the invention, charging coil 312 and charging coil 314 contain a core of permeable material.

Charging coil 312 and charging coil 314 operate in a manner similar to Helmholtz coils to generate a substantially horizontal field in the volume of space between charging coil 312 and charging coil 314. In a further embodiment, the charging coil may be operated as Rubens coils. Each coil individually, lying on a horizontal surface produces a magnetic field with an essentially vertical orientation across most of the area bounded by the coil. Used in conjunction, charging coil 312 and charging coil 314 create a horizontal field in a volume of space between the coils. The paired coils produce an open structure.

The charger coils 312 and 314 may be considered as a derivative of the Helmholtz coil arrangement, whereby two circular coils of radius 'a' placed coaxially and in parallel planes produce a substantially uniform field in the space between them, given by the formula:

$$H = \mu_0 \frac{8}{\sqrt{125}} \frac{NI}{a}$$

Coil radius=a

Coil separation=a

If the coils in a Helmholtz system are made rectangular, the field at the centre maintains this property of near uniform strength. If the separation distance is increased slightly the uniformity is lost, but the vector orientation is maintained. If the coils are angled, as shown in the embodiment illustrated in FIG. 6, the field still remains essentially horizontal. In the limit, the coils could be horizontal.

FIG. 7 is a diagrammatic view of a further embodiment of charger 302. One or more pieces of permeable material 370, such as ferrite, are used to create a low reluctance path across the bottom of charger 302. The lower level pieces of permeable material 370 are disposed in a volume lying between the surface containing the charging coil 312 and charging coil 314 and the lower surface of the charger housing 356. Permeable material 370 may be overmoulded with a thermoplastic material. Alternatively, permeable

material 370 is a non-permeable carrier material loaded with permeable material, such as a ferrite loaded thermoplastic. The ferrite loaded thermoplastic could advantageously be utilized to create the shaped structure to hold the windings of charging coil 312 and charging coil 314 and provide a base for the charger housing.

Small air gaps 371 have little effect on the performance because the reluctance of the path is dominated by the air gap 373 between the two inward facing poles of the windings of charging coil 312 and charging coil 314. Flexible permeable tape, similar to that used for EMC shielding, might also be used to provide curved permeable paths for flux. Charging coil 312 and charging coil 314 may include permeable cores integrated with a permeable material.

The low reluctance path created by permeable material 370 underneath the charging coil 312 and charging coil 314 windings enhances the flux density on charging surface 357. It also controls back flux emission, the flux emanating from the bottom surface of charger 302. Without the low reluctance path, there are significant eddy current losses if charger 302 is placed on a metal desk or filing cabinet.

Field leakage from charging surface 357 is controlled by use of a permeable path 375 formed with an upper layer of permeable tiles 372 on or just below charging surface 357. The upper layer of permeable tiles are disposed in a volume lying between the surface containing charging coil 312 and charging coil 314 and charging surface 357. Permeable tiles 372 may consist of one or more pieces of ferrite material, a non-permeable carrier material loaded with permeable material, or a permeable material over-moulded with thermoplastic. In an embodiment of the invention, permeable tiles 372 are composed of ferrite loaded thermoplastic.

FIGS. 8A, 8B, and 8C illustrate embodiments of permeable path 375. Referring to FIG. 8A, a top view of a layout 377 of upper layer permeable tiles 372 in a first embodiment is shown. Layout 377 utilizes a rectangular array of permeable tiles 372. Referring to FIG. 8B, a top view of a layout 379 of upper layer permeable tiles 372 is shown. Layout 377 utilizes a rectangular array of permeable tiles 372 with a tile clearing 374. Referring to FIG. 8C, a tile stacking arrangement 376 cross section layered structure providing variable permeability is shown.

The distribution and/or size of tiles 372 need not be regular. The size and spacing controls the effective permeability of the surface in that region. There is some benefit to having tile clearing 374, in that a greater percentage of the available flux will pass through the core in the secondary unit. Although the layout of tiles 372 in the preferred embodiment is elliptical to conform to the preferred elliptical dish shape of the charging surface, the boundary may be any arbitrary shape.

The permeable path may, by way of practical implementation, be formed by any other means of controlled and/or variable permeability. In a preferred embodiment the surface is formed by a moulded ferrite loaded thermoplastic sheet. The distribution of permeable material need not be uniform. It may be varied to create regions of higher and lower effective permeability. In another preferred embodiment layers of ferrite loaded sheet are stacked such that a larger number of layers is formed at the sides than at the centre and the resulting stack is over-moulded.

The benefits of a permeable charging surface 357 are multi-fold. The permeable charging surface 357 provides containment of the field to avoid interference with proximate electronic equipment. It reduces the effect of proximate metallic objects, even if items such as keys or coins are placed in the charging area of the charger, since there is little

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or no diversion of the flux from the path provided by the permeable surface. The permeable charging surface 357 provides concentration of flux into the area where a secondary unit will be placed and allows the creation of a plurality of charging zones to allow the simultaneous charging of a plurality of secondary units through allocation to individual zones. Furthermore, the permeable charging surface 357 lowers the change of inductance of the drive coils in the charger when a secondary unit is introduced, since one permeable path is exchanged for another.

FIG. 9 is a diagrammatic view of the charger 302 with a controlled permeability charging surface 357 and a secondary unit 304. Charger 302 is that of the embodiment described in reference to FIG. 8. Charger 302 charging surface 357 is composed of a patterned layout of ferrite tiles. The size and shape of the tiles is designed such that, whilst performing the field containment, the placement of a secondary unit 304 provides a lower reluctance path and magnetic flux 362 would be diverted to the coil 316 in the secondary unit 304. As illustrated in FIG. 9, the curvature of charging surface 357 assists the redirection flux through secondary unit 304. However, the curvature is arbitrary and in other embodiments the surface for the secondary unit to be placed on could be flat.

FIG. 10 illustrate placement of the secondary unit on the surface of charger 302. Charger 302 utilizes a geometrically advantageous charging surface 357. As illustrated in FIG. 10, where charging surface 357 is dished, a secondary unit 304 placed on it tends to align in one axis. This alignment is such that the coupling between a solenoid receive coil in secondary unit 304 and the charging coils of charger 302 is maximized as described in FIG. 3. For this reason the preferred embodiment provides a dished surface. Furthermore, a headset with an ear clip extending from one side placed on the dished surface will tend to create a preferential stable orientation as the earclip rests on the sidewall of the dished surface. FIG. 11 illustrate the use of a directional logo on charger 302. A directional logo 380 placed on charging surface 357 is utilized to indicate a preferred orientation with which secondary unit 304 should be placed on the charging surface 357 such that coupling is maximized and a preferred side to place the secondary unit 304 onto charging surface 357. A corresponding logo may also be placed on the secondary unit 304.

FIGS. 12A is a top view and 12B is a side view of a charger 302 utilizing a rotating horizontal field. As disclosed in U.S. Pat. No. 5,966,641, entitled "Aerial Arrays for Inductive Communications System", which is hereby incorporated by reference, a solenoidal coil placed in the plane of a rotating field will not experience a coupling null. A coil in the plane of a rotating field is always aligned with the field for a period in the cycle. The voltage induced is at the frequency of rotation and there are no positions of zero coupling. The rotating field is produced by providing a second pair of charger coils 388 including a coil 382 and coil 384 in addition to a first pair of charger coils 386 comprising a charging coil 312 and charging coil 314. The second pair of charger coils 388 is positioned orthogonal to first pair of charger coils 386, and the two pairs are driven with voltage waveforms having a 90° phase shift, thereby creating a net field with a rotating horizontal field. Coil 382 and coil 384 are positioned within charger 302 at an angle and depth similar to charging coil 312 and charging coil 314.

First pair of charger coils 386 and second pair of charger coils 388 are electrically connected in series, and are disposed and electrically connected to provide two magnetic fields with a substantial horizontal component through a

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substantial percentage of the volume that may be occupied by a secondary item placed on the upper surface to receive power from the charger. The horizontal components of these two fields are substantially orthogonal and the fields are created at the same frequency with a nominal 90° phase shift. The shape and distribution of the first and second pair of coils can be varied to suit the ascetics of the product or the requirements of a particular secondary unit. In an embodiment, coils are wound on rectangular cores and distributed so as to produce a dish with an elliptical boundary.

The use of a rotating horizontal field also minimizes the effects of areas of low field strength on charging surface 357 (referred to herein as "shadow zones"). A secondary unit with a large induction coil extracting a large amount of power from the charger may create a shadow zone which prevents an adjacent smaller secondary unit from charging. The effect is minimized by the use of a rotating field, since an incident field orthogonal to a first horizontal field creates a shadow zone at a different location. As a result, a smaller secondary unit is only in a shadow zone periodically.

Two element inductive charging systems typically create a resonance in both the transmitting and the receiving coils for a given frequency. The resonance maximizes the current, and hence the flux density from a given drive voltage, and maximizes the receive voltage for a given intercepted flux. This technique is effective and economic where, as is the usual case, the two elements of a contactless charging system are designed only for use as a matched pair.

The present invention is capable of charging a variety and/or plurality of secondary units. When the number and type of secondary units being charged is variable, the power extracted from the field and the amount of permeable material and its distribution are ill defined and therefore the inductance and loss resistance seen in the resonant system are also ill defined. Changes in the inductance or loss resistance resulting from placement of one or more secondary units must be compensated for. The inventive system includes a resonance tuning circuit for operating the first charging coil and second charging coil in a resonance circuit with one or more rechargeable devices placed on the charging surface.

The fundamental equation for a resonant system is

$$2\pi f = \frac{1}{LC}$$

where

f is the resonant frequency

L is the coil inductance

C is the capacitance used to tune the system.

In one embodiment, the resonance tuning circuit includes a variable capacitance which is adjusted when a secondary unit 304 is placed on the charging surface. In a further embodiment, the resonance tuning circuit varies the frequency of the first charging coil and second charging coil when a secondary unit 304 is placed on the charging surface. Either the capacitance used to resonate the circuit is altered to compensate for the changed inductance or the frequency is changed to keep the system resonant.

FIG. 13 is a circuit schematic illustrating variable tuning of a drive coil. Additional capacitors are switched in or out of the circuit by logic control signals. The capacitors are, by way of example, arranged in a binary manner such that

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sixteen discrete tuning points are provided by the circuit shown. The pair of windings associated with a simple time varying field may be connected in series such that only a single tuning node is required. The driver may be an analogue amplifier, driven by any waveform having a significant frequency component at the resonant frequency of the tuned circuit, or a digital driver, such as provided by one or more logic gates, driven by any digital signal containing a significant frequency component at the resonant frequency.

A rotating field requires a minimum of two drivers for the two pairs of coils, and two tuning nodes. High Q tuning is problematical since the tuning of one pair of coils will affect the second pair through the mutual inductance existing between the two pairs. Furthermore, an item placed to one side of a charging surface will have a different coupling to each coil, so there is not a single resonant frequency for the array and the rotating field will be elliptical rather than circular. The "free running" state, where no secondary unit **304** is present, can be detected and the power output reduced to a predetermined level or applied periodically to determine whether an item has been placed on the charging surface.

An alternative to varying capacitance is varying the drive coil frequency to maintain resonance when the inductance is altered by the addition of a secondary unit **304**. Analog tuning circuits may be utilized to vary the drive coil frequency. In addition, a sense coil near a driven coil could provide a feedback signal to a microcontroller that produces the signal to the driver. Software can provide a process whereby the output frequency is adjusted to maximize the signal from the sense coil. Application of a variable frequency is predicated on the basis that the high efficiency achieved by driving a resonant system is needed for effective operation but that power extraction from the coil in the secondary unit **304** will result in that system having a relatively low Q. The efficiency of reception is therefore not significantly affected by shifts in frequency, particularly if these are minimized by the use of a charger **302** with a permeable charging surface **357**, which minimizes the change of inductance seen by the drive coils when a secondary unit **304** is introduced.

One advantage of a variable frequency system is that secondary units create a change in inductance and an associated increase in losses. When a loss increase is too large in relation to the inductance increase, the presence of foreign conductive items is detected and the user is warned that performance is being compromised. When there is no item to be charged the charger runs at the lowest possible frequency. This could be automatically associated with a low-power standby mode, with high power only being provided when the resonant frequency is within a pre-defined range.

In a further embodiment, the charger **302** may use a high voltage to drive the charger coil directly without resonance. In a preferred embodiment a DC-to-DC converter is used to provide a voltage supply, which may be in the order of a hundred volts. This supply is provided to a high voltage driver, which may be an analog or a digital circuit. The drive is by a digital signal with a pulse width modulated waveform in an embodiment of the invention. The carrier frequency is chosen to be high enough that it does not produce significant current in the coil inductance, and therefore does not produce a field. The modulating waveform is a sine wave at the frequency desired for the field. This system is relatively unaffected by changes in the magnetic environment. This system has the benefit of optimum efficiency in power transfer, minimizing thermal losses, and simplifying thermal management and enhancing reliability in the charger.

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The frequency, phase, amplitude, or any combination thereof of the drive voltage may be modulated in such manner as to convey data to the secondary unit **304**. In an embodiment of the invention, the charger coils are driven by a voltage waveform comprising a high frequency carrier modulated with a lower frequency such that only the lower frequency produces significant magnetic flux. In one embodiment, the charger coils are driven by a voltage waveform comprising a high frequency square-wave carrier pulse-width modulated with a lower frequency sine wave such that only the lower frequency produces significant magnetic flux.

Adding a third driven coil, lying in the horizontal plane, provides a field that can be steered to provide three dimensional rotation and coverage of any relative orientation between primary and secondary unit coils as described in U.S. Pat. No. 6,134,420, entitled "Vector Measuring Aerial Arrays for Magnetic Induction Communication Systems," which is hereby incorporated by reference. Specifically this would allow optimal coupling to a secondary unit **304** placed such that the receive coil is tilted in the vertical plane. The magnetic field provided by the third driven coil has a substantial vertical component and has the same frequency and phase as one of the substantially horizontal fields, resulting in a rotating magnetic field that can be tilted out of the horizontal plane. The phase of the magnetic field provided by the third driven coil may be alternated between the phases of the substantially horizontal fields.

It is desirable to provide some communication between the charger **302** and secondary units. The frequency, phase, amplitude, or any combination thereof, may be modulated in such manner as to convey data to a secondary unit **304**. A communication system allows the charger **302** to identify the number of secondary units placed on the charging surface and to determine the total charge required. The user is then informed if the charging capacity of the system is being exceeded. Additional information can be conveyed through a display unit or via audible signal. The number of secondary units present can be determined from inductance changes in resonant systems. The state of battery charge of a secondary unit **304** can be determined if secondary units with 'fuel gauge' monitoring of battery use send data on remaining capacity and/or operating time. Such data can include the stage in the charge cycle reached and the power being demanded. This is particularly useful for small secondary units such as headsets that can not incorporate a significant visual display. Use of a data link increases accuracy and usefulness. Instantaneous demand on charge power can be determined as well as maximum charging power based on communication between the charger **302** and secondary unit **304**.

Resonant systems are amenable to switched-key modulation or phase modulation in the charger **302**. The secondary unit **304** may transmit on a specified separate frequency using its receive coil. This signal would be detected by the charger coils, or a separate coil or array of coils, connected to an appropriate receiver. The choice of frequency, modulation and data encoding is an open one.

The non-resonant system is amenable to switched-key modulation and all forms of frequency and phase modulation. The field from the charger **302** constitutes a robust and flexible data link. The communication from the secondary unit **304** is achieved by transmission on the solenoidal coil and reception by the drive coils, or by a dedicated coil or array of coils in the charger **302**. The choice of frequency, modulation and data encoding is an open one.

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If the secondary unit **304** has a dedicated communication channel as a part of its prime application, such as an infra-red or radio link, the channel might also be used for the return data link from the secondary unit **304** to the charger **302**. In an embodiment of the invention, the radio link used may be a Bluetooth link.

The present invention thereby can charge any appropriately equipped secondary unit **304** simply by placement of the device on the charging surface. Further, multiple secondary units can be placed on the charging surface and all will be charged simultaneously. In a specific embodiment of the invention, approximately 10 W of charging power is provided. Charger **302** may replace a number of different chargers, reducing cable clutter and reducing the number of chargers carried by users. In a present embodiment, charger **302** has a charging surface of approximately 148 mm in width and 210 mm in length, the size of an A5 sheet of paper. A charging surface of this size may include two or three recesses for items to be charged. Greater size charging surfaces may be used, but may be limited in practical terms where desk space is restricted.

In summary, the inventive charger **302** described herein offers several advantages. The charger does not require a housing with a compartment that must be mechanically matched to the item being charged. Furthermore, the charger **302** provides a solution that can charge several small electronic devices simultaneously. A feature of the invention utilizes angled charging coils beneath the charging surface to generate a substantially horizontal field across the charging surface. In an embodiment of the invention, the angled charging coils are placed beneath a concave or similarly shaped charging surface.

Because the charging surface is a relatively flat and wide surface, placing a device to be charged on the charging surface requires the simplest and easiest possible action from the user to recharge, such that recharging becomes a transparent operation. This is particularly convenient for devices that are frequently cycled between use and non-use, such as a telephone headset. Every time the user removes the headset and places it on the charging surface, the headset receives a top-up charge, extending the user operating time in practice. Furthermore, the charger doubles as convenient and safe storage for the headset.

The absence of electrical contacts improves both performance and appearance of the rechargeable device. Without contacts, there is no possibility for the contacts to be contaminated. Since the charger may be operated with a variety of dissimilar devices because close mechanical matching is not required, the invention provides a near universal charger. As a result, the charger and associated rechargeable devices can be manufactured more cost-effectively.

One of ordinary skill in the art will recognize that other architectures for the charger may be employed. For example, a variety of charging circuits may be utilized. Furthermore, other shapes and sizes for the charging surface and charger housing may be employed. Having described the invention in terms of a preferred embodiment, it will be recognized by those skilled in the art that various types of components may be substituted for the configuration described above to achieve an equivalent result. It will be apparent to those skilled in the art that modifications and variations of the described embodiments are possible, and that other elements or methods may be used to perform equivalent functions, all of which fall within the true spirit and scope of the invention as measured by the following claims.

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The invention claimed is:

1. An apparatus for inductive charging a battery comprising:

- a housing with a lower surface and a charging surface, wherein a rechargeable device with a rechargeable battery may be variably placed on the charging surface;
- a controller for driving an oscillator, wherein the controller receives power from a power source;
- a first charger coil disposed within the housing;
- a second charger coil disposed within the housing, wherein the first charger coil and the second charger coil are coupled to the oscillator and create a substantially horizontal magnetic field in a volume of space above the charging surface; and
- one or more permeable tiles disposed on or below the charging surface and above the first charger coil and the second charger coil, wherein the one or more permeable tiles form a controlled permeable path to limit field leakage from the charging surface.

2. The apparatus of claim 1, wherein the first charger coil and the second charger coil have a core comprising air or a non-permeable material.

3. The apparatus of claim 1, wherein the first charger coil and the second charger coil have a core comprising a permeable material.

4. The apparatus of claim 1, further comprising a permeable material disposed in the housing above the lower surface and below the first charger coil and the second charger coil.

5. The apparatus according to claim 4, wherein the permeable material comprises ferrite.

6. The apparatus according to claim 4, wherein the permeable material is disposed within a non-permeable carrier.

7. The apparatus according to claim 4, wherein the permeable material is ferrite loaded thermoplastic.

8. The apparatus according to claim 4, wherein the permeable material is over-moulded with thermoplastic.

9. The apparatus according to claim 4, wherein the permeable material is integrated with a core permeable material disposed within the first charger coil and the second charger coil.

10. The apparatus of claim 1, wherein the first charger coil and the second charger coil create a first substantially horizontal magnetic field along a first direction above the charging surface, the apparatus further comprising:

- a third charger coil disposed within the housing; and
- a fourth charger coil disposed within the housing, wherein the third charger coil and fourth charger coil create a second substantially horizontal magnetic field along a second direction above the charging surface, wherein the first direction is orthogonal to the second direction.

11. The apparatus of claim 10, wherein the first substantially horizontal magnetic field and the second substantially horizontal magnetic field have the same frequency and a phase difference of 90 degrees.

12. The apparatus of claim 10, further comprising a fifth charger coil disposed within the housing for creating a substantially vertical magnetic field.

13. The apparatus of claim 12, wherein a substantially vertical magnetic field phase is alternated between a first horizontal magnetic field phase and a second horizontal magnetic field phase.

14. The apparatus of claim 1, further comprising a resonance tuning circuit for operating the first charging coil and the second charging coil in a resonance circuit with one or more rechargeable devices placed on the charging surface.

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15. The apparatus of claim 14, wherein the resonance tuning circuit comprises a variable capacitance which is adjusted when a rechargeable device is placed on the charging surface.

16. The apparatus of claim 14, wherein the resonance tuning circuit varies the frequency of the first charging coil and the second charging coil when a rechargeable device is placed on the charging surface.

17. The apparatus of claim 1, wherein the charging surface is a concave surface.

18. The apparatus of claim 17, wherein the first charging coil and the second charging coil are disposed adjacent to the concave surface at an inward angle with respect to a vertical axis.

19. The apparatus of claim 1, wherein the charging surface comprises a plurality of recessed areas for simultaneous charging of a plurality of rechargeable devices.

20. The apparatus of claim 1, wherein the power source is an electronic device.

21. The apparatus of claim 1, wherein the power source is coupled to the controller via a USB port.

22. The apparatus of claim 1, wherein the first charging coil and the second charging coil receive a drive voltage from the oscillator that is modulated in frequency, phase, amplitude, or any combination thereof to convey data to the rechargeable device.

23. The apparatus of claim 22, wherein a high frequency carrier is modulated with a lower frequency such that only the lower frequency produces significant magnetic flux.

24. The apparatus of claim 23, wherein the high frequency carrier is a square-wave carrier and the lower frequency is a sine wave.

25. The apparatus of claim 1, wherein the oscillator provides an A.C. signal with a frequency between 10 kHz and 40 kHz.

26. A system for inductive charging comprising:

a charger comprising:

a housing with a lower surface and a charging surface, wherein a rechargeable device with a rechargeable battery may be variably placed on the charging surface;

a controller for driving an oscillator, wherein the controller receives power from a power source;

a first charger coil disposed within the housing;

a second charger coil disposed within the housing, wherein the first charger coil and the second charger coil are coupled to the oscillator and create a substantially horizontal magnetic field in a volume of space above the charging surface; and

one or more permeable tiles disposed on or below the charging surface and above the first charger coil and the second charger coil, wherein the one or more permeable tiles form a controlled permeable path to limit field leakage from the charging surface,

wherein the rechargeable device comprises:

a receive coil for coupling to the substantially horizontal magnetic field and producing an induced voltage; and

a rectifier for producing a rectified induced voltage to charge the battery in the rechargeable device.

27. The system of claim 26, wherein the rectified induced voltage further provides operating power to the rechargeable device.

28. The system of claim 26, wherein the rechargeable device sends data to the charger.

29. The system of claim 28, wherein data is sent with the receive coil.

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30. The system of claim 29, wherein the charger receives data with the first charging coil and the second charging coil.

31. The system of claim 29, wherein the charger further comprises a charger receive coil for receiving data from the rechargeable device.

32. The system of claim 28, wherein the rechargeable device sends data to the charger with a radio signal.

33. The system of claim 28, wherein the rechargeable device sends data to the charger with an infrared signal.

34. The system of claim 28, wherein the charger further comprises a USB port and wherein data received from the rechargeable device is transferred to a personal computer through the USB port.

35. The system of claim 26, wherein the receive coil is a solenoidal coil.

36. The apparatus of claim 1, wherein the one or more permeable tiles comprise ferrite.

37. An apparatus for inductive charging a battery comprising:

a housing having a concave charging surface;

a controller for driving an oscillator, wherein the controller receives power from a power source;

a first angled charger coil disposed within the housing adjacent the concave charging surface; and

a second angled charger coil disposed within the housing adjacent the concave charging surface, wherein the first angled charger coil and the second angled charger coil are coupled to the oscillator and create a substantially horizontal magnetic field in a volume of space above the concave charging surface; and

one or more permeable tiles disposed on or below the concave charging surface and above the first angled charger coil and the second angled charger coil, wherein the one or more permeable tiles form a controlled permeable path to limit field leakage from the concave charging surface.

38. The apparatus of claim 37, wherein the first angled charger coil and the second angled charger coil have a core comprising a permeable material.

39. The apparatus of claim 38, further comprising a permeable material disposed in the housing below the first angled charger coil and the second angled charger coil.

40. The apparatus of claim 39, wherein the permeable material comprises ferrite.

41. The apparatus of claim 39, wherein the permeable material is disposed within a non-permeable carrier.

42. The apparatus of claim 39, wherein the permeable material is ferrite loaded thermoplastic.

43. The apparatus of claim 39, wherein the permeable material is over-moulded with thermoplastic.

44. The apparatus of claim 39, wherein the permeable material is integrated with a core permeable material disposed within the first angled charger coil and the second angled charger coil.

45. The apparatus of claim 37, wherein the first angled charger coil and the second angled charger coil create a first substantially horizontal magnetic field along a first direction above the concave charging surface, the apparatus further comprising:

a third angled charger coil disposed within the housing; and

a fourth angled charger coil disposed within the housing, wherein the third angled charger coil and fourth angled charger coil create a second substantially horizontal magnetic field along a second direction above the concave charging surface, wherein the first direction is orthogonal to the second direction.

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46. The apparatus of claim 45, wherein the first substantially horizontal magnetic field and the second substantially horizontal magnetic field have a same frequency and a phase difference of 90 degrees.

47. The apparatus of claim 45, further comprising a fifth 5
charger coil disposed within the housing for creating a substantially vertical magnetic field.

48. The apparatus of claim 47, wherein a substantially vertical magnetic field phase is alternated between a first horizontal magnetic field phase and a second horizontal 10
magnetic field phase.

49. The apparatus of claim 37, further comprising a resonance turning circuit for operating the first angled charger coil and the second angled charger coil in a resonance circuit with one or more rechargeable devices placed 15
on the concave charging surface.

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50. The apparatus of claim 49, wherein the resonance tuning circuit comprises a variable capacitance which is adjusted when a rechargeable device is placed on the concave charging surface.

51. The apparatus of claim 49, wherein the resonance turning circuit varies the frequency of the first angled charging coil and the second angled charging coil when a rechargeable device is placed on the concave charging surface.

52. The apparatus of claim 37, wherein the concave charging surface comprises a plurality of recessed areas for simultaneous charging of a plurality of rechargeable devices.

* * * * *

EXHIBIT E



US006912137B2

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Berghegger

(10) **Patent No.:** **US 6,912,137 B2**
(45) **Date of Patent:** **Jun. 28, 2005**

(54) **INDUCTIVE CONTACTLESS POWER TRANSMITTER**

(75) Inventor: **Schroder Ralf gen Berghegger**,
Glandorf (DE)

(73) Assignee: **Friwo Geraetebau GmbH**, Ostbevern
(DE)

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patent is extended or adjusted under 35
U.S.C. 154(b) by 110 days.

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(51) **Int. Cl.**⁷ **H02M 3/335**

(52) **U.S. Cl.** **363/21.03**

(58) **Field of Search** 363/16, 131, 178,
363/21.03; 307/150

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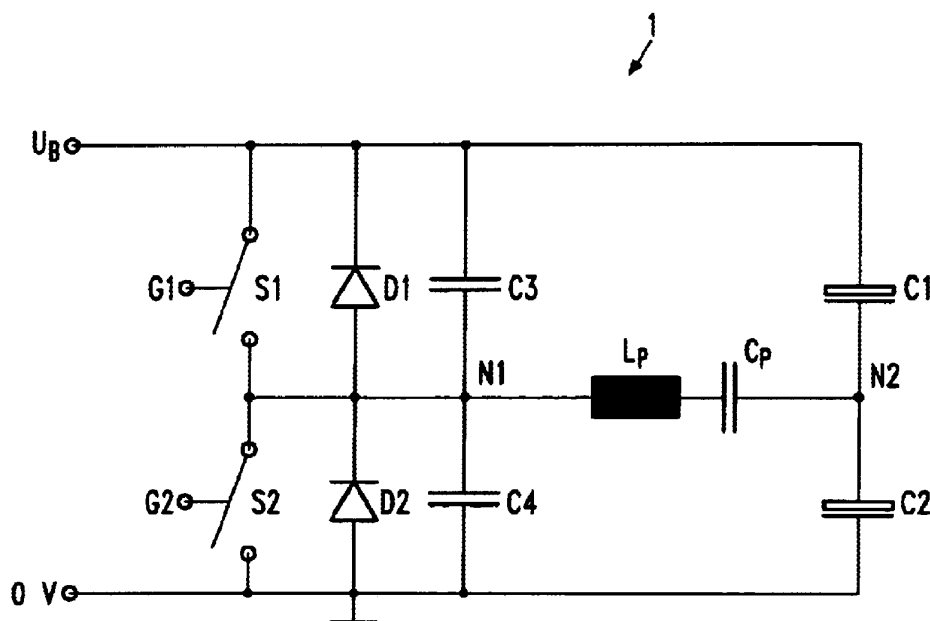
Primary Examiner—Shawn Riley

(74) *Attorney, Agent, or Firm*—Michael Best & Friedrich
LLP

(57) **ABSTRACT**

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

14 Claims, 4 Drawing Sheets



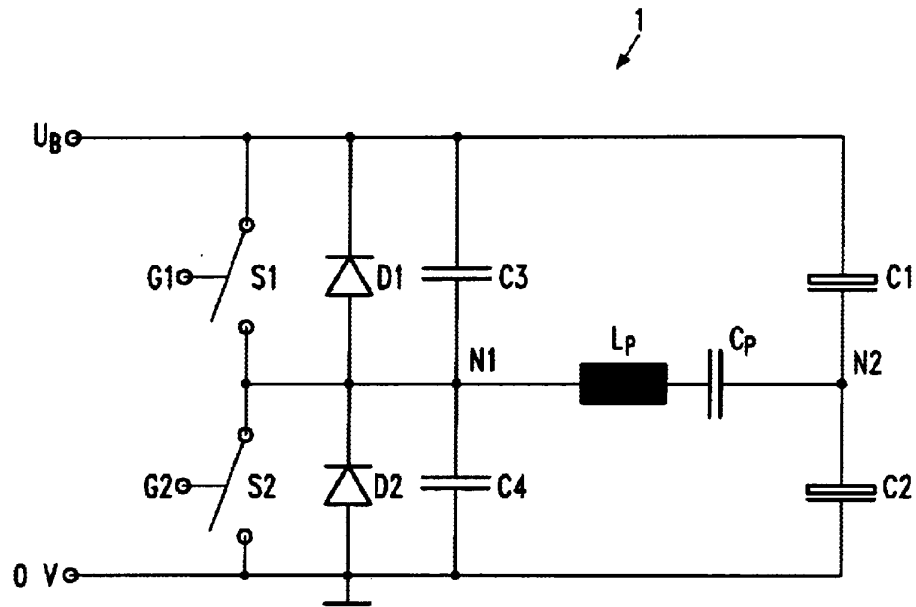


Fig. 1a

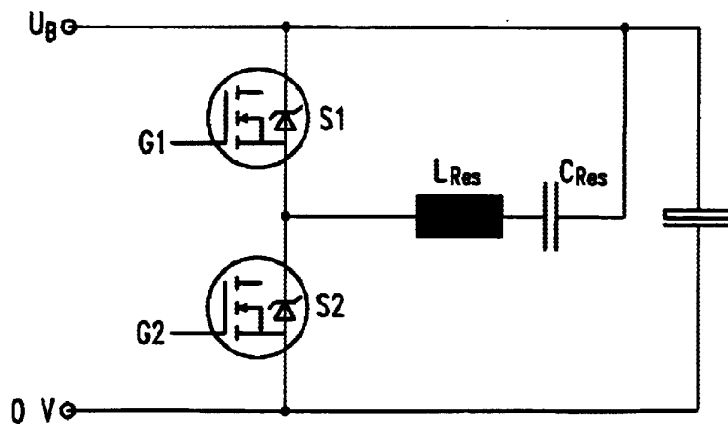


Fig. 1b

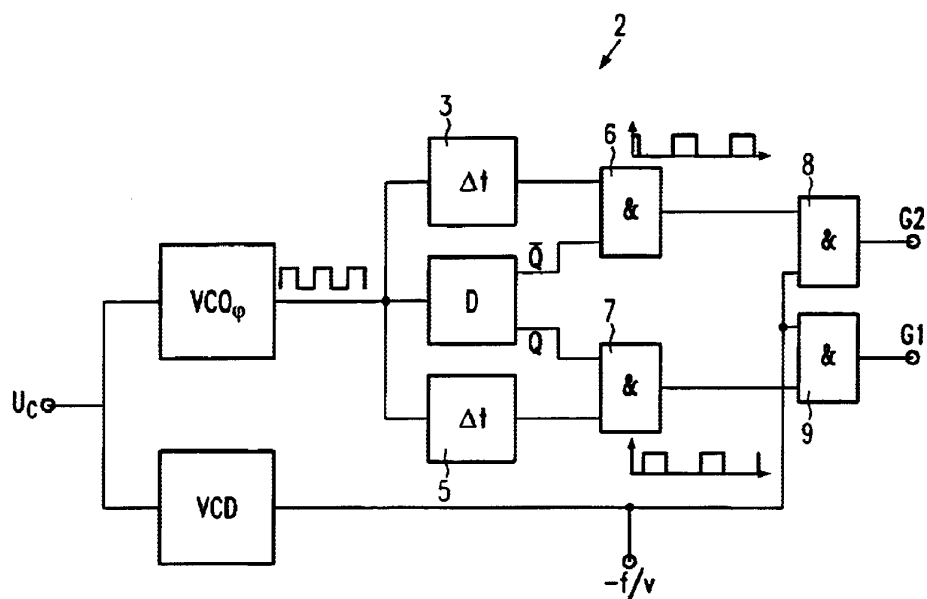


Fig.2

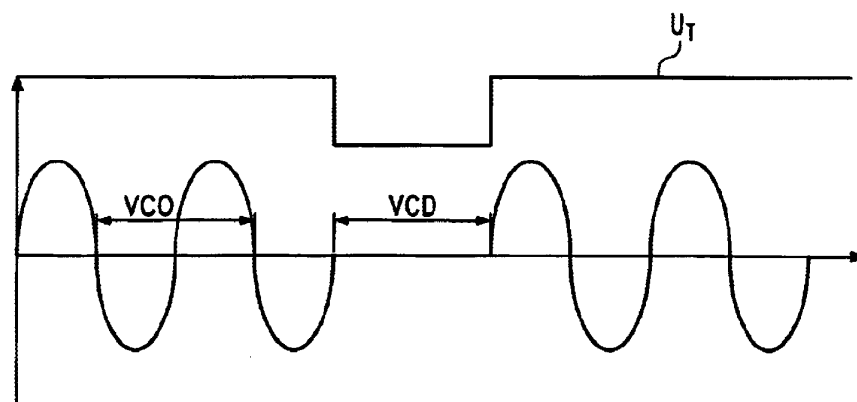


Fig.3

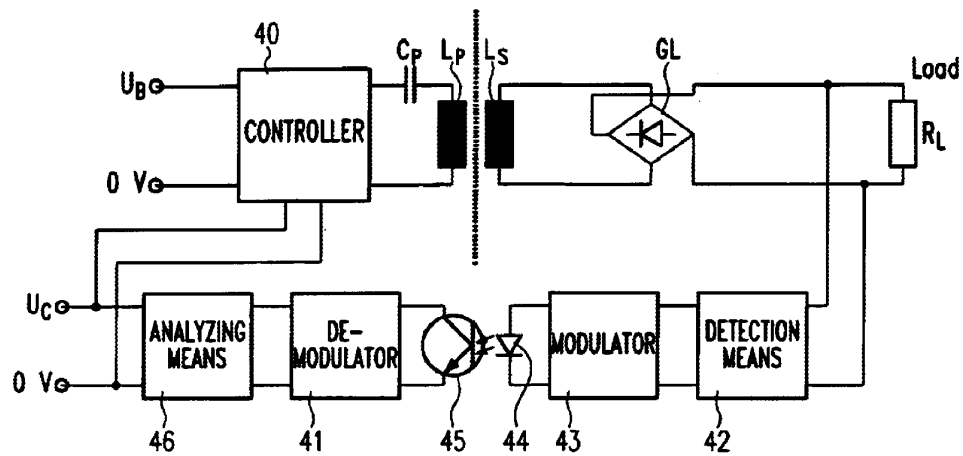


Fig.4

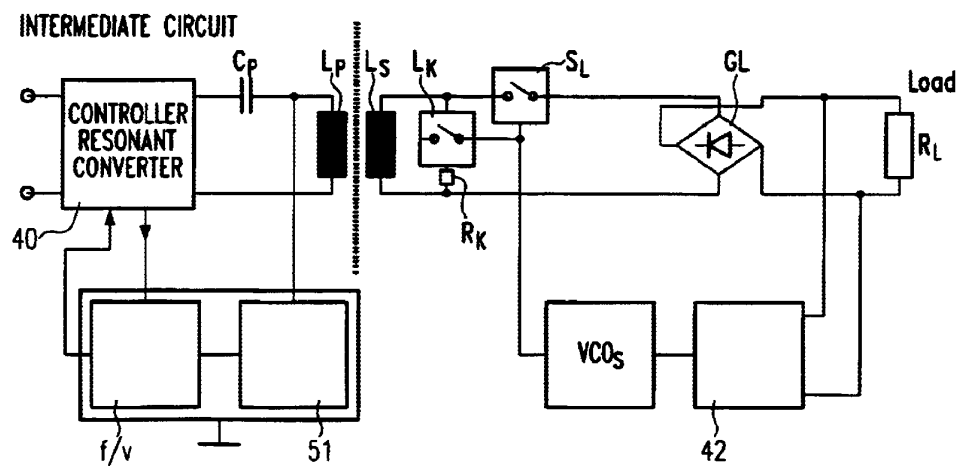
INDUCTIVE FEEDBACK

Fig.5

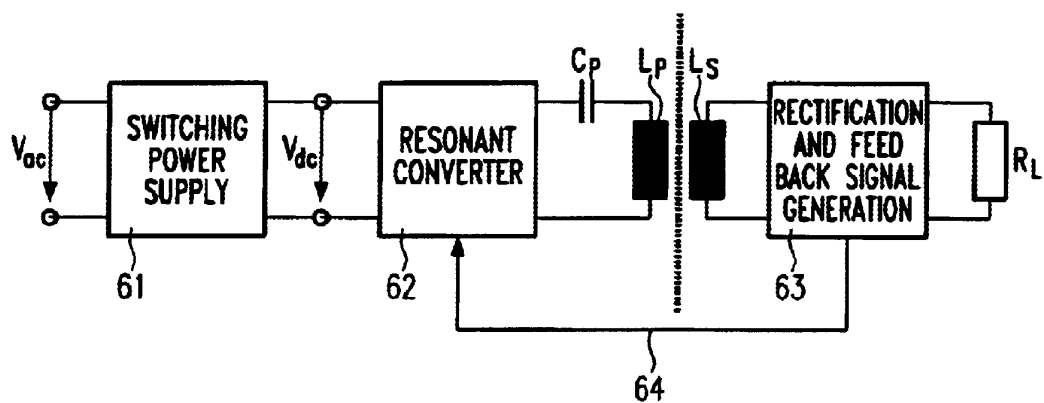


Fig. 6
(prior art)

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INDUCTIVE CONTACTLESS POWER TRANSMITTER

BACKGROUND OF THE INVENTION

The present invention relates to an inductive contactless power transmitter according to the preamble of patent claim 1. Such a power transmitter is known from U.S. Pat. No. 6,118,249.

SUMMARY OF THE INVENTION

U.S. Pat. No. 6,118,249 is concerned with the detection of a mobile part on a secondary side by an inductive charging station forming a primary side. On the secondary side, the ac voltage generated in the coil on the secondary side is rectified and supplied via a field effect transistor to a smoothing capacitor. The smoothing capacitor is discharged by a load including batteries. The field effect transistor is driven into the conductive state when the voltage at the smoothing capacitor falls below a lower value and is driven into the non-conductive state when said voltage exceeds an upper threshold value, resulting in hysteresis. The change in load effected by the switching on and off of a field effect transistor on the secondary side modulates the frequency and power input of the oscillator on the primary side. A feedback is realized in this way. The coil on the primary side is fed by a free-running oscillator. Due to the changes in load on the secondary side, the frequency of the oscillator is also changed. Said change in frequency can be determined by a simple frequency discriminator, such as a PLL (phase-locked loop), and a first control signal can be generated. Moreover, the current input of the oscillator can be measured as a voltage drop at an impedance. Said voltage drop is filtered, a second control signal being produced therefrom. In the presence of one of the two control signals, the oscillator is supplied with power. A third control signal ensures that the oscillator is switched on from time to time independently of the first two control signals.

German Offenlegungsschrift DE 197 41 279 A1 shows a device for charging batteries, the device consisting of a mobile electric device and a charging unit and inductively transmitting electrical power by means of a magnetic alternating field from a primary winding in the charging unit to a secondary winding in the mobile device. If there is no device in the charging unit or when a foreign body affects the magnetic alternating field, the charging unit should pass into a low-power waiting state. To this end, the magnetic alternating field supplied by the charging unit is produced by the primary windings of a free-running push-pull oscillator.

DE 196 33 171 A1 describes the contactless charging of batteries of a cordless hand-held apparatus via inductive transmitters which are arranged in a sub-housing. The inductive transmitters have connected thereto a control device which is also arranged in the sub-housing for controlling the charging operation and which also assumes a monitoring of the charge state of the electric energy storage devices.

U.S. Pat. No. 5,959,433 describes a universal inductive battery charger which charges a battery pack when the pack is placed on the charger. The battery pack comprises a pick-up coil for this purpose.

U.S. Pat. No. 6,160,374 describes an inductive charger as can e.g. be used for charging batteries of an electric vehicle.

A further embodiment of a known inductive contactless power transmitter is shown in FIG. 6. Typically, an alternating voltage V_{ac} is supplied to the power transmitter at a

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frequency of 50 to 60 Hz. A switching power supply 61 converts the ac voltage V_{ac} into a dc voltage V_{dc} which is supplied to a resonant converter 62. The resonant converter, in turn, generates an ac voltage, typically in the range of several 100 kHz. On the secondary side there is provided an inductor L_s which is magnetically coupled to the inductor L_p on the primary side. The circuit 63 on the secondary side comprises a rectifier and supplies the rectified voltage to a load R_L . Typically, the load R_L comprises batteries whose power demand decreases with an increasing load. Furthermore, the circuit 63 additionally includes a detection means for determining the power required on the secondary side. Said detection means measures either the voltage generated by the inductor L_s on the secondary side or the voltage at the batteries and produces a signal therefrom that is transmitted via the feedback 64 to the primary side and controls the resonant converter 62.

It is the object of the present invention to indicate an energy-efficient, inductive contactless power transmitter.

Said object is achieved by an inductive contactless power transmitter according to claim 1.

Preferred embodiments are the subject matter of the dependent claims.

A disconnecter for temporarily switching off the inductor on the primary side offers the advantage that in the switched-off state of the inductor on the primary side the power transmitter only consumes only a small amount of power.

The control of a pulse duty cycle control unit in response to the power demand on the secondary side, as determined by a detection means, offers the advantage that a sufficient amount of electrical power is always available on the secondary side and that this permits an automatic transition from a continuous to a pulsed operation.

The advantage of the combination of a continuous operation with a pulsed operation is an enlarged power range in which the power input on the primary side is adapted to the power demand on the secondary side without an unnecessarily large amount of energy being consumed on the primary side.

The separation of the continuous operation from the pulsed operation by a threshold value offers the advantage that the more energy-efficient continuous operation is exploited in an optimum way.

The advantage of an optical transmission path is that control signals need not be modulated on the secondary side to the high currents and voltages used for power transmission and that said high voltages and currents need not be filtered out therefrom on the primary side. Rather, the optical interface exclusively serves to transmit data from the secondary side to the primary side. An optical transmission path further offers the advantage that it does not lead to an electrical coupling between primary side and secondary side.

A modulation of the data transmitted from the secondary side via the photodiode to the photodetector on the primary side leads to reduced sensitivity to ambient light.

The supplementing of the inductor on the primary side by a capacitor to obtain a serial resonant circuit has the advantage that the power transmission from the primary side to the secondary side is improved. Advantageously, the highest frequency that can be produced by the voltage-controlled oscillator is chosen to be equal to the resonant frequency of said serial resonant circuit.

The use of a short-circuit switch or of a disconnecter switch is that an existing interface is used for the data transmission from the secondary side to the primary side.

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The generation of pulses (whose duration is short in comparison with the period duration of the alternating signal produced by the voltage-controlled oscillator) by a short-circuit switch or a disconnect switch has the advantage that the power transmission is only impaired for a short period of time. Furthermore, such pulses clearly differ from the alternating signal used for power transmission, so that they can be filtered out from the alternating signal on the primary side with relatively small efforts regarding the circuitry.

The use of frequency modulation for transmitting the power demand on the secondary side, as determined by the detection means, by means of a pulse train to the primary side, and of the frequency-to-voltage converter thus needed on the primary side has the advantage that the frequency modulation is interference insensitive relative to amplitude variations resulting from the phase position changing in time between the signals supplied by the two oscillators. Moreover, a frequency-to-voltage converter can be realized by a few components. To modulate the frequency of the pulses, a second voltage-controlled oscillator is advantageously used on the secondary side.

Advantageously, the frequency-to-voltage converter evaluates the signal supplied by the pulse detector only if power is transmitted from the primary side to the secondary side, i.e. an alternating signal is supplied to the inductor on the primary side, because, otherwise, no pulses can be transmitted and the pulse packet control would thus be regulated in a faulty way.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments will now be explained in the following in more detail with reference to the enclosed drawings, in which:

FIG. 1a shows a basic circuit for driving the inductor of a resonant transmitter on the primary side,

FIG. 1b shows a simplified basic circuit according to 1a;

FIG. 2 shows a drive circuit for the switches of the basic circuit shown in FIG. 1;

FIG. 3 shows a diagram for explaining the influence of a voltage-controlled oscillator and of a duty cycle control unit;

FIG. 4 shows a resonant transmitter with an optical feedback path;

FIG. 5 shows a resonant transmitter in which the two magnetically coupled inductors are used for transmitting the feedback signal; and

FIG. 6 shows a resonant transmitter according to the prior art.

FIG. 1a shows a basic circuit for driving an inductive resonant transmitter. The basic circuit includes a first and second switch S1 and S2, a first and second diode D1 and D2, two large capacitors C1 and C2, two small capacitors C3 and C4, a resonant capacitor C_p as well as an inductor L_p on the primary side. Nodes N1 and N1 are additionally plotted in FIG. 1.

The inductor L_p on the primary side forms a resonant circuit with the resonant capacitor C_p . The circuit operates at an oscillator frequency f_o , which is excited by switches S1 and S2. Whenever following the switching off of one of the switches the inductor L_p on the primary side produces—at node N1—a voltage which is by the conducting-state voltage of the diode D1 above the operating voltage U_B , said voltage is short-circuited by the diode D1 towards the operating voltage U_B . Likewise, an under-voltage at node N1 which is below mass by the conducting-state voltage of

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diode D2 is short-circuited against mass. The small capacitors C3 and C4 serve interference suppression because they short-circuit high-frequency signals that are created during opening and closing of the switches or MOSFETs and when diodes D1 and D2 become conductive.

The large capacitors C1 and C2 are electrolyte capacitors in one embodiment. They serve to stabilize the operating voltage U_B and form a virtual mass on node N2, so that voltage $U_B/2$ is here applied. That is why the capacitors C1 and C2 as well as the resonant capacitor C_p must have a dielectric strength of slightly more than $U_B/2$.

An embodiment which is simplified in comparison with the above description is shown in FIG. 1b. Switches S1 and S2 are here replaced by MOSFETs (MOSFET: metal oxide semiconductor field effect transistor). The diodes D1 and D2 can be omitted; their functions are taken over by the inverse diodes of the MOSFETs. Moreover, a capacitor C1 or C2 can be replaced by a short-circuit link by connecting L_p and C_p to the operating voltage. In this form the circuit operates in an unchanged way, but a dc voltage of $U_B/2$ is superposed on C_p . In these embodiments the respectively other capacitor and the resonant capacitor C_p must have a dielectric strength higher than the operating voltage U_B .

In the charge mode the inductor L_p on the primary side is magnetically coupled with an inductor L_s on the secondary side, as shown in FIGS. 4 and 5. Without a load on the impedance L_s on the secondary side, the switches S1 and S2 are opened and closed at a higher frequency than the resonant frequency of the resonant circuit which is formed by the inductor L_p on the primary side and the resonant capacitor C_p . A load on the coil on the secondary side results in a change in impedance of the coil L_s on the secondary side and thus in an off-resonance setting of the resonant circuit towards higher frequencies. As a consequence, at a constant oscillator frequency f_o , the oscillation frequency approaches the resonant frequency, whereby the transmitted power increases. To avoid switching losses and high-frequency disturbances, switching is carried out in the voltage-free state. This is referred to as ZVS (zero voltage switching).

When switch S2 is switched off, the current is first maintained by inductor L_p . As a result, the voltage on node N1 rises, with the small capacitor C3 being discharged and the small capacitor C4 charged. Finally, when the voltage on node N1 exceeds the operating voltage U_B by the diode forward voltage of diode D1, diode D1 becomes conductive, thereby defining the voltage on node N1. It is only now that switch S1 is activated. After switch S1 has been deactivated, switch S2 will only be activated when the voltage on node N1 falls below 0V by the forward voltage of diode D2.

According to a preferred embodiment the control electrodes G1 and G2 are controlled by the drive circuit 2 shown in FIG. 2. The drive circuit 2 comprises a voltage-controlled oscillator (VCO_p), two delay elements 3 and 5, a delay flip-flop D and gates 6, 7, 8, 9 as well as a duty cycle control unit VCD. Both the voltage-controlled oscillator VCO_p and the duty cycle control unit VCD have a control signal U_C supplied thereto. The control signal U_C depends on the power demand of the secondary side. It will be explained further below with reference to FIGS. 4 and 5 how the control signal is generated.

In one embodiment the control signal is an analog voltage which can vary between an upper and a lower limit value. In one embodiment the control signal U_C has its maximum voltage at a maximum output load on the secondary side. Under these circumstances the voltage-controlled oscillator VCO_p produces its minimum frequency. This corresponds to

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the resonant frequency of the resonant circuit. When the load on the secondary side decreases, the voltage of the control signal decreases as well. As a result, the voltage-controlled oscillator VCO_P produces an increasing frequency that shifts the oscillator frequency f_O relative to the resonant frequency of the resonant circuit formed by L_P and C_P . At this point the control signal U_C reaches a threshold value.

A further reduction of the transmitted power is achieved with the help of the voltage-controlled duty cycle control unit VCD. The duty cycle control unit produces a frequency that is small in comparison with the oscillator frequency VCO_P . Small in this context means smaller than half as great. Depending on the control signal U_C , the duty cycle control unit changes the duty ratio of the output signal. When the control signal U_C has a value above the threshold value, the duty ratio is 100%, so that the duty cycle control unit always outputs a logic one. This means in the case of a CMOS logic (complementary metal oxide semiconductor) that the duty cycle control unit outputs a voltage slightly below the operating voltage U_B . It is only when the control signal falls below the threshold value that the duty cycle control unit actually outputs an ac voltage. With a decreasing control signal the duty ratio becomes smaller and smaller, and even when the control signal U_C assumes its minimum value, the duty ratio remains still greater than zero. For instance, the smallest adjustable duty ratio may be 1 or 0.1%. As will be explained further below, it can no longer be detected at a duty cycle ratio of 0 whether a secondary side is magnetically coupled with the primary side, i.e. whether e.g. a mobile device is placed in the charging tray.

The alternating signal of the voltage-controlled oscillator VCO_P on the primary side is supplied to the two delay elements 3 and 5 and to the delay flip-flop D. The output $\bar{Q}$ of the delay flip-flop D and the output of the delay element 3 are supplied to the AND gate 6. The output Q of the delay flip-flop D and the output of the delay element 5 are supplied to the AND gate 7. At the outputs of the AND gates 6 and 7, two output signals that are phase-shifted by 180° are thereby created at a duty ratio of slightly below 50% for controlling switches S1 and S2. Thanks to the ANDing of the duty signal U_T with the output signals of the AND gates 6 and 7 in the AND gates 8 and 9, ac voltage is supplied at times to the control electrodes G1 and G2 in accordance with the duty signal U_T and is not supplied at times. This is shown in FIG. 3. While the duty signal is at a high level, which corresponds to a logic one, ac voltage is supplied to the control electrodes G1 and G2 and thus to the resonant circuit consisting of L_P and C_P . The frequency of the ac voltage is determined by the voltage-controlled oscillator VCO. While the duty signal has a low level, no ac voltage is passed on through the AND gates 8 and 9. In another embodiment, the AND gates 6 and 8 and the AND gates 7 and 9 may each be realized by an AND gate with three inputs.

In another embodiment, the operating ranges of the voltage-controlled oscillator VCO_P and the duty cycle control unit VCD are overlapping, so that a central range exists in which upon a change in the control signal both the duty ratio of the duty signal U_T and the frequency of the alternating signal are changed. Apart from such a transitional range, there may be an upper range in which a change in the control signal U_C just influences the frequency of the voltage-controlled oscillator VCO_P on the primary side and a lower range in which a change in the control signal U_C just influences the duty cycle ratio of the duty signal U_T .

An embodiment of the feedback of the load on the secondary side to the primary side will be explained with reference to FIG. 4. FIG. 4 shows a controller 40, the

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resonant circuit formed by L_P and C_P , the inductor L_S on the secondary side, a rectifier GL, a load R_L , a detection means 42, a modulator 43, a photodiode 44, a photoelement 45, a demodulator 41, and an analyzing means 46.

Circuit 40 substantially contains the drive circuit 2 shown in FIG. 2 and the basic circuit 1 shown in FIG. 1 and used for driving the inductor L_P and the resonant capacitor C_P on the primary side. The inductor L_S on the secondary side is magnetically coupled to the inductor L_P on the primary side. The ac voltage supplied by the inductor on the secondary side is rectified in the rectifier GL and supplied to a load R_L . The load R_L can also include batteries so that the power required by the batteries decreases with an increasing load. In this instance the power required by load R_L is variable in time.

A detection means 42 determines the power demand on the secondary side. The detection means 42 can e.g. measure the voltage decreasing on the load, the voltage across the batteries or also the load current. The output signal of the detection means is preferably an analog voltage which is supplied to the modulator 43. Said modulator modulates the voltage supplied by the detection means 42 to a carrier signal and controls the photodiode 44. The light of the photodiode 44 impinges on a photoelement which can e.g. be realized as the phototransistor. The output signal supplied by the photoelement is demodulated in the demodulator 41 and analyzed in the analyzing means 46 and thus converted into the control signal U_C . The demodulation operation takes place in the reverse order compared to the modulation operation.

Sensitivity to ambient light, which can also impinge on the photoelement, can be reduced by modulating the output signal supplied by the detection means. In particular, ambient light variations are most of the time slow and not periodic, so that they clearly differ from a modulated signal. Frequency modulation can advantageously be employed as a kind of modulation.

The primary side can e.g. be designed as a charging tray while the secondary side may be a mobile or cordless telephone or also an electric toothbrush. Charging tray and secondary device are designed such that the secondary device can easily be removed from the charging tray and that upon insertion of the secondary device into the charging tray the two inductors L_P and L_S are closely positioned side by side, so that a magnetic coupling takes place. The photodiode 44 is also positioned near the photoelement when the secondary device is inserted in the charging tray, so that a sufficiently large amount of the light produced by the photodiode 44 impinges on the photoelement.

FIG. 5 shows an embodiment in which in contrast to FIG. 4 a signal about the power demand on the secondary side is transmitted via the two inductors L_P and L_S to the primary side. FIG. 5 shows a controller 40, a resonant circuit formed by L_P and C_P , the inductor L_S on the secondary side, a short-circuit switch S_K as well as a disconnect switch S_L , a short-circuit resistor R_K , a rectifier GL, a load R_L , a detection means 42, a voltage-controlled oscillator VCO_S on the secondary side, a pulse detector 51, as well as a frequency-to-voltage converter f/v.

As described above, the detection means 42 determines the power required on the secondary side. It outputs an analog voltage. The voltage-controlled oscillator VCO_S controls either the short-circuit switch S_K , the disconnect switch S_L or both types of switches S_K and S_L together. To avoid undesired power loss, the short-circuit switch S_K is only closed for a very short period of time, i.e. considerably shorter than the period duration of the alternating signal

supplied by the voltage-controlled oscillator VCO_P on the primary side. Moreover, the frequency of the voltage-controlled oscillator VCO_S on the primary side is lower than the frequency supplied by the voltage-controlled oscillator VCO_P on the primary side. To this end the voltage-controlled oscillator VCO_S on the secondary side supplies an alternating signal the duty ratio of which is almost zero or one.

The short circuit on the secondary side creates a drop in the oscillator voltage on the primary side, said drop being detectable. Since each real switch and each real line has a resistor, said resistor was explicitly plotted as R_K in the circuit diagram. The short-circuit resistance R_K can be chosen to be so high that on the primary side the pulse detector **51** can detect a voltage drop with a sufficient noise ratio. It is thus not necessary that the short-circuit switch S_K and the short-circuit resistor R_K actually short-circuit the inductor L_S on the secondary side, i.e. R_K is actually lower than the resistance of the inductor L_S on the secondary side. The designations "short-circuit switch" and "short-circuit resistor" were chosen because they illustrate the connecting together of the two elements with the inductor L_S on the secondary side.

In another embodiment a disconnecter switch S_L may also be connected between the inductor L_S and the rectifier GL on the secondary side. The opening of the disconnecter switch leads—on the primary side—to a rise in voltage at the inductor L_P on the primary side. The disconnecter switch S_L is only opened for a short period of time in comparison with the period duration of the alternating signal supplied by the voltage-controlled oscillator VCO_P on the primary side. The power supply of the load on the secondary side is disturbed in this way only slightly. For this purpose, the disconnecter switch is also operated at a frequency below the frequency used for power transmission.

In a third embodiment, both short-circuit switch S_K and disconnecter switch S_L are provided. They are preferably switched one after the other, so that the short-circuit switch is first short-circuited and directly thereafter the disconnecter is opened, or vice versa. This first of all creates a drop on the primary side, followed by an increase in voltage, or vice versa. An improvement of the noise ratio and thus a reliable detection of the pulses on the primary side can thereby be carried out.

On the primary side a pulse detector **51** is provided for detecting the voltage increases or voltage drops on the inductor on the primary side. Since the drops or increases are short in comparison with the period duration of the alternating signal used for power transmission, they can be detected with little effort. The pulse detector may e.g. consist of a high-pass filter. A pulse shaper may be provided after the high-pass filter, so that the signal produced by the voltage-controlled oscillator VCO_S on the secondary side is regenerated on the primary side after the pulse detector, for the pulse height is modulated with the alternating signal used for power transmission. That is why it is more advantageous to encode the information to be transmitted by frequency modulation into the time sequence of the pulses than to use an amplitude modulation. Moreover, an amplitude modulation would not be possible by switching on and off the switches S_K and/or S_L alone. Subsequently, the control signal U_C which is supplied to the voltage-controlled oscillator VCO_P on the primary side and the duty cycle control unit VCD is produced in a frequency-to-voltage converter f/v.

The duty signal U_T , in turn, which is produced by the duty cycle control unit, is supplied to the frequency-to-voltage

converter f/v. The frequency-to-voltage converter f/v will only change its output voltage if power is transmitted to the secondary side because it is only then that data can be transmitted from the secondary side to the primary side. Otherwise, the voltage-controlled oscillator VCO_P and the duty cycle control unit VCD on the primary side would be controlled in a wrong way. This e.g. prevents a possible heating by foreign bodies.

What is claimed is:

1. Inductive contactless power transmitter comprising:

a primary side including:

- a first inductor (L_P) on the primary side;
- a first oscillator for producing an alternating signal which is supplied to said inductor (L_P) on the primary side;

a secondary side including:

- an inductor (L_S) on the secondary side which can be coupled to said inductor (L_P) on the primary side;
- a load (R_L) which is variable in time or constant; and
- a detection means (**42**) for determining a power demand of said load on the secondary side,

characterized in that

said first oscillator is a voltage-controlled oscillator (VCO_P) having a frequency which is adjustable in response to the power demand determined by said detection means (**42**).

2. Power transmitter according to claim 1, characterized in that said primary side includes a disconnecter (VCD , **8, 9**) for temporarily preventing the alternating signal produced by said oscillator (VCO_P) from being supplied to said inductor (L_P) on the primary side.

3. Power transmitter according to claim 2, characterized in that said disconnecter comprises a voltage-controlled duty cycle control unit (VCD) and logic gates (**8, 9**), said duty cycle control unit producing a duty signal (U_T) which controls said logic gates, said duty cycle control unit controlling the duty ratio of said duty signal in dependence upon the power demand determined by said detection means, and said alternating signal being supplied to said logic gates in addition to said duty signal.

4. Power transmitter according to claim 3, characterized in that in the case of a small power demand the primary side is adapted to a slightly changed power demand on the secondary side mainly by increasing or reducing the duty ratio, whereas in the case of a high power demand the primary side is mainly adapted to a slightly changed power demand by increasing or decreasing the frequency of said oscillator.

5. Power transmitter according to claim 4, characterized in that a threshold value is provided for the power demand on the secondary side, the primary side below the threshold value adapting said duty cycle control unit to the power demand on the secondary side by changing the duty ratio, said first oscillator (VCO_P) producing its maximum or minimum frequency, and the primary side above the threshold value being adapted to the power demand on the secondary side by changing the frequency of said first oscillator (VCO_P) between a minimum and the maximum frequency, said duty cycle control unit holding the duty ratio at 100%.

6. Power transmitter according to any one of the above claims, characterized by a photodiode (**44**) on the secondary side and a photodetector (**45**) and an analyzing means (**46**) on the primary side, said photodiode (**44**) being optically coupled with said photodetector, said detection means (**42**) controlling said photodiode, and said analyzing means (**46**) supplying a voltage signal to said first oscillator (VCO_P), said voltage signal depending on the signal supplied by said photodetector.

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7. Power transmitter according to claim 6, characterized in that a modulator (43) is further provided on the secondary side and a demodulator (41) on the primary side, said modulator (43) being fed with the output signal of said detection means (42) and said modulator directly driving said photodiode, and the signal supplied by said photodiode being supplied to said demodulator (41) and the output signal thereof being supplied to said analyzing means.

8. Power transmitter according to any one of the above claims, characterized in that a capacitor (C_p) is connected on the primary side in series with said inductor (L_p) on the primary side, the resonant frequency from said inductor (L_p) and capacitor (C_p) on the primary side being equal to the maximum or minimum frequency of said first oscillator (VCO_p).

9. Power transmitter according to any one of claims 1 to 5, characterized in that a short-circuit switch (S_K) which is opened and closed by said detection means (42) in a controlled way is provided on the secondary side in parallel with said inductor (L_s) on the secondary side.

10. Power transmitter according to any one of claims 1 to 5 or 9, characterized in that said inductor on the secondary side is connected via a disconnecter switch (S_L) to the load, so that said disconnecter switch (S_L) can separate said inductor (L_s) on the secondary side from said load (R_L), said disconnecter switch (S_L) being controlled by said detection means (42).

11. Power transmitter according to claim 9 or 10, characterized in that on the primary side a pulse detector (51) is provided for detecting pulses whose duration is short or long

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in comparison with the period duration of said alternating signal produced by said first oscillator (VCO_p), the output signal of said pulse detector (51) controlling said first oscillator (VCO_p).

12. Power transmitter according to claim 11, characterized in that on the primary side there is further provided a frequency-to-voltage converter (f/v) which has supplied thereto the output signal of said pulse detector (51) and supplies a voltage (U_T) to said first oscillator (VCO_p).

13. Power transmitter according to any one of claims 9 to 12, characterized in that on the secondary side a second voltage-controlled oscillator (VCO_s) is provided which has supplied thereto a control voltage produced by said detection means (42), said second oscillator (VCO_s) controlling said short-circuit switch (S_K) and/or said disconnecter switch (S_L), said second oscillator (VCO_s) producing pulses of a pulse duration which is short or long in comparison with the period duration of said alternating signal produced by said first oscillator (VCO_p), and whose frequency is low or high in comparison with that of said alternating signal.

14. Power transmitter according to claim 12, as far as it refers back to claim 3, characterized in that the duty signal of said duty cycle control unit (VDC) is supplied to the frequency-to-voltage converter (f/v) and the frequency-to-voltage converter (f/v) will only change the voltage on the basis of the signal supplied by said pulse detector if said alternating signal of said first oscillator (VCO_p) is supplied to said inductor on the primary side and said frequency-to-voltage converter (f/v) keeps the voltage otherwise constant.

* * * * *

EXHIBIT F



US005949213A

United States Patent [19]
Lanni

[11] **Patent Number:** **5,949,213**
[45] **Date of Patent:** **Sep. 7, 1999**

[54] **METHOD AND SYSTEM FOR CHARGING RECHARGEABLE BATTERIES**

[75] Inventor: **Thomas W. Lanni**, Laguna Niguel, Calif.

[73] Assignee: **Comarco Wireless Technologies, Inc.**, Irvine, Calif.

[21] Appl. No.: **09/213,018**

[22] Filed: **Dec. 16, 1998**

Related U.S. Application Data

- [63] Continuation-in-part of application No. 09/148,811, Sep. 4, 1998, which is a continuation of application No. 08/994,905, Dec. 19, 1997, Pat. No. 5,838,554, which is a continuation-in-part of application No. 08/767,307, Dec. 16, 1996, abandoned, which is a continuation-in-part of application No. 08/567,369, Dec. 4, 1995, Pat. No. 5,636,110, which is a continuation-in-part of application No. 08/233,121, Apr. 26, 1994, Pat. No. 5,479,331
- [60] Provisional application No. 60/002,488, Aug. 17, 1995.

- [51] **Int. Cl.⁶** **H02J 72/00**
[52] **U.S. Cl.** **320/106; 363/144**
[58] **Field of Search** 320/132, DIG. 4, 320/106; 363/144, 147, 21, 97

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Primary Examiner—Adolf Deneke Berhane

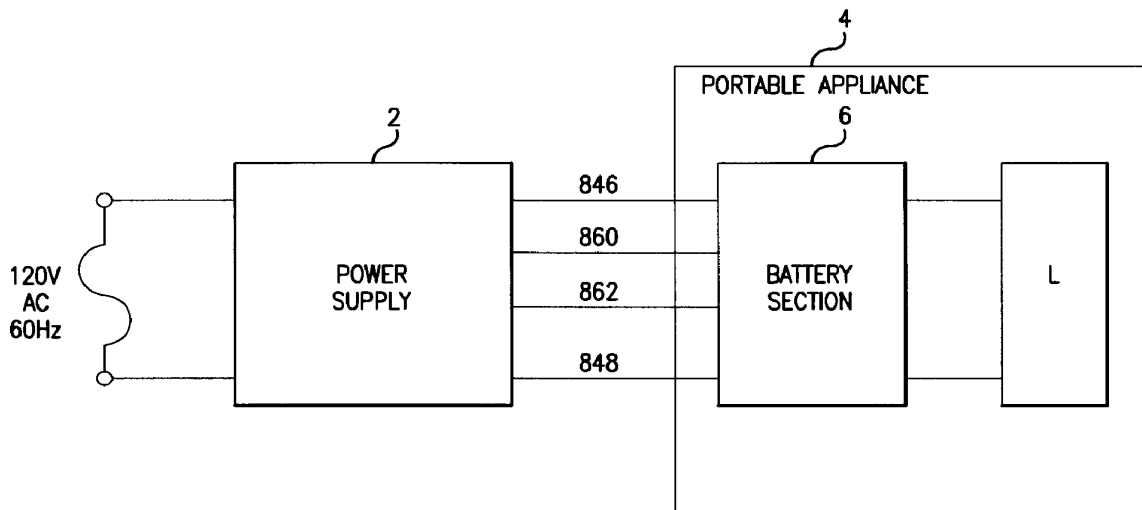
Attorney, Agent, or Firm—Pillsbury Madison & Sutro LLP

[57]

ABSTRACT

A system and method for charging rechargeable batteries is disclosed. A charging circuit monitors aspects of a rechargeable battery during charging and applies power to the terminals of the battery received from a power supply. The charging circuitry signals to a power supply to control the current or voltage applied to the charging circuitry based upon the monitored aspects of the battery and the type of charge storing compound within the cells of the battery. The charging circuitry and battery may be part of a rechargeable battery cartridge disposed within a compartment of a portable electronic device having a dynamic operational load. By controlling the power supply, the charging circuitry can simultaneously apply power to the operational load to operate the device while charging the battery.

18 Claims, 27 Drawing Sheets



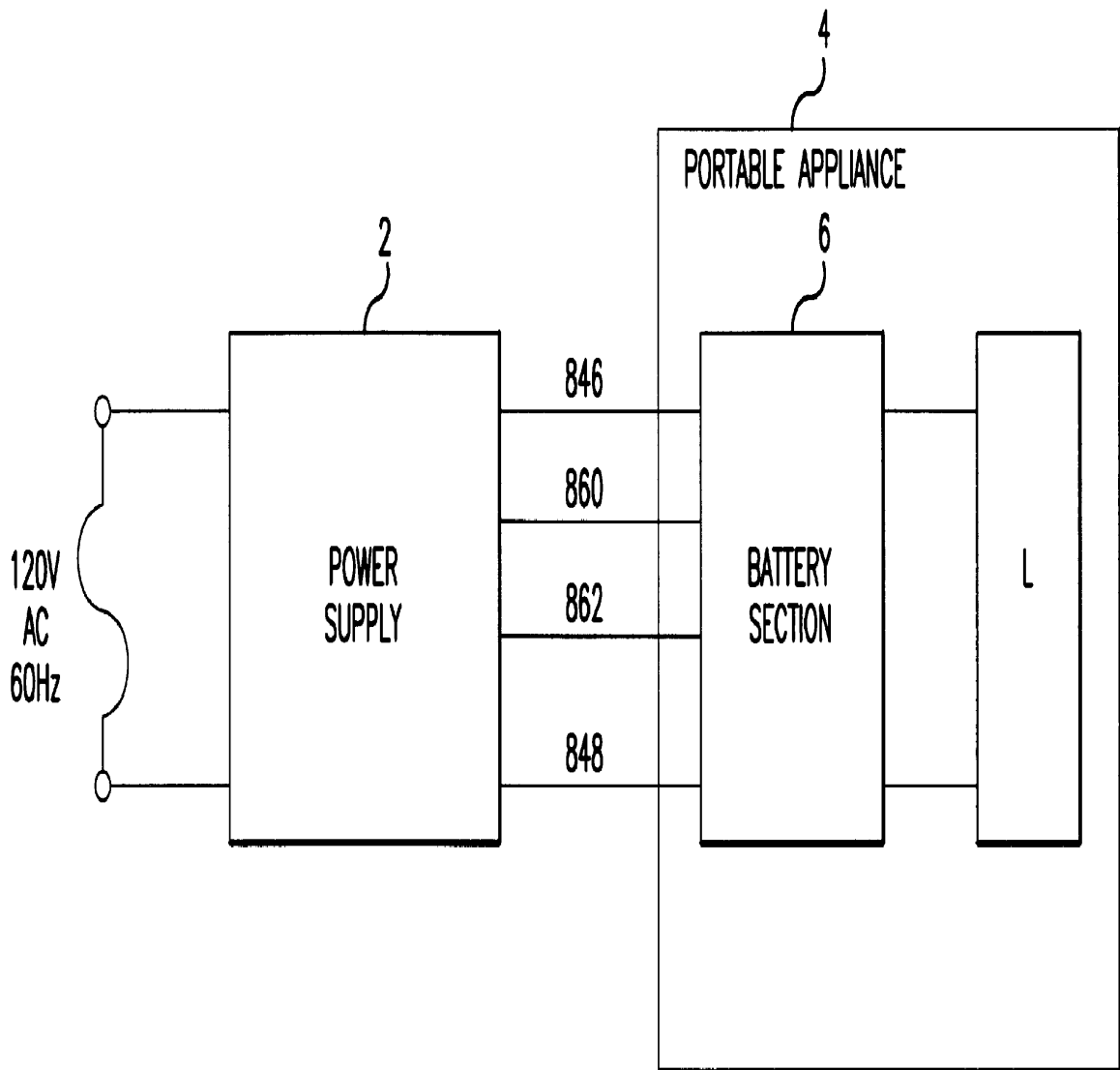


FIG. 1

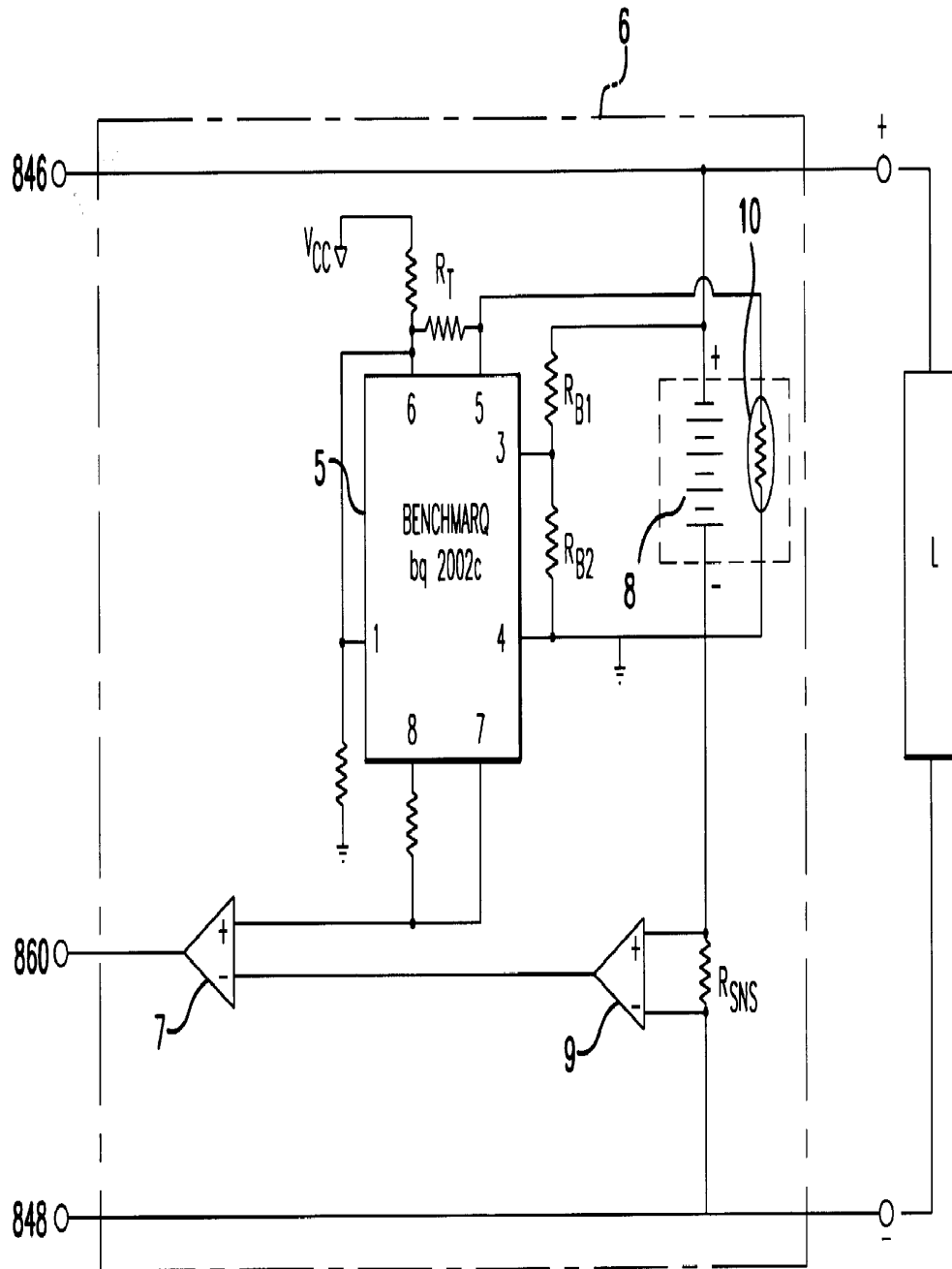


FIG.2

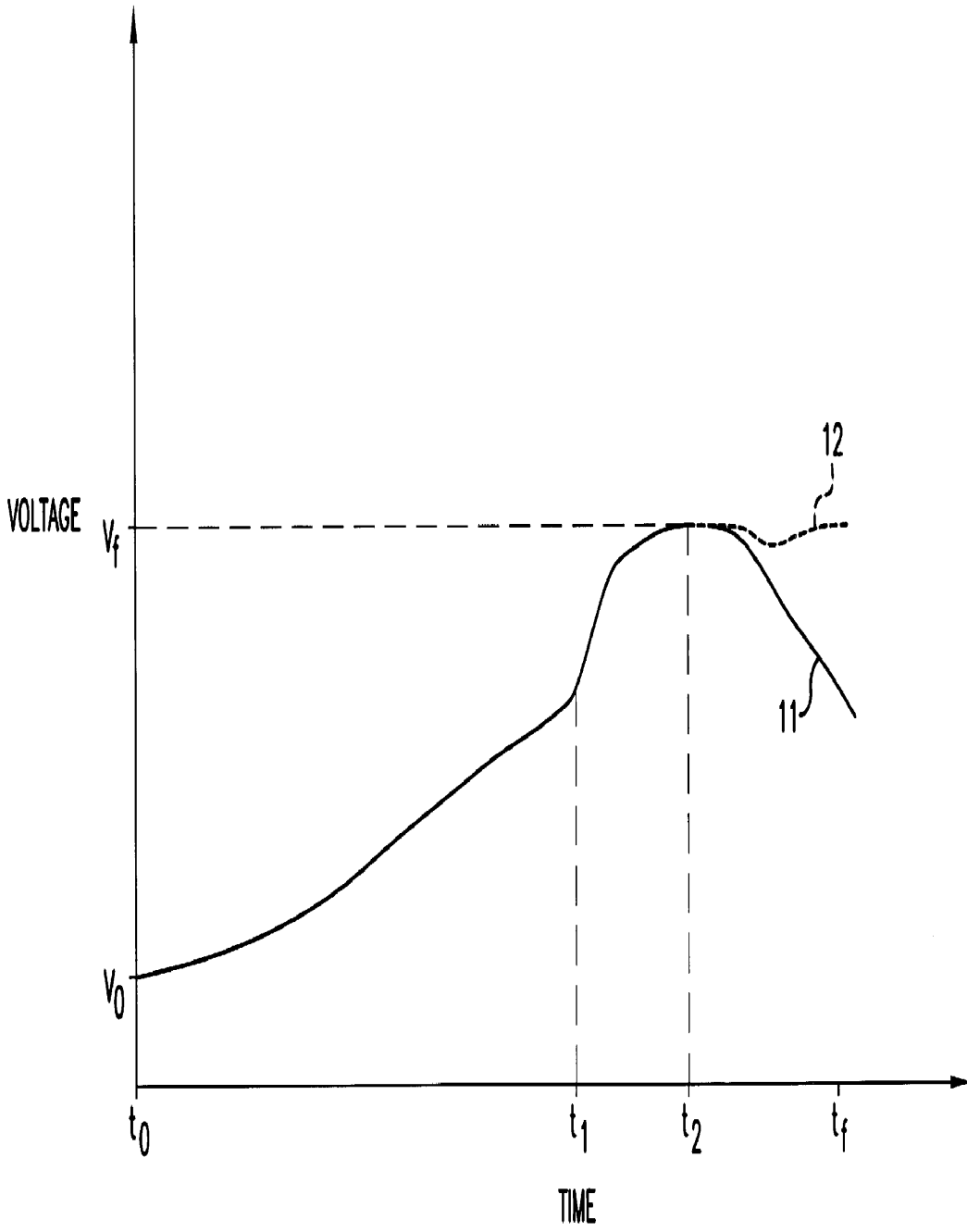


FIG.3

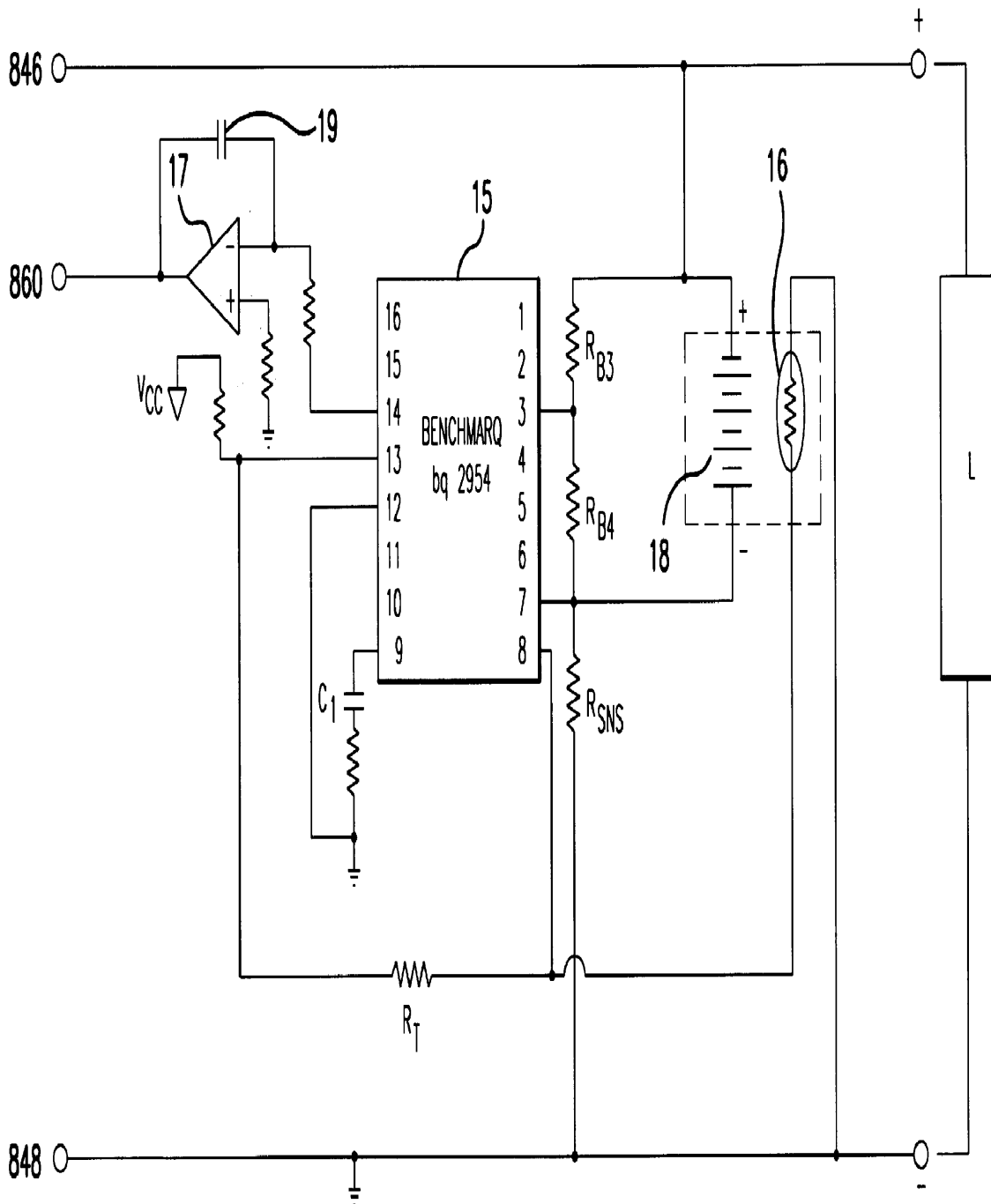


FIG. 4

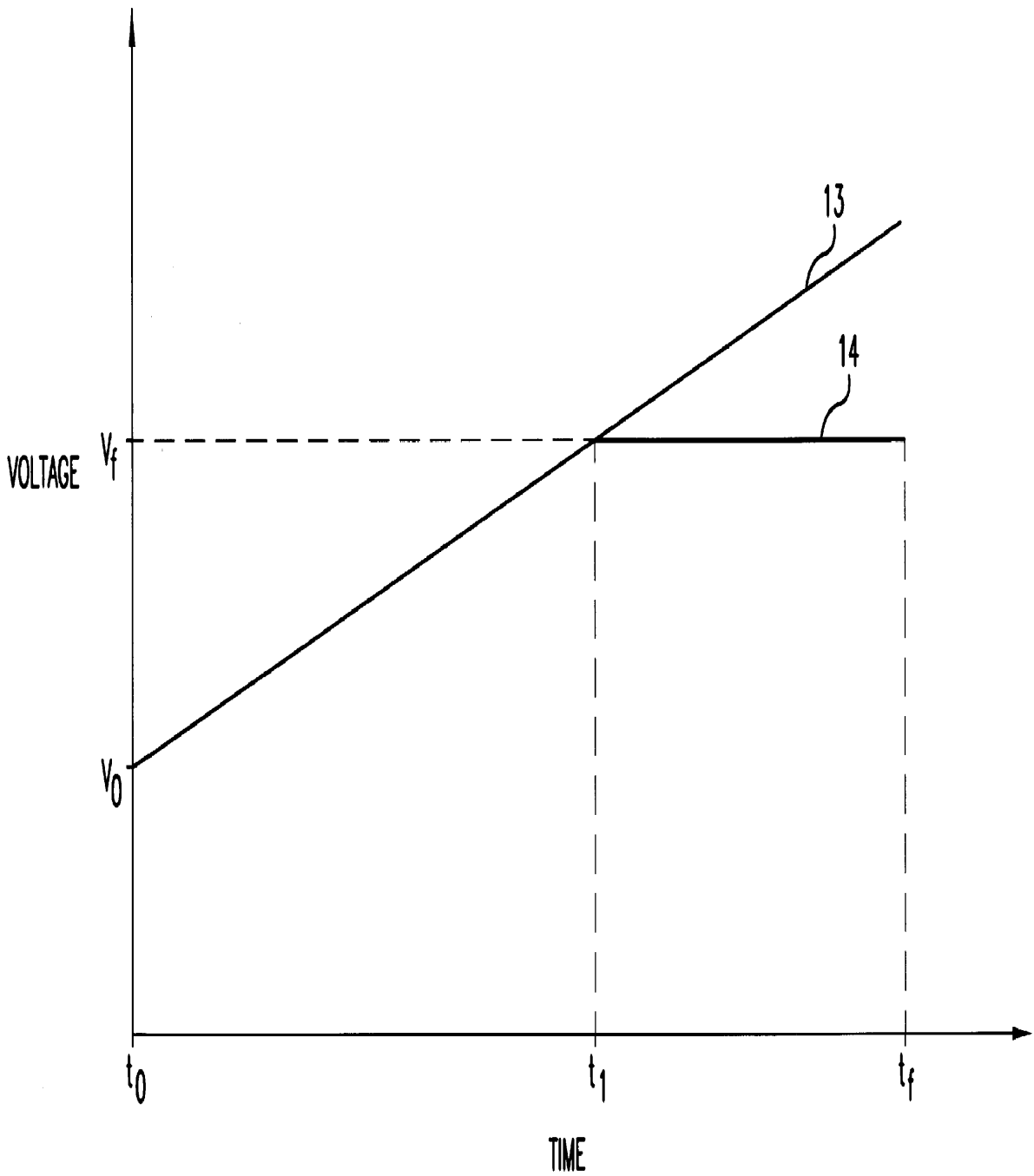


FIG.5

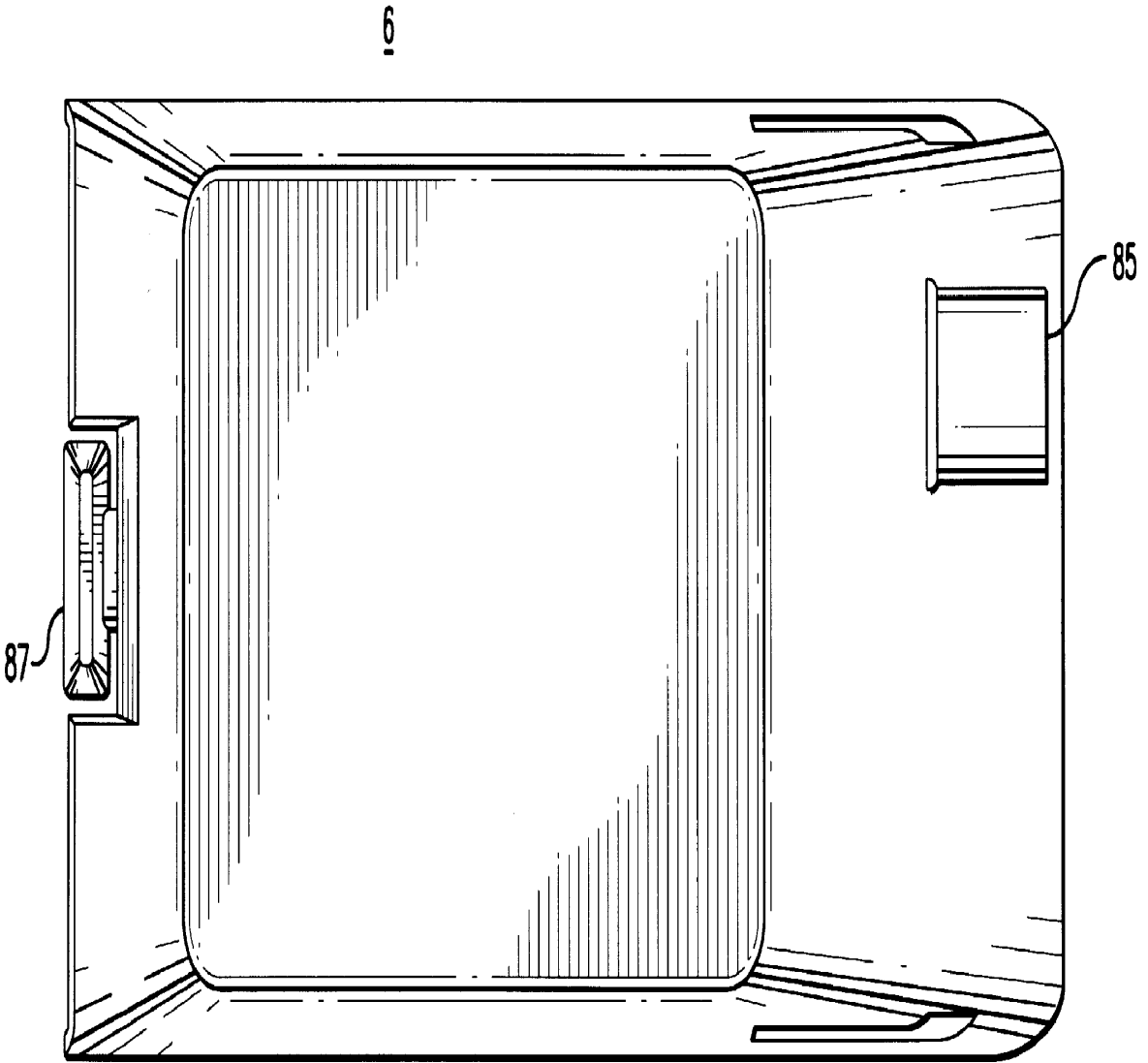


FIG. 6A

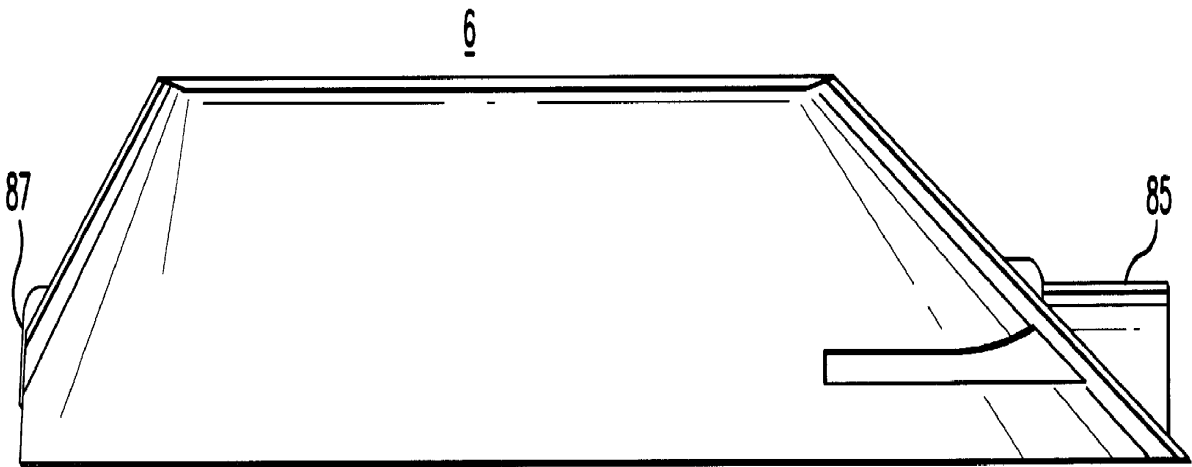


FIG. 6B

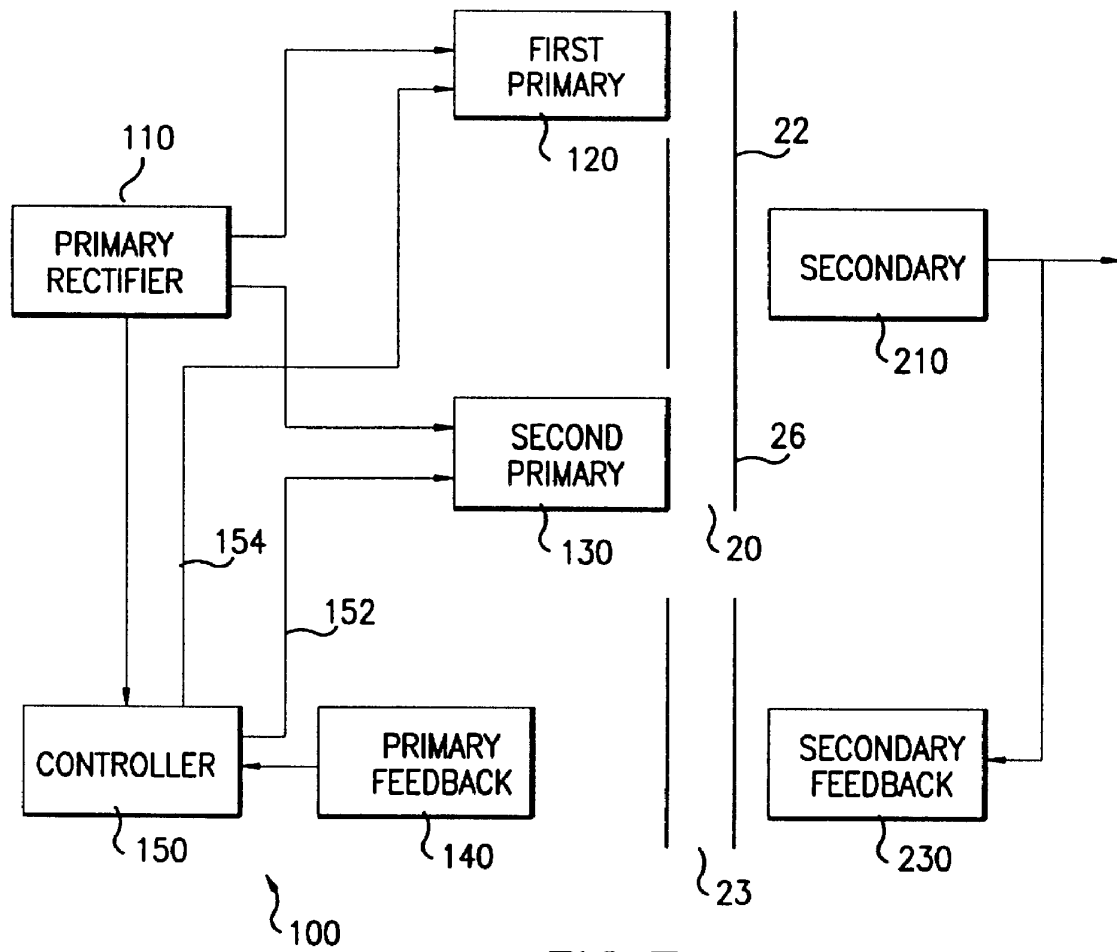


FIG. 7

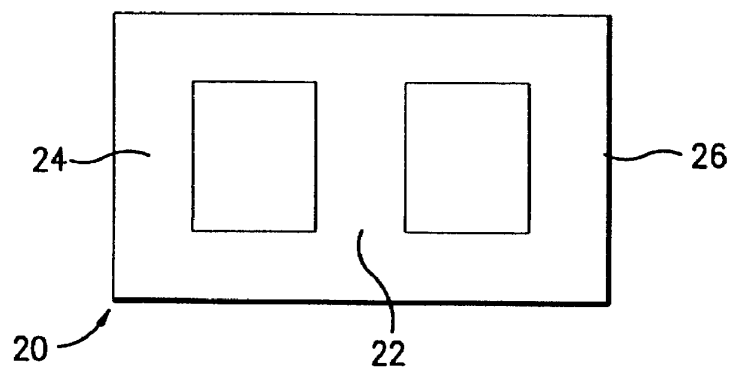


FIG. 8

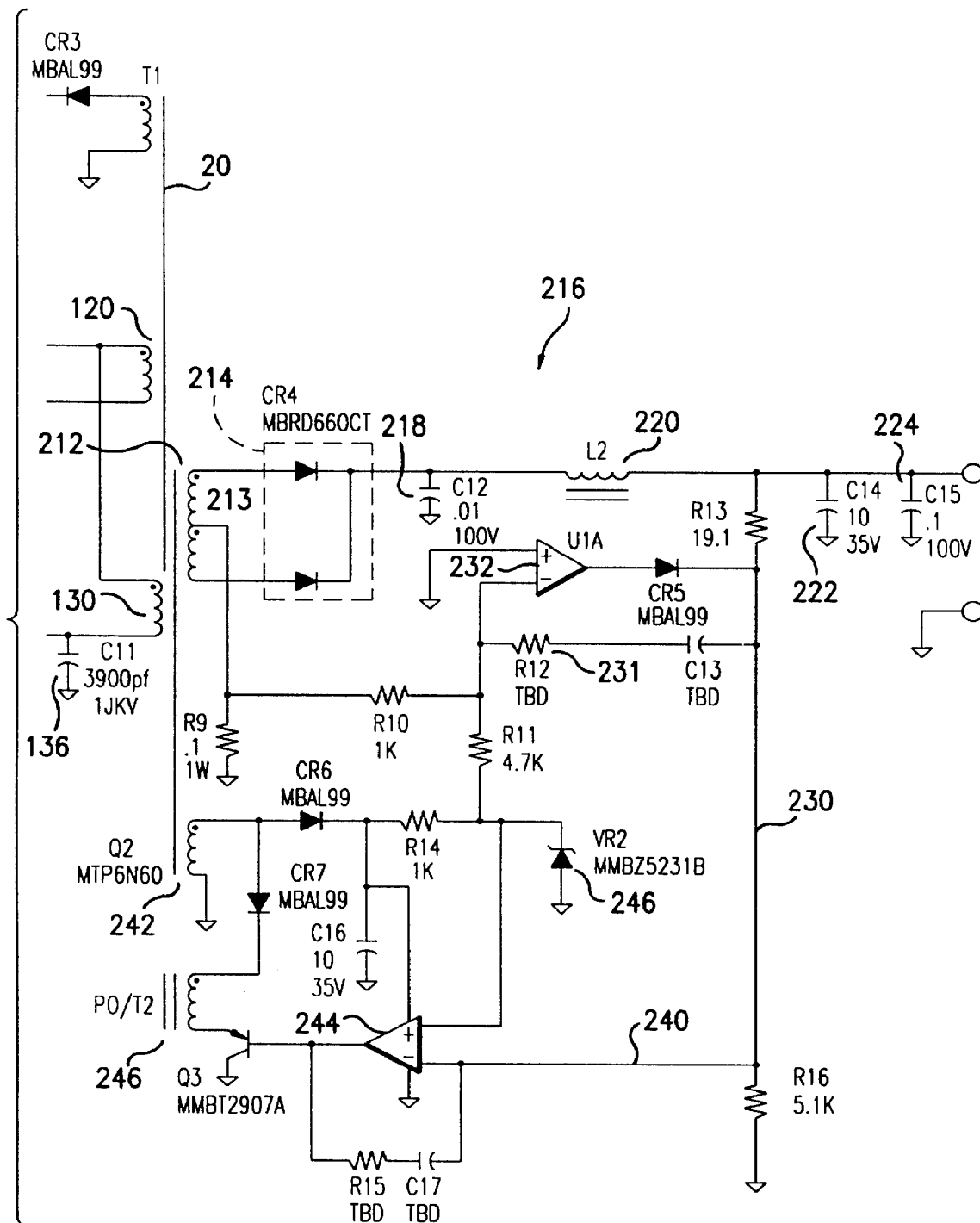
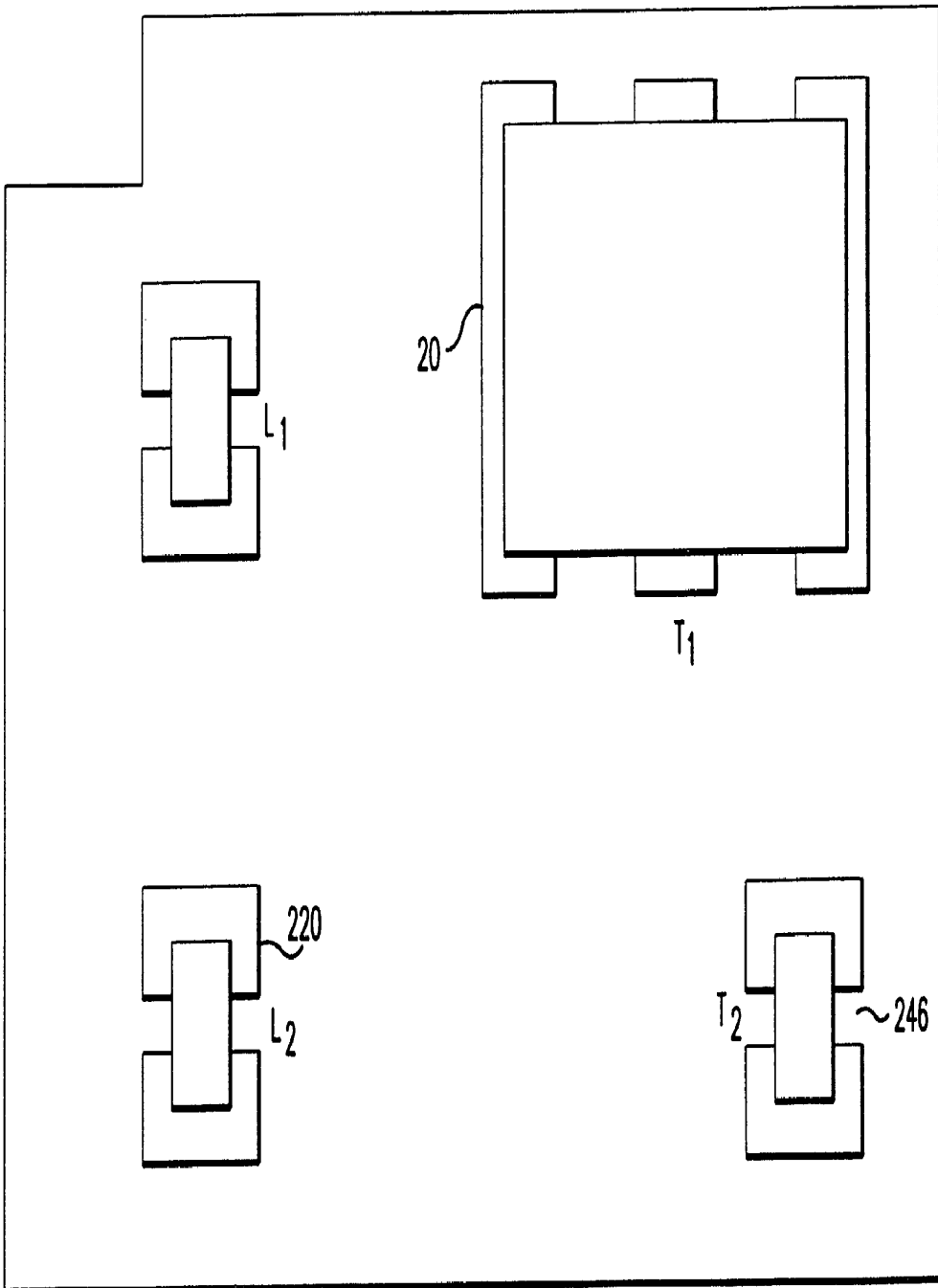


FIG. 9B



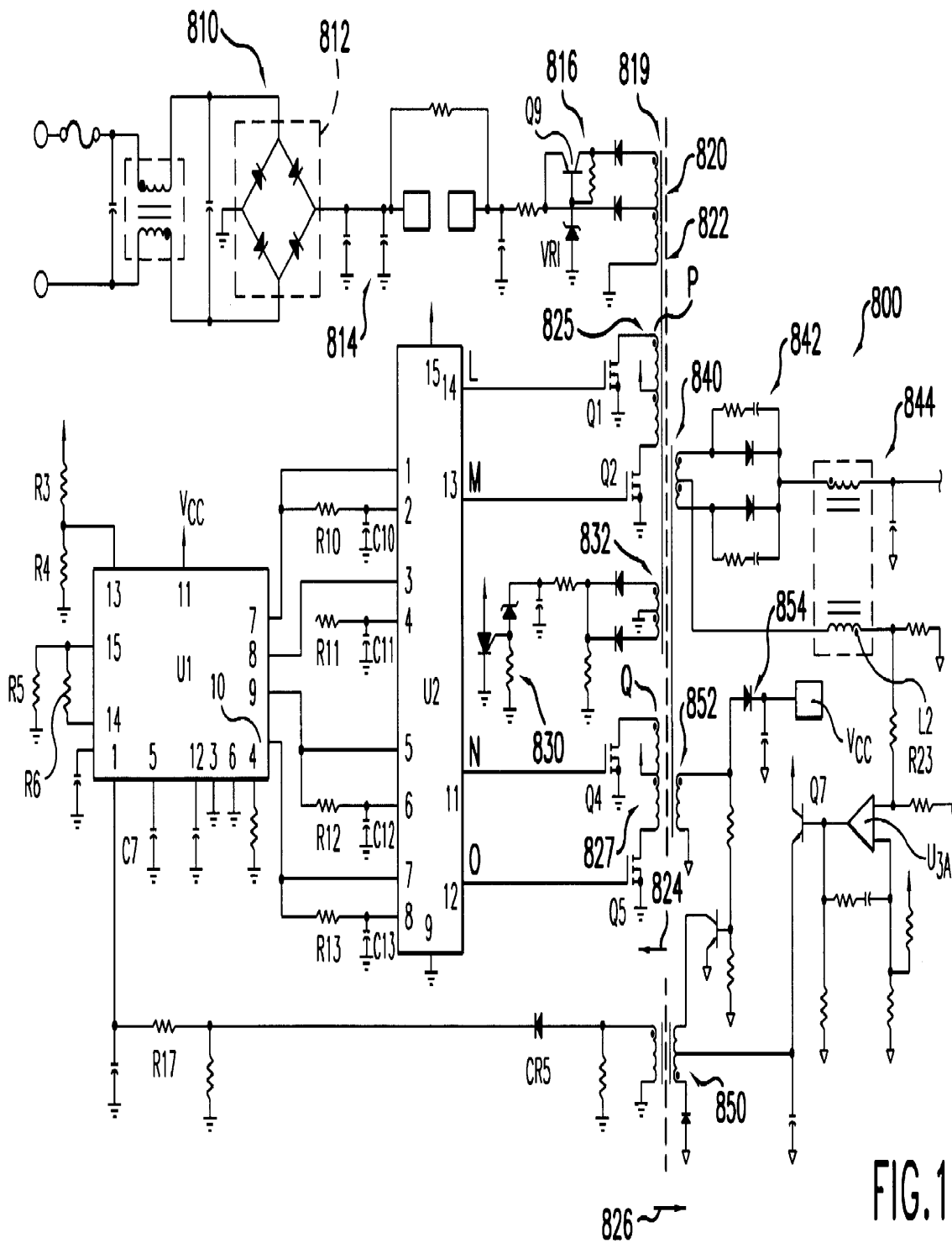


FIG. 11A

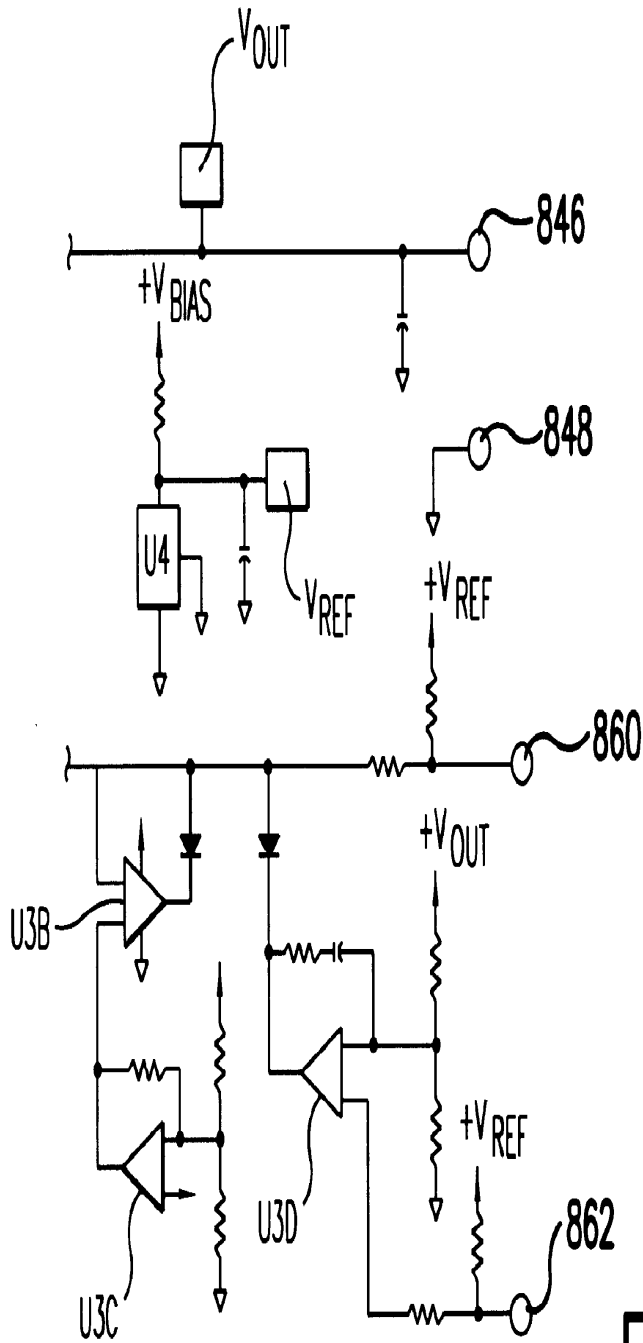
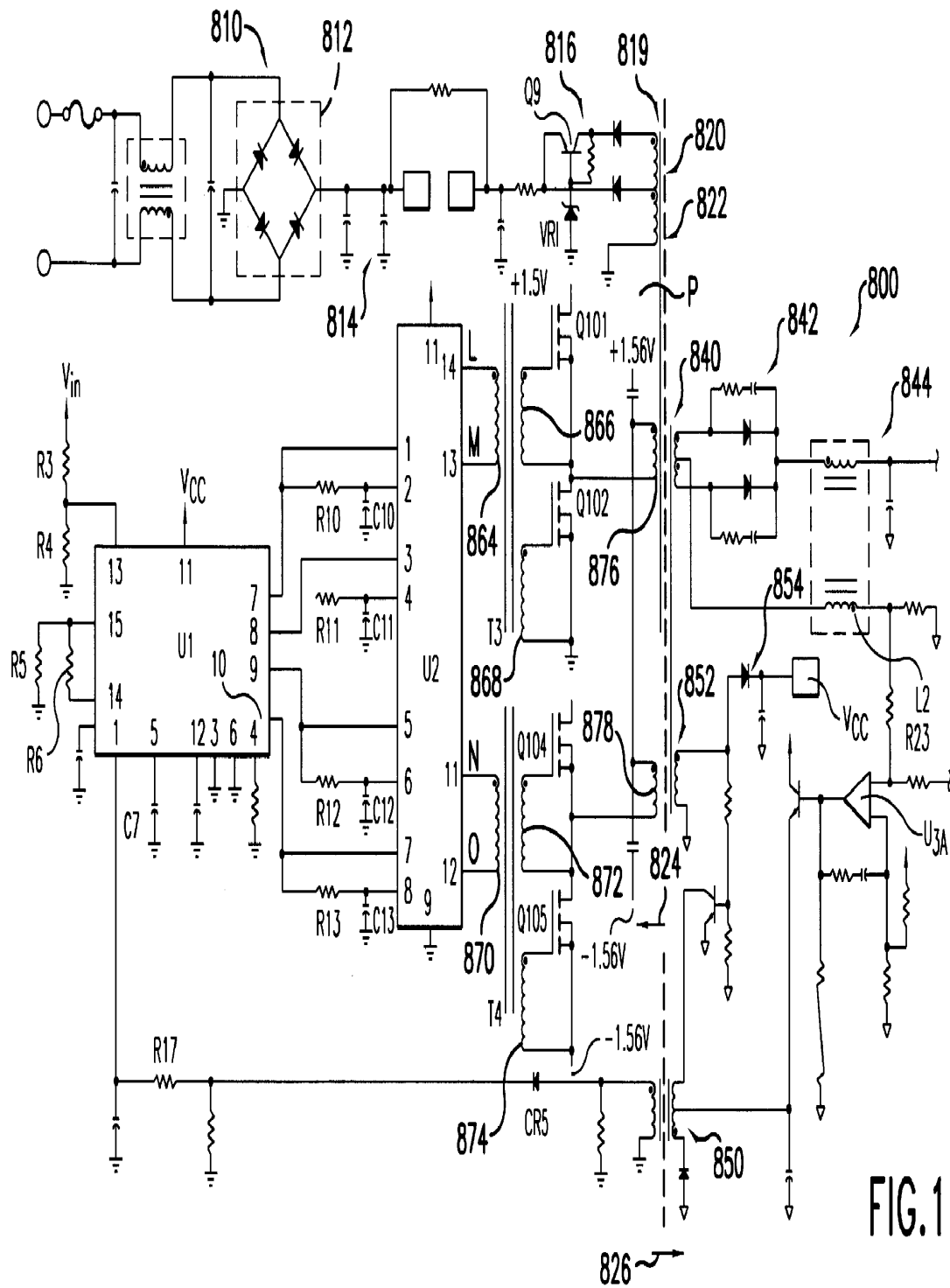


FIG.11B



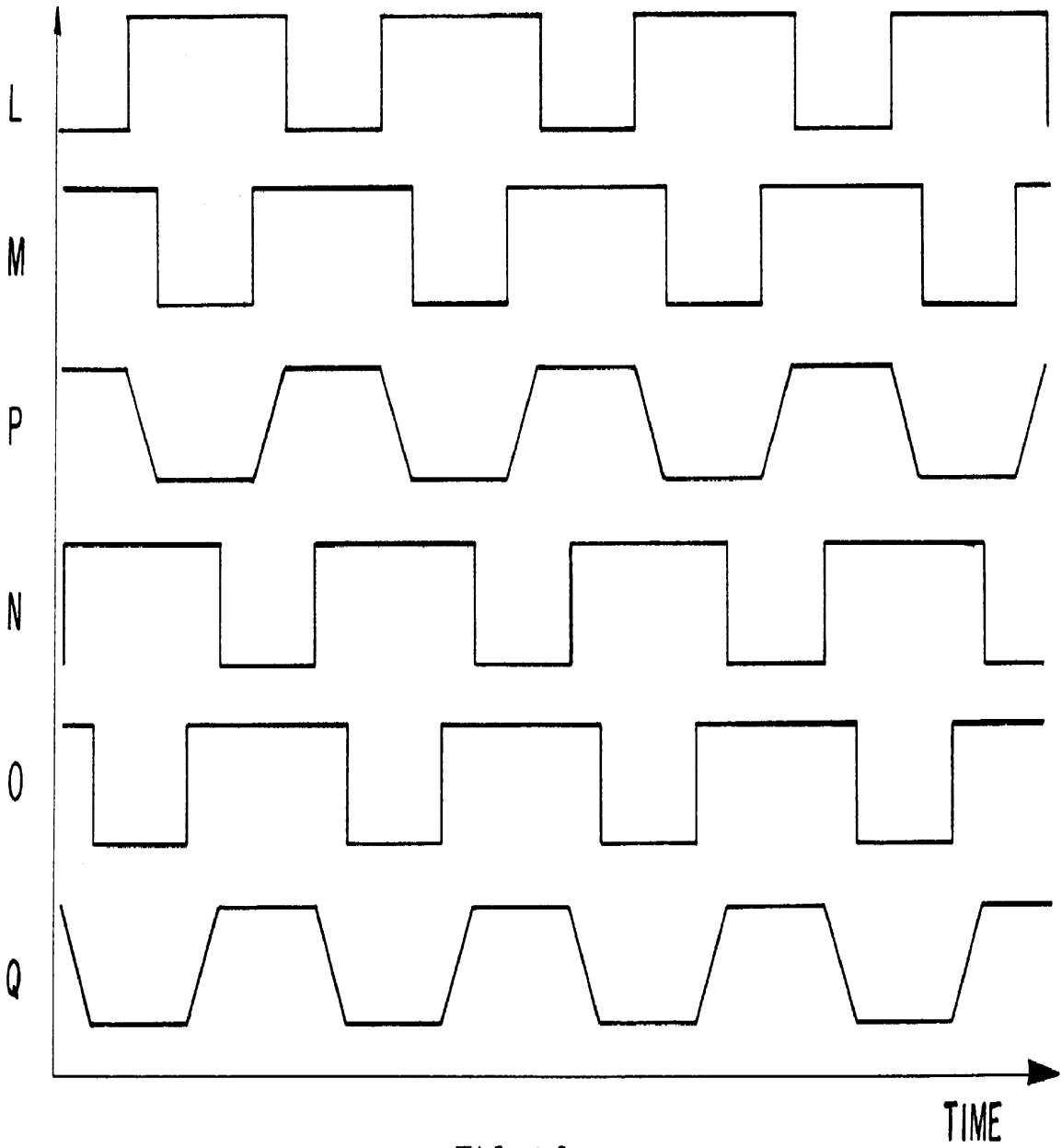


FIG.12

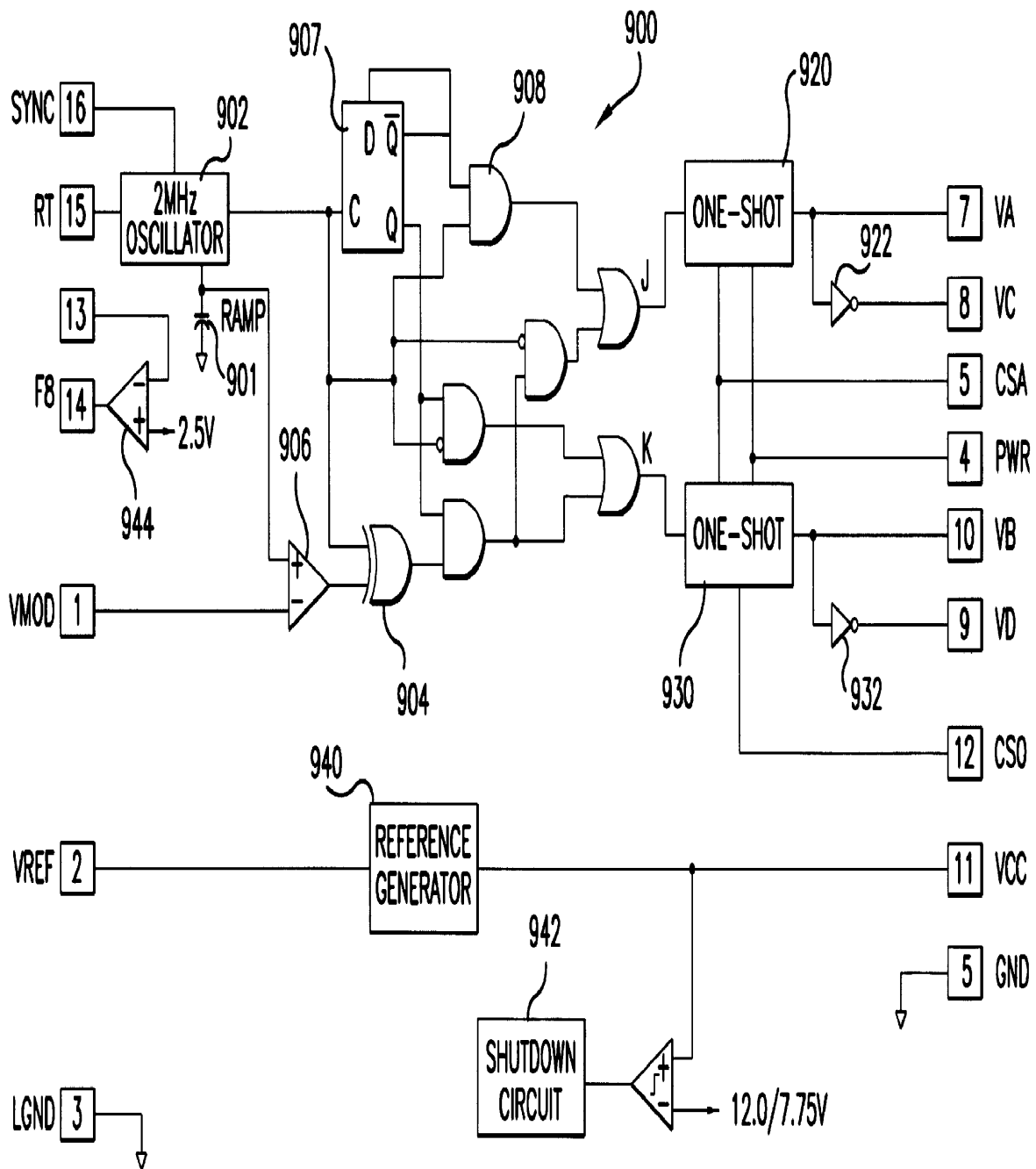
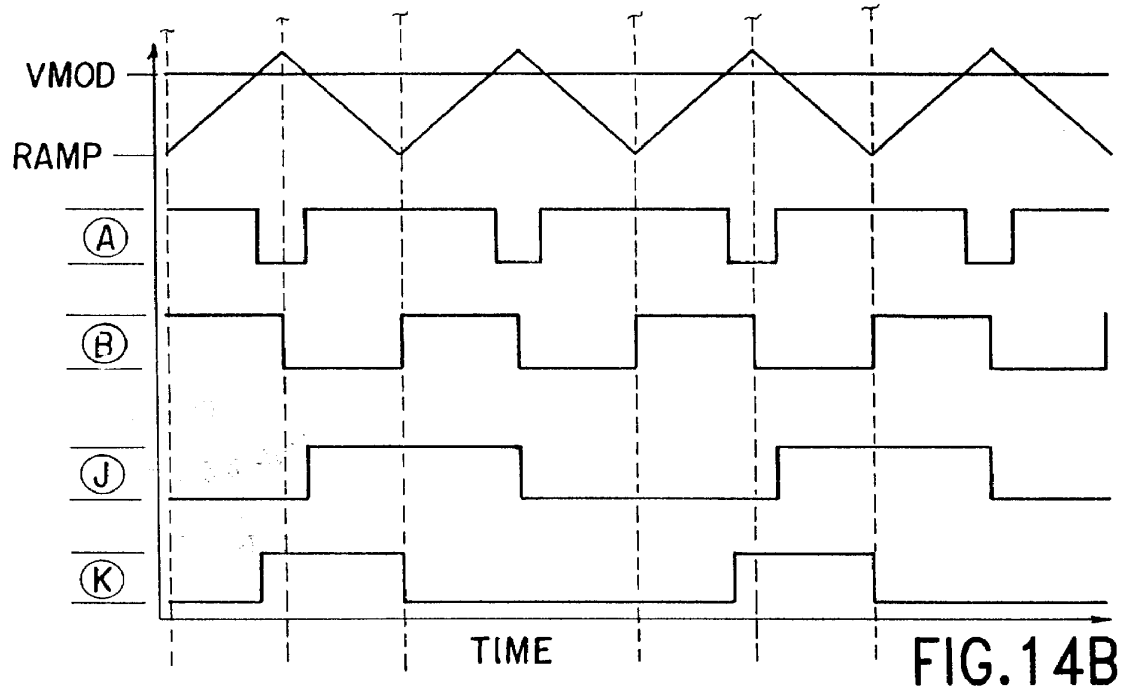
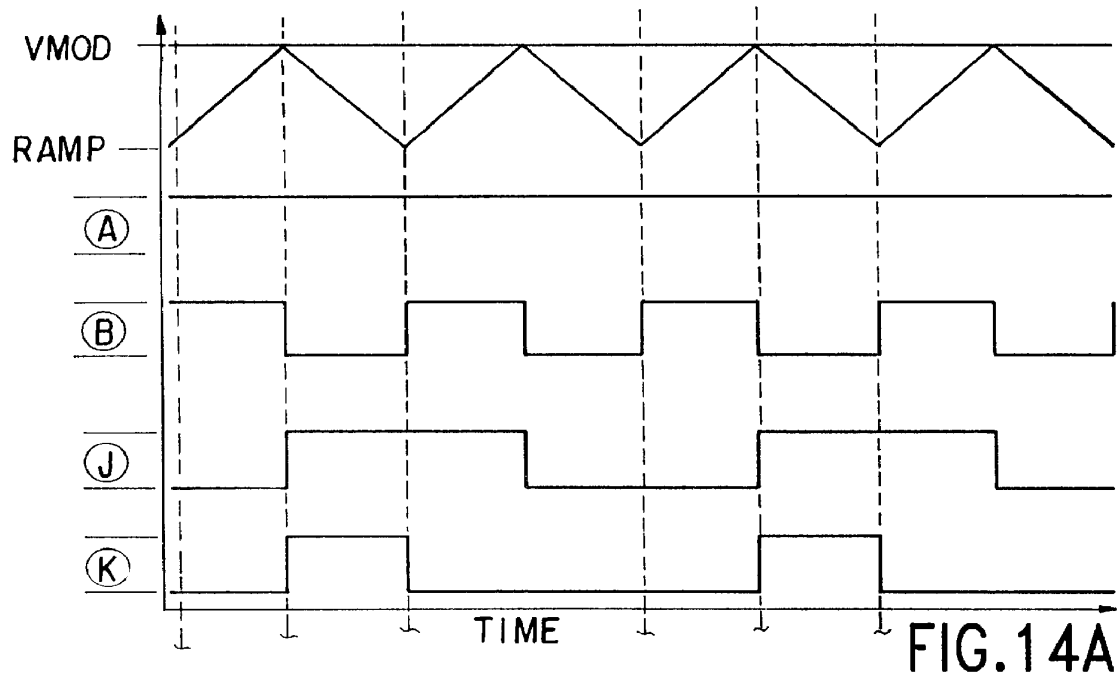


FIG. 13



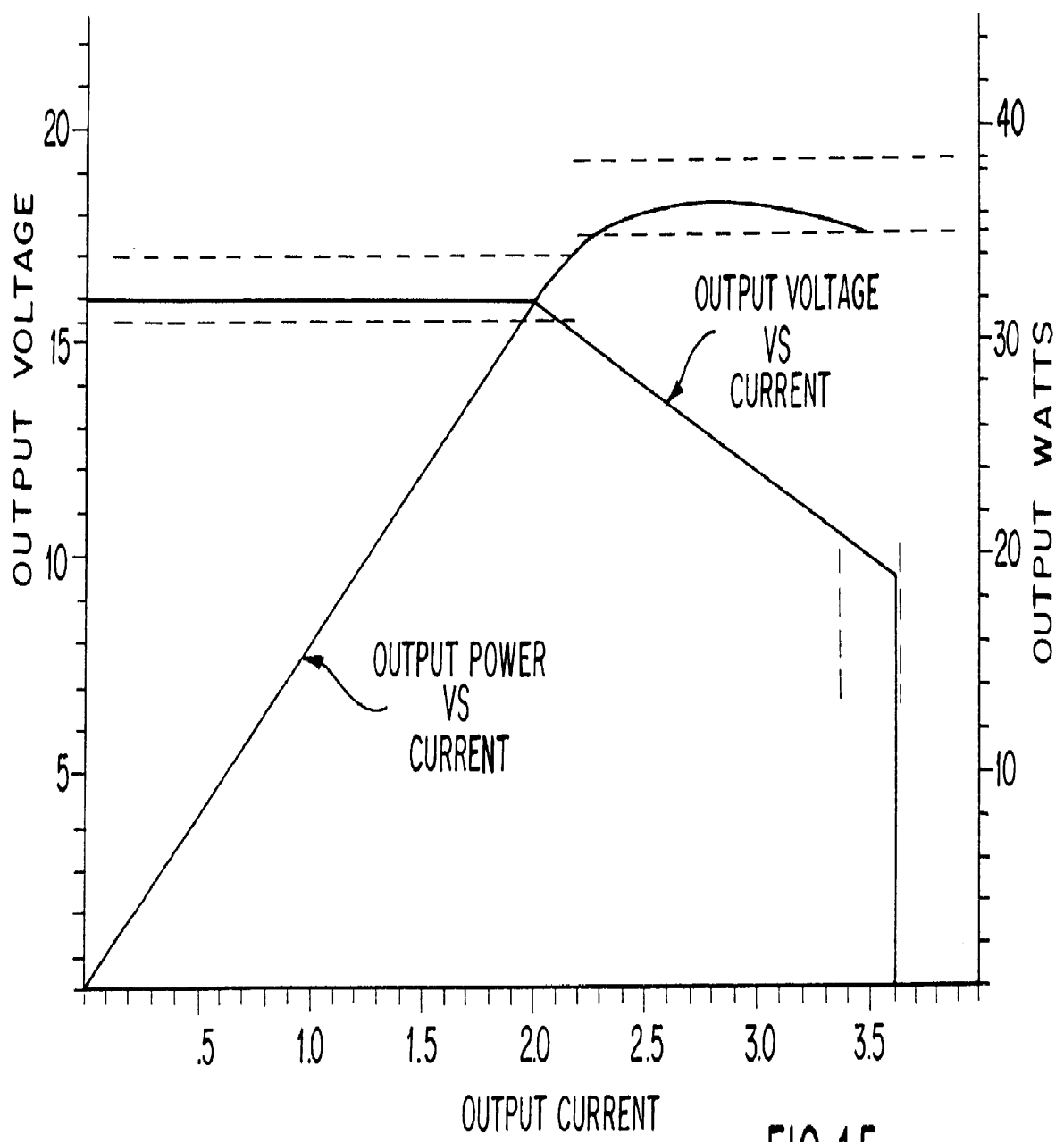
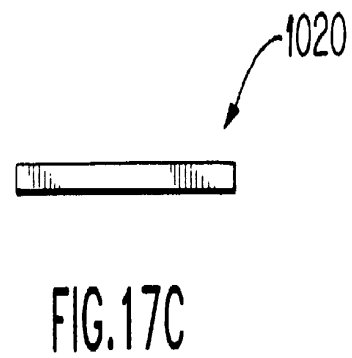
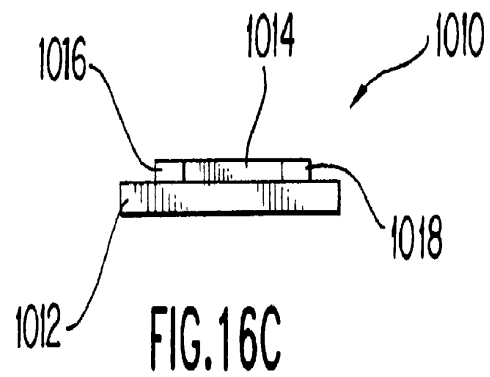
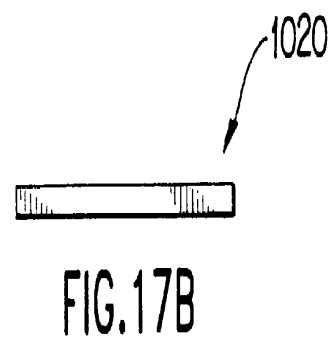
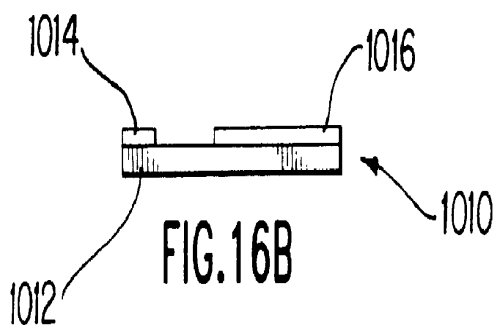
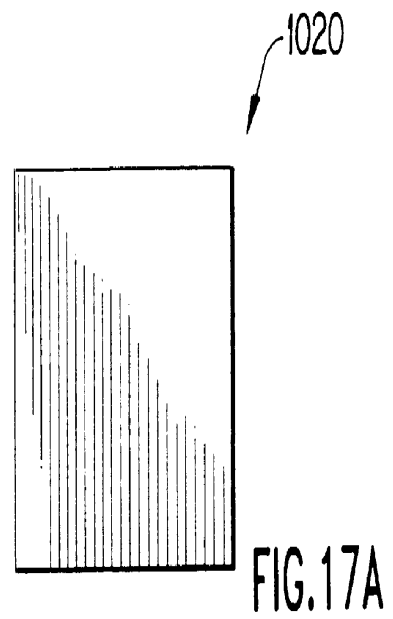
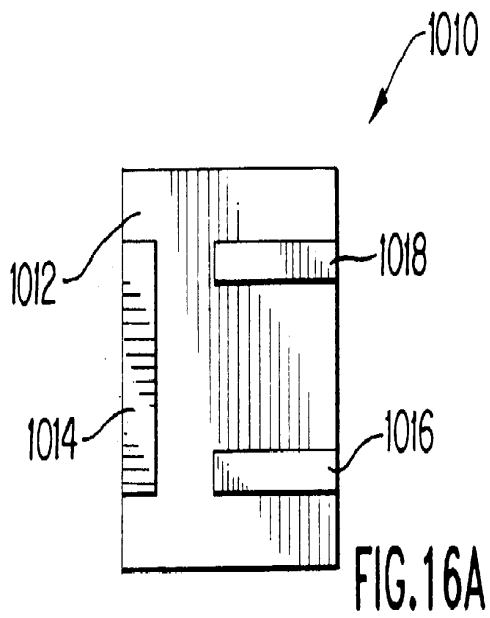


FIG.15



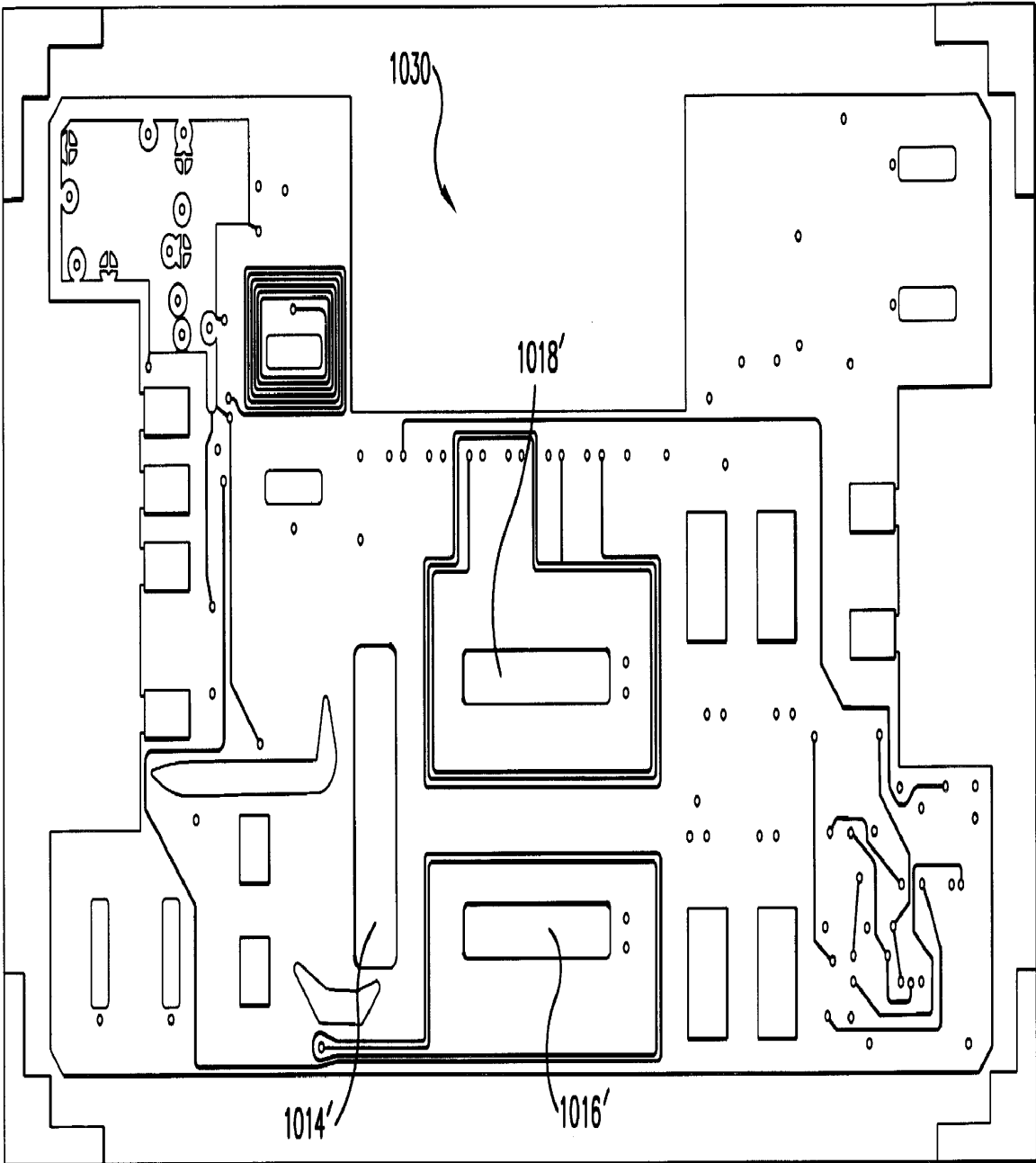


FIG. 18

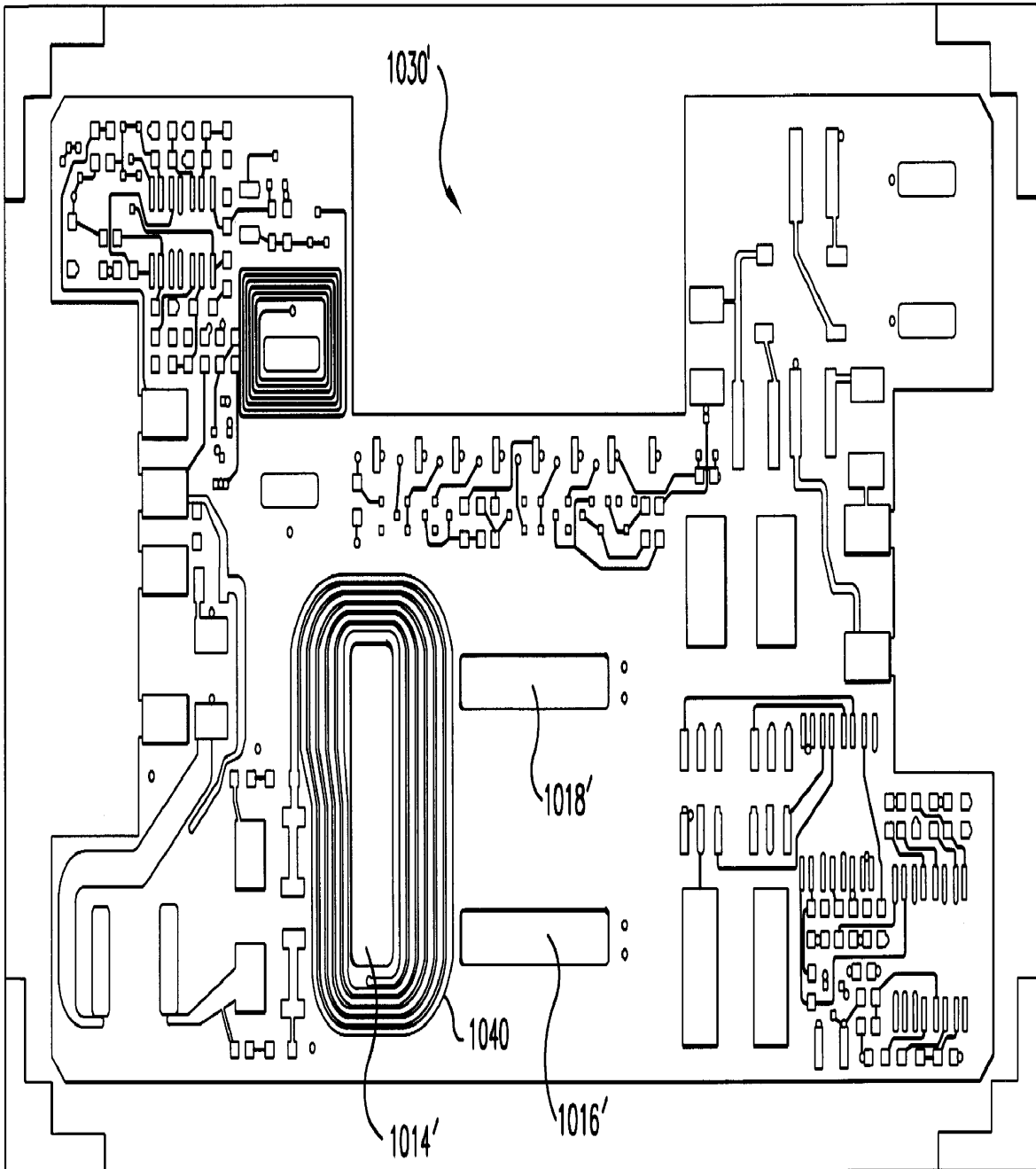


FIG. 19

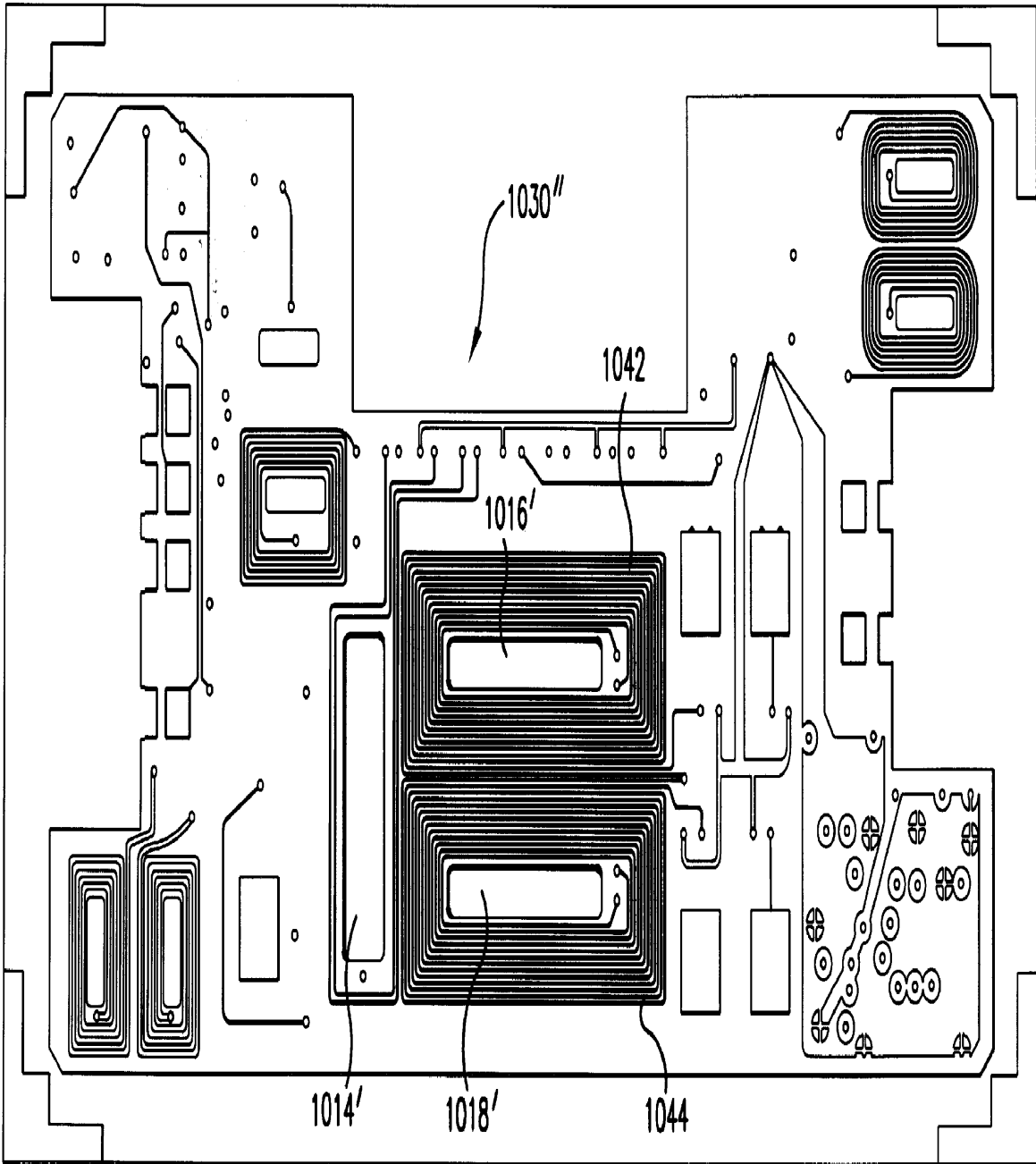


FIG. 20

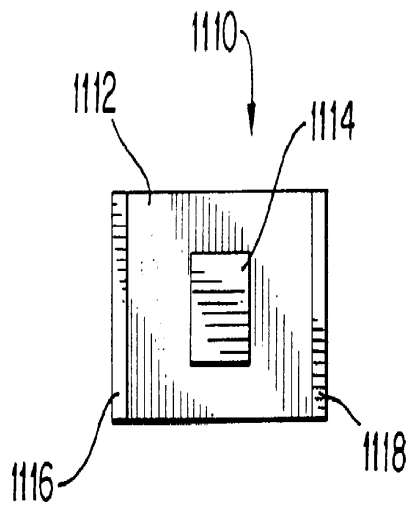


FIG. 21A

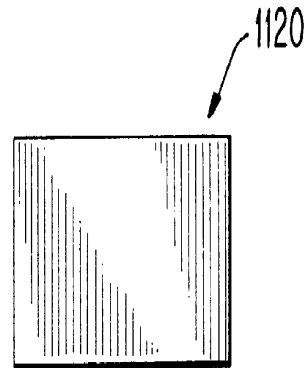


FIG. 22A

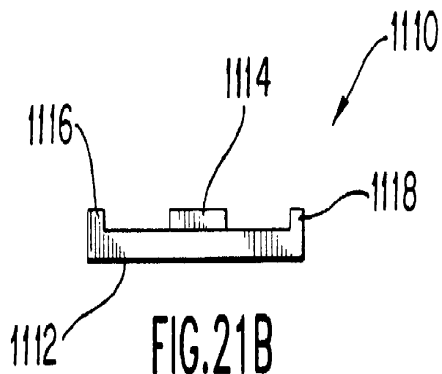


FIG. 21B

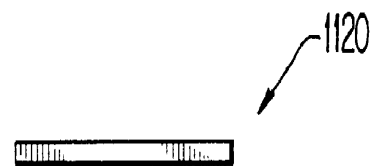


FIG. 22B

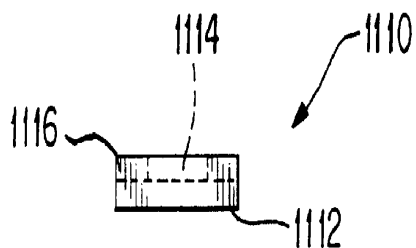


FIG. 21C

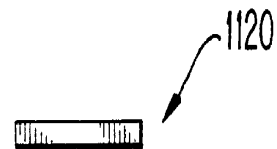


FIG. 22C

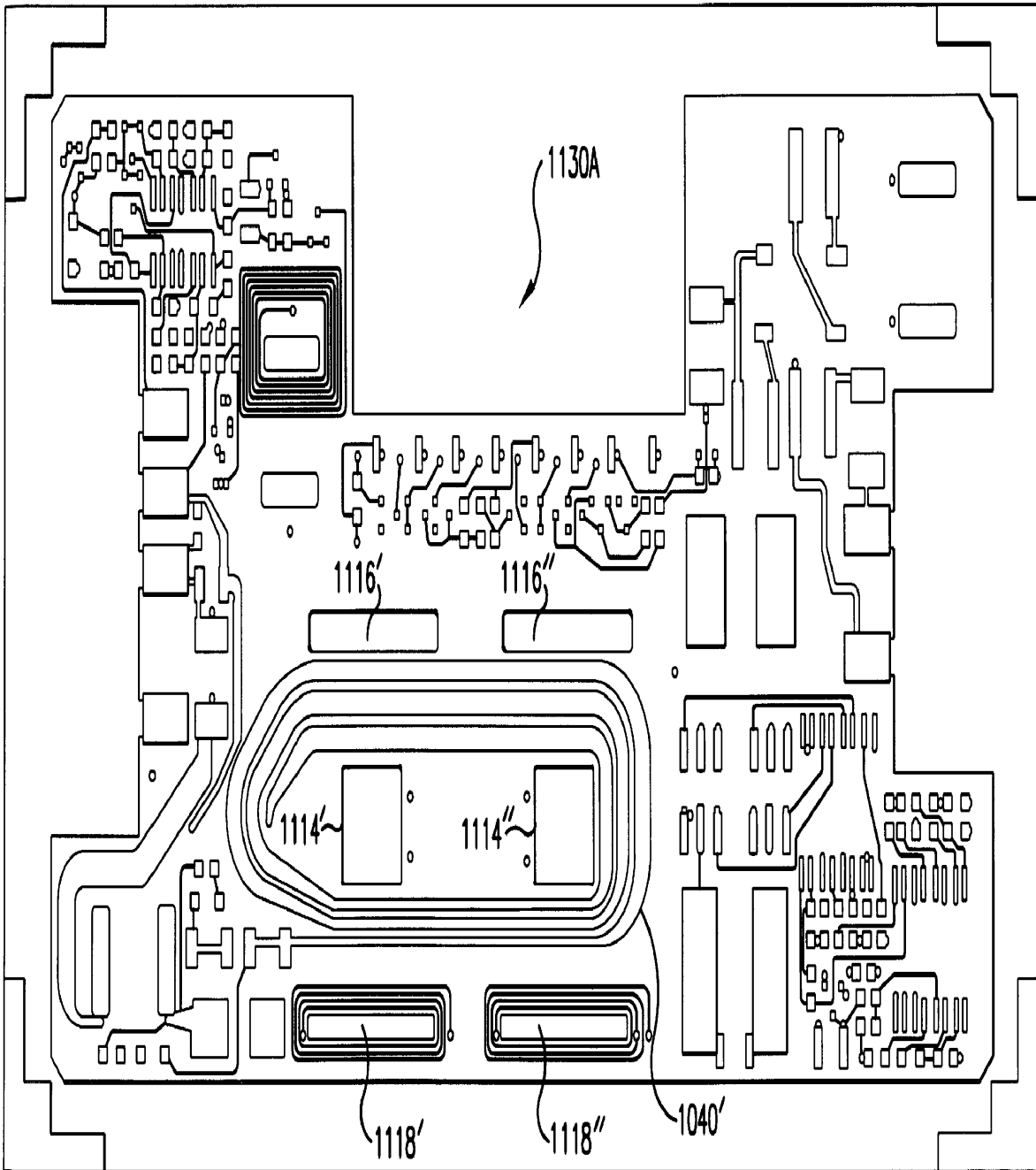


FIG. 23

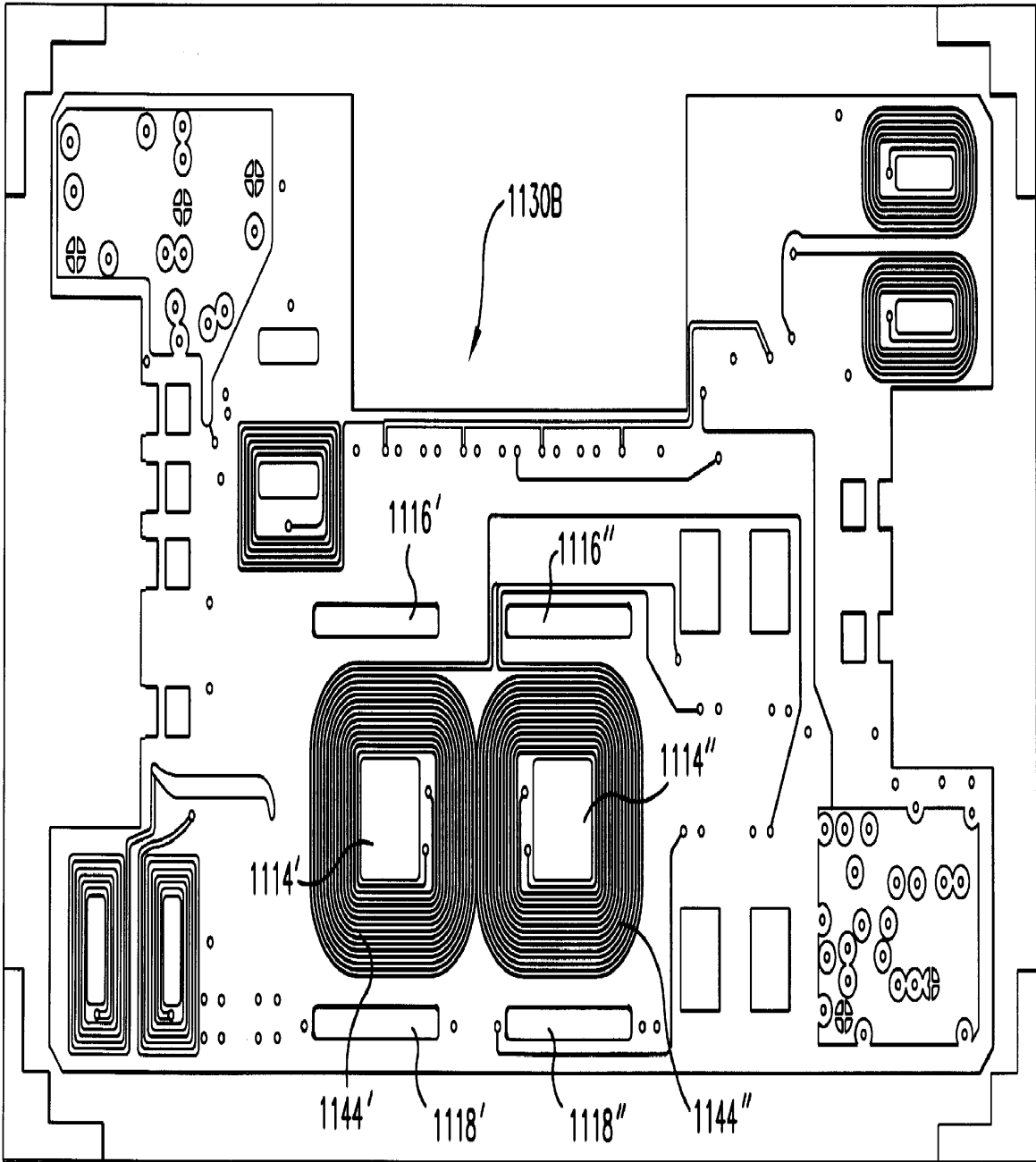


FIG. 24

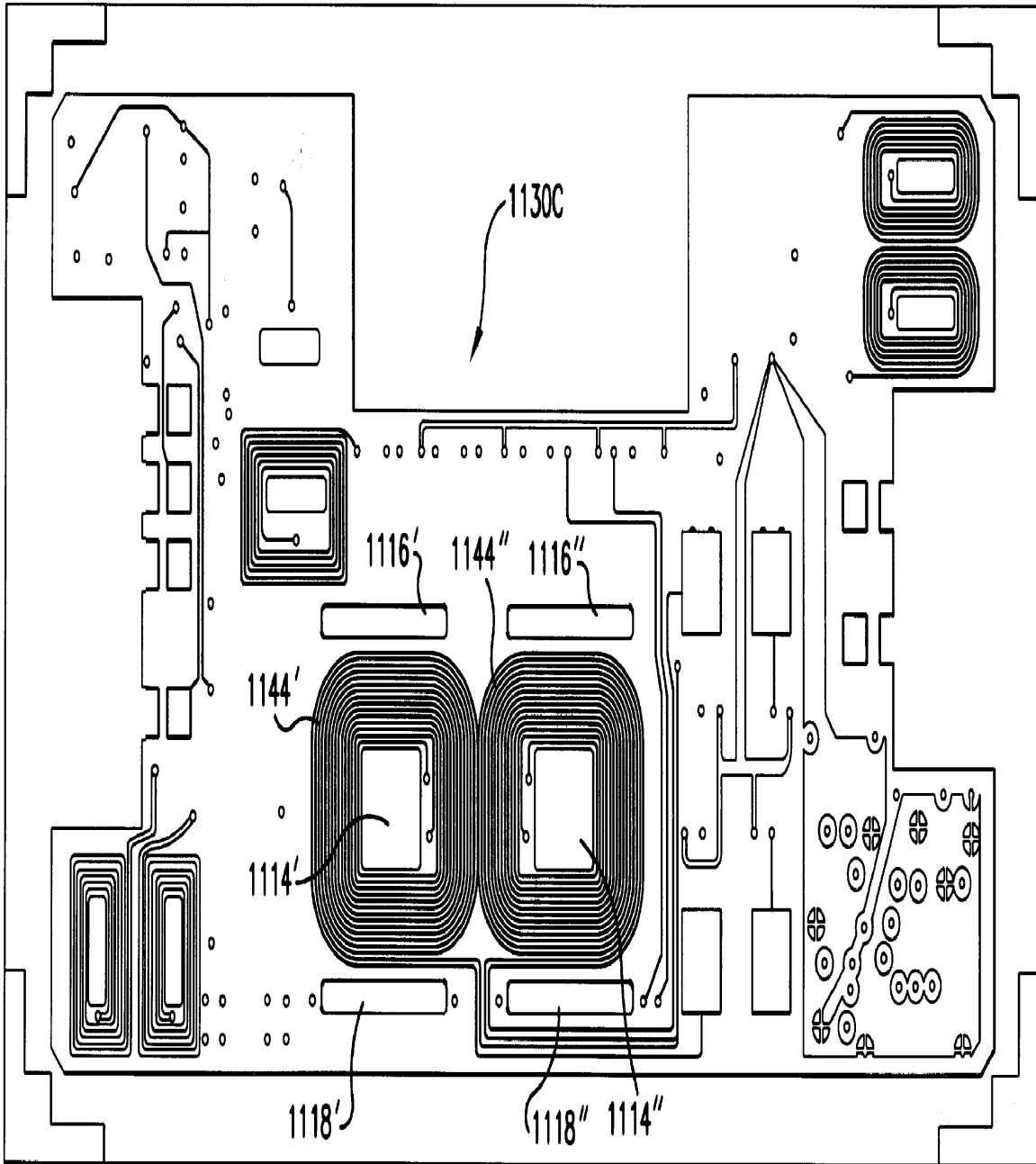


FIG. 25

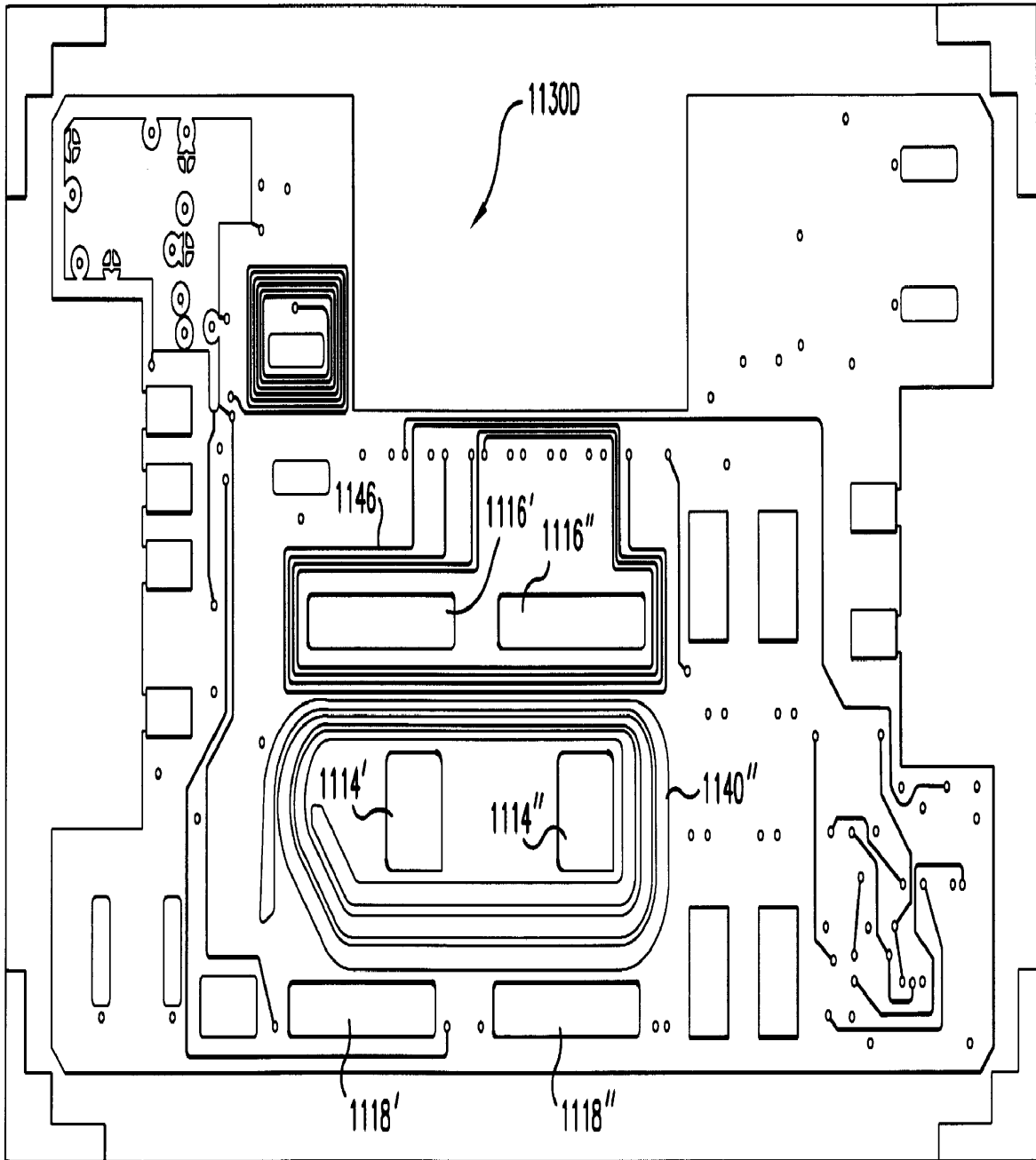


FIG. 26

METHOD AND SYSTEM FOR CHARGING RECHARGEABLE BATTERIES

RELATED APPLICATIONS

This application is a continuation-in-part application of utility application 09/148,811 filed on Sep. 4, 1998, which is a continuation of utility application 08/994,905 filed on Dec. 19, 1997, now U.S. Pat. No. 5,838,554, which is a continuation-in-part of utility application 08/767,307 filed Dec. 16, 1996, now abandoned, which is a continuation-in-part application of utility application 08/567,369 filed on Dec. 4, 1995, now U.S. Pat. No. 5,636,110 and claims priority of provisional application Ser. No. 60/002,488 filed on Aug. 17, 1995, and is also a continuation-in-part application of utility application Ser. No. 08/233,121 filed on Apr. 26, 1994, now U.S. Pat. No. 5,479,331 issued Dec. 26, 1995.

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BACKGROUND

1. Field of the Invention

Embodiments described herein relate to rechargeable batteries. In particular, the embodiments relate to systems for controlling power supplies to charge rechargeable batteries.

2. Related Art

The miniaturization of electronics was allowed for the proliferation of portable electronic appliances such as mobile telephones, notebook computers, personal digital assistants and the like. These portable devices are commonly powered by batteries which are disposable or rechargeable. Thus, when batteries expire the user must periodically incur either the cost of replacing disposable batteries or the inconvenience of recharging a rechargeable battery.

Charging a rechargeable battery typically requires an external power supply which plugs into a wall socket to provide a DC voltage to terminals of the rechargeable battery while the battery is disposed within the portable system. Fully recharging a battery typically requires one or more hours of contact with the power supply. While many portable systems allow a user to operate the device from either direct power (from the power supply) or from their rechargeable battery, these systems typically do not permit the user to operate the device while a rechargeable battery is charging. Thus, charging the battery typically requires a set period of non-use of the device while the battery receives current from the power supply.

A rechargeable battery typically includes one or more cells in series between positive and negative terminals of the rechargeable battery. Each of the cells typically have a charge storing compound which may be one of many types such as nickel cadmium, nickel hydride or lithium ion compounds. Each of these compounds possess unique charging characteristics. There is a need to optimize the delivery of the power to the rechargeable battery based upon its particular charging characteristics to reduce charging time and reduce the rate of decomposition of the charging compounds disposed within the cells of the rechargeable batteries.

SUMMARY

It is an object of an embodiment of the present invention to provide an improved system and method for charging rechargeable batteries.

It is another object of an embodiment of the present invention to provide a system for providing power to a portable appliance while recharging a battery coupled to the portable appliance.

It is another object of embodiment of the present invention to provide a system and method for providing one of an optimal voltage and an optimal current to charge a rechargeable battery.

It is yet another object of an embodiment of the present invention to provide a method and system for reducing the time required to recharge a rechargeable battery.

Briefly, embodiments of the present invention are directed to a system and method for charging a rechargeable battery which includes at least one battery cell between positive and negative terminals. A circuit generates a signal to control a power supply to provide one of 1) an optimal battery current; and 2) an optimal battery voltage to the rechargeable battery based upon one of a measured current through the battery and a measured voltage across the battery.

The generated signal may dynamically program an external power supply to provide an optimal current for charging the rechargeable battery based upon the chemical characteristics of the at least one battery cell. This reduces the time for charging the rechargeable battery.

In another embodiment, a rechargeable battery cartridge includes a circuit for generating a signal for controlling an external power supply to provide a level of current sufficient to simultaneously charge the rechargeable battery and power a dynamic operational load in the portable appliance. Thus, the power supply powers the portable appliance while charging the rechargeable battery.

BRIEF DESCRIPTION OF THE FIGURES

A detailed description of embodiments of the invention will be made with reference to the accompanying drawings, wherein like numerals designate corresponding parts in the several figures.

FIG. 1 illustrates an operational environment in which an embodiment of the present invention is to operate.

FIG. 2 shows a battery charging circuit according to an embodiment of the present invention suitable for charging nickel cadmium and nickel hydride batteries.

FIG. 3 illustrates the charging characteristics of a typical nickel cadmium or nickel hydride battery.

FIG. 4 shows a battery charging circuit according to an embodiment of the present invention suitable for charging lithium ion batteries.

FIG. 5 illustrates the charging characteristics of a typical lithium ion battery.

FIGS. 6A and 6B plan and side views show an embodiment of a rechargeable battery cartridge adapted to be coupled to a portable electronic appliance.

FIG. 7 is a block diagram illustrating an embodiment of the power supply shown in FIG. 1.

FIG. 8 is a sectional view of the E core for use in an embodiment of the power supply shown in FIG. 7.

FIGS. 9A and 9B are a detailed circuit schematic of an embodiment of the power supply shown in FIG. 7.

FIG. 10 is a top planar view of a printed circuit board as an embodiment of the circuit of FIG. 9.

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FIGS. 11A, 11B and 11C are a schematic diagram of additional embodiments of the power supply.

FIG. 12 is a timing diagram for an embodiment of the circuit shown in FIGS. 11A and 11B.

FIG. 13 is a block diagram of the U1 integrated circuit shown in FIGS. 11A and 11B.

FIGS. 14A and 14B are timing diagrams for the block diagram shown in FIG. 13.

FIG. 15 is a power versus output current curve and an output voltage versus current curve of a power supply in accordance with an embodiment of the power supply of FIG. 1.

FIGS. 16A–16C are a top plan view and two side plan views of a transformer core in accordance with another embodiment of the power supply.

FIGS. 17A–17C are a top plan view and two side plan views of a transformer cap for use with the transformer core shown in FIGS. 16A–16C.

FIG. 18 is a top plan view of a printed circuit board layer, without winding patterns, to be coupled with the transformer core shown in FIGS. 16A–16C.

FIG. 19 is a top plan view of another printed circuit board layer showing a secondary winding pattern to be coupled with to the transformer core shown in FIGS. 16A–16C.

FIG. 20 is a top plan view of another printed circuit board layer showing a primary winding pattern to be coupled with the transformer core shown in FIGS. 16A–16C.

FIGS. 21A–21C are a top plan view and two side plan views of a transformer core in accordance with an alternative embodiment of the power supply of FIG. 1.

FIGS. 22A–22C are a top plan view and two side plan views of a transformer cap for use with the transformer core shown in FIGS. 21A–21C.

FIG. 23 is a top plan view of a printed circuit board layer with a secondary winding pattern to be coupled with the transformer core shown in FIGS. 21A–21C.

FIG. 24 is a top plan view of another printed circuit board layer showing primary winding patterns to be coupled with the transformer core shown in FIGS. 21A–21C.

FIG. 25 is a top plan view of another printed circuit board layer showing additional primary winding patterns to be coupled with the transformer core shown in FIGS. 21A–21C.

FIG. 26 is a top plan view of another printed circuit board layer showing a another secondary winding pattern to be coupled with the transformer core shown in FIGS. 21A–21C.

DETAILED DESCRIPTION

As shown in the drawings for purposes of illustration, the invention is embodied in an improved system and method for charging rechargeable batteries. Preferred embodiments are used to charge rechargeable batteries in portable electronic appliances such as notebook computers, mobile phones and personal digital assistants. However, it will be recognized that additional embodiments of the invention may be used with other electronic devices, such as computer peripherals, audio and video electronics and the like.

Embodiments of the present invention are directed to a system and method for charging a rechargeable battery by programming a power supply to provide a specific current or voltage in response to measurements of battery characteristics including, for example, battery voltage, current and temperature. Programming signals control a power supply to

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generate power at either an optimum current or an optimum voltage according to particular charging characteristics of the rechargeable battery. Such a system permits fast charging of the rechargeable battery. Embodiments in which the rechargeable battery and charging circuit are implemented in a portable electronic device, a power supply may simultaneously power an operational load of the portable appliance while providing current to charge the rechargeable battery. The rechargeable battery and recharging circuit may be disposed within a single cartridge which is adapted to be coupled to, or installed in, the portable electronic appliance. Recharging circuitry may be tailored to specific charging characteristics of the rechargeable battery to provide power supply control signals according to a common interface with a programmable power supply.

FIG. 1 shows an embodiment of the present invention in which a battery section 6 is installed in a portable appliance 4 such as a notebook personal computer or mobile telephone. The battery section 6 provides power to an operational load L in the portable appliance 4, and receives power from a power supply 2 on conductors 846 and 848. The power supply 2 receives power from a 120 volt AC source such as a wall socket. According to an embodiment, the battery section 6 provides signals to the power supply 2 on conductors 860 or 862 to control the voltage or current provided on conductors 846 and 848. Circuitry within the battery section 6 monitors the operational characteristics of a rechargeable battery (not shown) and generates signals on conductors 860 and 862 to provide an optimum current or voltage to the rechargeable battery facilitating rapid charging of the battery. As discussed in detail below, if the operational load L is coupled in parallel with the rechargeable battery, the circuitry within the battery section 6 may control the current of the power provided by the power supply 2 to power the operational load L while the rechargeable battery is charging.

FIG. 2 shows an embodiment of the battery section 6 in which a rechargeable battery 8 is of the nickel cadmium or nickel hydride variety. The rechargeable battery 8 is coupled in series with a resistor R_{SNS} which is coupled between inverting and non inverting inputs of operational amplifier 9. The voltage across the R_{SNS} resistor is substantially proportional to a current through the rechargeable battery 8. The resistance of resistor R_{SNS} is sufficiently small, 25.0 mΩ for example, to minimize resistive losses. The output of operational amplifier 9 provides a signal which is representative of the current in the rechargeable battery 8. An integrated circuit 5 provides an output at P in 8 which is representative of an optimum current in the rechargeable battery 8 which is based upon, for example, a temperature of the voltage across the rechargeable battery 8. Operational amplifier 7 receives at its inputs the signal from pin 8 of the integrated circuit 5 representative of the optimum current applied to the rechargeable battery 8 and the output of operational amplifier 9 which is representative of the actual current in the rechargeable battery 8. Thus the output of the operational amplifier 7 provides a signal which is representative of difference between the optimal and actual currents in the rechargeable battery 8. Conductor 860 provides this signal to an input terminal of the power supply 2 (FIG. 1) to either increase or decrease the current provided on conductor 846.

The power supply 2, battery 8, and operational amplifier 7 are part of a control loop which maintains a level of current sufficient to power the operational load L and recharge the battery 8. The current measured at R_{SNS} is isolated from the current in the operational load L. This enables the output of operational amplifier 7 to control the power supply 2 to change its output current based upon the current in the battery 8.

The integrated circuit 5 which generates the signal representative of the optimal current in the rechargeable battery 8 is preferably tailored to monitor the characteristics of a nickel cadmium or nickel hydride type rechargeable battery. Integrated circuit 5 may be a bq2002c integrated circuit sold by Benchmarq. A voltage divider formed by resistors RB1 and RB2 provide a voltage to pin 3 of the integrated circuit 5 which is representative of a voltage across the rechargeable battery 8. The rechargeable battery 8 may include one or more cells coupled in series. Accordingly, the resistances of RB1 and RB2 are selected to scale the voltage at the pin 3 based upon the fully charged voltage across all cells of the rechargeable battery 8. A thermistor 10 also provides a voltage to pin 5 which is representative of the temperature of the rechargeable battery 8. Based upon the voltages received at pins 3 and 5, the integrated circuit 5 determines the optimal current through the rechargeable battery 8 according to algorithms known to those of ordinary skill in the art and described in the data sheet of the Benchmarq bq2002c integrated circuit.

The operational load L coupled in parallel with the rechargeable battery 8 may not be constant and vary over time depending upon the particular operational state of the portable appliance 4 (FIG. 1). Nevertheless, under the control of the feedback signal of the output of the operational amplifier 7, the power supply 2 may apply current at conductor 846 to be provided to the positive terminal of the rechargeable battery 8 for charging while powering the operational load L. As the current into the load L increases, the current through the rechargeable battery 8 decreases. Such a decrease in the current through the rechargeable battery 8 provides a corresponding decrease in the voltage at the output of operational amplifier 9. While the signal representative of the optimal current at the non-inverting input of operational amplifier 7 remains constant, the output voltage of the operational amplifier 7 at conductor 860 increases, signaling to the power supply 2 to increase the current to the conductor 846. The circuit shown in FIG. 2 similarly reacts to decreases in current drawn from the load L which causes the voltage of the output of operational amplifier 7 to decrease, signaling to the power supply 2 to decrease the current supply to the conductor 846. Thus, the circuit shown in FIG. 2 permits the power supply to simultaneously power the operational load L of the portable appliance 4 while providing current to charge the rechargeable battery 8.

FIG. 3 shows a voltage versus time profile for a nickel cadmium or nickel hydride rechargeable battery according to an embodiment of the present invention. From time t_0 through t_1 , the battery charges at a rapid rate with the power supply 2 providing a high constant current to the rechargeable battery to increase the voltage across the battery 8 above v_0 . Between times t_1 and t_2 , the voltage of the rechargeable battery increases at a faster rate until the voltage begins to peak at about v_f at time t_2 . If the power supply continues to provide current to the rechargeable battery at the same rate, the voltage begins to decrease rapidly as shown in portion 11 of the curve. In an embodiment of the present invention according to FIG. 2, however, the peak of the curve at time t_2 is detected so that current may be reduced. This allows the battery to continue charging at about or slightly below the peak voltage v_f until the battery is completely charged at time t_f as shown in portion 12 of the voltage curve. Integrated circuit 5, as discussed above with reference to FIG. 2, measures a voltage across the rechargeable battery 8 and the temperature of rechargeable battery 8 to provide control signals at conductor 860 to program the power supply 2 to reduce the level of current.

The difference between v_0 and v_f is preferably significantly less than the total voltage across the rechargeable battery 8. According to an embodiment, the operational load L of the appliance 4 may function at any voltage between v_0 and v_f . Therefore, with the operational load L coupled in parallel with the rechargeable battery 8, the power supply 2 can provide sufficient current to power the operational load L while providing the optimum current to charge the rechargeable battery 8. This eliminates the requirement for non-use of the portable appliance 4 while the rechargeable battery 8 is charging.

FIG. 4 shows an embodiment of the battery section 6 in which a rechargeable battery 18 is of the lithium ion variety. An integrated circuit 15 such as the bq2954 integrated circuit sold by Benchmarq provides a pulse width modulation (PWM) signal at pin 14 to control the current provided at the terminals of the battery 18 based upon measurements of a voltage across the battery 18 and a current through the battery 18. Resistors R_{b3} and R_{b4} provide a voltage divider across the battery 18 providing a voltage measurement to pin 3 of the integrated circuit 15 which is proportional to the voltage across the battery 18. As the battery 18 may include any number of cells, the resistances of R_{b3} and R_{b4} are selected to properly scale the voltage at pin 3. The resistances of R_{b3} and R_{b4} are sufficiently high so that the current across the resistor R_{SNS} is essentially that of the current through the battery 18. Pin 7 of the integrated circuit 15 receives the voltage across the resistor R_{SNS} which is about proportional to the current through the battery 18. Based upon the measurements of the voltage across the battery 18 and the current through battery 18, the integrated circuit 15 determines a duty factor for the PWM signal outputted from pin 14 of integrated circuit 15. Changes in the duty factor effect changes in the rate of charge applied to conductor 846. The PWM signal is received at an inverting input of an operational amplifier 17. The operational amplifier 17 forms an integration circuit with a capacitor 19. The output of the operational amplifier 17 is therefore an integration of the PWM signal provided at pin 14 of the integrated circuit 15. Thus, the duty factor of the PWM signal determines the voltage at the output of operational amplifier 17.

The integrated circuit 15 may determine such a duty factor using an algorithm known to those of ordinary skill in the art and described in the data sheet of the bq2954 integrated circuit sold by Benchmarq. According to an embodiment, charging takes place according to a 2-phase fast charge algorithm. In the first phase, the integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programed threshold. Charging is then complete.

The output at pin 14 of the integrated circuit 15 is a PWM signal having a duty factor between 0 and 80%. This duty factor is adjusted based upon the voltage received at pin 7 of the integrated circuit 15 (which is representative of the current through the battery 18) and a voltage at pin 3 of the integrated circuit 15 (which is representative of the voltage across the battery 18). Based upon the measured voltage across the battery 18, the algorithm embedded in the integrated circuit 15 determines an optimal current through the battery 18. Thus, depending upon the voltages at pins 3 and 7 of the integrated circuit 15, the integrated circuit 15 may increase the duty factor of the pulse signal at pin 14 to increase the rate of charge applied at conductor 846 or decrease the duty factor of the pulse signal at pin 14 to decrease the rate of charge applied to the conductor 846.

The embodiment shown in FIG. 4 is also capable of providing power to the dynamic operational load L while current is provided to the battery 18. It is understood that prior to charging, the battery 18 provides a voltage lower than the maximum voltage but sufficient to power the operational load L. Thus, the difference between the voltage across the battery 18 when its in its fully charged state and depleted state is small compared with the voltage across the battery 18 in the fully charged state.

As the dynamic operational load L draws an increasing current, this is reflected as a decrease of the voltage across the resistor R_{SNS} detected at pin 7 of the integrated circuit 15. This will cause the integrated circuit 15 to raise the duty factor of the pulse signal provided at pin 14 to increase a level of charge provided at conductor 846. When the operational load L draws less current, this is detected as an increase in the voltage across the resistor R_{SNS} , causing the integrated circuit 15 to lower the duty factor of the pulse signal provided at pin 14. This causes a decrease in the level of charge provided by the power supply to the conductor 846. Thus, as in the embodiment described with reference to FIGS. 2 and 3, the embodiment shown in FIG. 4 monitors the current through the battery 18 to provide an optimal level of current to the battery 18 for charging while simultaneously powering the dynamic operational load L.

In this embodiment, the integrated circuit 15 monitors the temperature of the battery 18 and will cut off charging if the temperature exceeds the threshold. If thermistor 16 is coupled to the battery 18 to provide a voltage to pin 8 of the integrated circuit 15 which is representative of the temperature of the battery 18. This threshold temperature can be adjusted by selection of a resistor R_T . This temperature sensing feature can also be disabled by providing R_T as a 10K Ω resistor.

FIG. 5 shows a voltage versus time plot representative of the charging characteristics of a lithium ion battery according to an embodiment of the present invention as shown in FIG. 4. From t_0 to t_1 , the battery is charged with a constant maximum current and a voltage across the battery steadily rises from v_0 . If the constant current is applied after the battery voltage reaches the voltage v_p , the voltage will continue to rise as shown in the portion 13 of the voltage plot. However, the battery reaches saturation at v_f . According to the embodiment shown in FIG. 4, the integrated circuit 15 detects when the voltage across the battery 18 reaches v_f and then begins to reduce the current which is provided to the battery 18 by decreasing the duty factor of the PWM signal. This maintains the battery voltage at v_f while the current is gradually reduced over time. When the power supply 2 eventually stops providing current to the battery 18, charging is complete. As discussed above with reference to the embodiment shown at FIG. 4, the integrated circuit 15 detects the voltage across the battery 18 and begins sending control signals to the power supply 2 on the conductor 860 to maintain the voltage at v_f . In response, the power supply 2 gradually reduces the current provided at conductor 846 to maintain the voltage v_f .

The difference between v_0 and v_f is preferably significantly less than the total voltage across the rechargeable battery 18 and any voltage between v_0 and v_f is sufficient to power the operational load L. Therefore, with the operational load L coupled in parallel with the rechargeable battery 8, the power supply 2 can provide sufficient current to power the operational load L while providing the optimum current to the rechargeable battery 18 (while maintaining the voltage across the rechargeable battery 18 at or below v_f). This eliminates the requirement for non-use of the portable appliance 4 while the rechargeable battery 18 is charging.

FIGS. 6A and 6B show respective plan and side views of an embodiment of the exterior portions of battery section 6 shown in FIGS. 1, 2 and 4. The battery section 6 may be secured to the portable appliance (not shown) such that a connector 87 mates with the load L (FIGS. 1, 2 and 4). A connector 85 is adapted to mate with a cable for connecting the battery section 6 to the power supply 2 (FIG. 1). Thus, the connector 85 includes conductors for mating with conductors 846, 848, 860 and 862 leading to the power supply 2. Once the battery section 6 is secured to the portable appliance, the connector 85 can receive power from the power supply 2 to recharge a rechargeable battery or power the operational load L.

FIGS. 7 through 26 illustrate various embodiments of the power supply 2 (FIG. 1) which is programmable to provide power at a set current or a set voltage in response to signals received on conductors 860 and 862. Further embodiments of the power supply 2 are described in U.S. Pat. No. 5,838,554 with reference to FIGS. 5A, 5B, 5C, 6 and 42 through 50 therein, incorporated herein by reference. It is understood that the above described system and method for charging a rechargeable battery is applicable to power supplies of other designs which permit dynamic programmability to provide power at a controlled current or a controlled voltage.

FIG. 7 shows a block diagram an embodiment of the power supply 2. All components on the left side of a magnetic core 20 are part of a primary portion 100 and all portions on the right hand side are part of a secondary portion 200 of the power supply 2. The primary portion 100 includes a primary rectifier and input circuit 110, a first primary and drive circuit 120, a second primary and drive circuit 130, a primary feedback circuit 140 and a controller 150. The secondary portion 200 includes a secondary output circuit 210 and a secondary feedback circuit 240.

The function of the primary rectifier and input circuit 110 is to couple the embodiment 10 to the line voltage (for example 120 volt, 60 Hz), to rectify that voltage and provide DC power for the remainder of the primary portion 100 and a ground path for the primary circuits 120 and 130. The controller 150, which may be a Unitrode 3875 of integrated circuit which provides two square wave driver signals 152 and 154 having alterable phases to the first and the second primary circuits 120 and 130. The first and second primary circuits are resonant circuits that are resonant at about the frequency of the driver signals and include coils that are coupled to the core 20, which may be a planar or low profile "E" type core, which may be any low loss material, as is shown in a sectional view in FIG. 8. Hence, the driver signals are magnetically coupled to the core 20 by first and second primary coils contained within the circuits 120, 130.

The coil 212 in the secondary circuit 210 is preferably positioned relative to the coils of the two primary cores so that the coil in the secondary circuit is at a summing point of the magnetic flux from the primary circuit coils. If a planar or low profile "E" type core as shown in FIG. 8 is used, the coil 212 for the secondary circuit 210 is positioned about the central leg 22. The coil for the feedback circuits 140 is positioned on one of the outer legs 24, 26. As a result, the magnetic flux from the two primary coils of the primary circuits 120, 130 are summed at the position where the secondary coil 212 for the secondary circuit 210 is positioned. (This positioning of the coils is shown in FIG. 7 by using the double line to indicate the central leg 22 and a single line to represent the outer legs 24, 26).

The secondary feedback circuit 230 monitors the amplitudes of the DC voltage and current produced by the

secondary circuit 210. Coils positioned on a core 23 magnetically couple the primary feedback circuit 140 and the secondary feedback circuit 230 to provide a feedback signal to the controller 150. In response to the feedback signal, the controller alters the relative phase between the two driver signals 152 and 154 to obtain the desired magnitude of the voltage and current. Since the secondary coil 212 is located at a summing point on the core of the flux from the two primary coils, as the phase between the driving signals 152 and 154 to the two primary coils alters, the magnitude of the current and voltage induced in the secondary coil will vary. This will permit control of the secondary circuit 210 output voltage and current, thereby providing a readily controlled output voltage.

FIGS. 9A and 9B show a more detailed schematic of an embodiment of the power supply 2. A standard AC plug may be coupled to input nodes 111, 112 to a first filter coil L1 that is coupled to a full wave rectifier bridge 113, which may be a MDA106G. Filtering capacitors C1, C2, C7, C8 are also coupled to the bridge 113 and one side of the bridge is coupled to AC ground.

The bridge is coupled to the primary coils 122 and 132 of the first and second primary circuits 120, 130 respectively. The other terminal of the primary coils 122, 132 are coupled to the remainder of the primary circuits 120 and 130. Each of these primary circuits 120, 130 also comprise a drive field effect 124, 134, which may be a MTP6N60 and a capacitor 126, 136. The coils 122, 132, transistors 124, 134 and capacitors 126, 136 are selected so that the resonant frequency of the circuits 120, 130 is at about the frequency of the drive signals 152, 154 to maximize the efficiency of the power supply. In this embodiment, the drive signal frequency oscillates at about one megahertz, though other frequencies may be used.

The drive signals 152 and 154 are supplied by a controller 150 such as a Unitrode UC3875QP or other similar product. The controller 150 receives the biasing power at pins 28 and 1 from the primary power supply circuit 160.

Each of the coils 122 and 132 induce a varying magnetic field in the outer legs of the core 20. The secondary coil 212, which has a center tap 213, is coupled to a half wave rectifier bridge 214, which may comprise an MBRD660CT, and then is coupled to a filtering circuit 216 comprised of a capacitor 218, an inductor 220, and capacitors 222 and 224 to provide a DC regulated output 226.

The regulation is provided by feeding back to the controller 150, a signal modulated by a current sensing amplifier circuit 232 and a voltage sensing circuit 240 comprising the feedback circuit 230. To provide the carrier for modulation, a further secondary carrier coil 242 is coupled to one of the outer legs of the core 20. One of the legs of this transformer coil 242 is coupled to an isolation feedback transformer T2.

The current sensing circuit takes the output of the center tap of the secondary coil 212 and provides a voltage drop across resistor R9 that is provided to current sensing amplifier circuit 232. The output of the current sensing amplifier circuit 232 is added to a voltage dropped across R13 and is provided to an amplifier 244 in the voltage sensing circuit 240. The other input in the voltage sensing circuit is a reference voltage developed by the zener reference diode 246 and also provided as a biasing level to the current sensing amplifier circuit 232. The output of the amplifier 244 is provided to the base of bipolar transistor Q3, which may be a MMBT2907T, configured in a common base configuration, to amplitude modulate the current through the secondary side coil 246.

The primary side coil 156 of feedback transformer T2 is magnetically coupled to the secondary side coil of 246 and generates an amplitude modulated signal that is envelope detected and integrated to provide a feedback voltage at input 22 of the controller 150.

As the amplitude of the envelope of the modulated signal increases, the voltage at input 22 of the controller 150 increases. When the controller 150 determines that the voltage has exceeded a predetermined limit, indicating that either the current or voltage at the output has increased beyond the predetermined maximum, the relative phase difference of driver signals 152 and 154 is increased. If the amplitude at input 22 decreases below a predetermined threshold indicating that the voltage or the current is below the desired levels, the relative phase of signals 152 and 154 is decreased towards zero to increase the voltage or current. Due to the summing effect of the magnetic flux at secondary coil 212, a highly efficient control or regulation of the power supply circuit is obtained.

Because of the high efficiency that is attained with this circuit, heat dissipation is much less and it is possible to reduce the size of power supply to a much smaller form factor. In particular, each of the electrical components in FIG. 8, other than the transformer, may be mounted using surface mount devices on a printed circuit board. Further, each of the inductors and transformer cores are low profile or planar cores mounted through cutouts formed in the printed circuit board. The coils of the inductors and transformers are provided by wiring traces on the circuit board that wrap around the portion of the appropriate core penetrating the circuit board. As a result, an extremely compact form factor may be obtained. FIG. 9 shows a top planar view of such a printed circuit board with each inductor L1, L2 and transformer cores T1 and T2 identified.

Notwithstanding the smaller size of the form factor, heat dissipation is not a serious problem due to the increased efficiency of the power supply according to the disclosed embodiments. Therefore, with all of the components assembled on a printed circuit board as described above, the assembled printed circuit board may be housed within a housing formed from an injection molded plastic dimensioned 2.75x4.5x0.436 inches without undue heating of the housing, although other dimensions may be used with a key to maintaining a thin profile of the power supply being the ratio of the surface area of the top and bottom surfaces to the overall thickness of the housing. With proper heat sinks, for example, even smaller dimensions may be attained.

Although the disclosed embodiments show only one regulated DC voltage being supplied (for example +5 or +16 volts DC), it would readily be understood by those of ordinary skill in the field that other regulated or unregulated voltages may also be supplied with minor modifications to the disclosed embodiment. For unregulated voltages, additional secondary coils (not shown) with the appropriate number of windings to provide the voltage may be magnetically coupled to any of the legs of the transformer core 120. The appropriate circuitry must then be provided for rectifying and filtering the output of this additional secondary coil. Similarly, an additional regulated voltage may be supplied by providing a feedback control circuit such as the type described above that provides the appropriate feedback.

FIGS. 11A and 11B show a schematic for the power supply circuit 800 with all resistance values in ohms and all capacitance values in microfarads unless otherwise labeled. The power supply is formed on a multilayer printed circuit board (not shown) having length and width dimensions that

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are only slightly smaller than the exterior of the case and fit as precisely as possible within the chamber of the case **300** sandwiched between the heat sinks to minimize movement after assembly. Further, as far as possible, surface mount devices are used to minimize the vertical dimension and all coil cores are preferably planar, low profile cores. Optimally, parts having the smallest possible thickness should be used.

The power supply **800** includes an input circuit **810** that may be coupled to any AC power source preferably having a frequency of between about 50 to 90 hertz and preferably having a voltage of between about 90 to 240 Volts AC. This input circuit **810** may include a full wave bridge rectifier **812**, a filter circuit **814** and a regulation circuit **816** to provide an independent power supply for all integrated circuits used on the primary side **824** of the circuit. For filtering purposes, the input regulator circuit **816** may also include a center tapped coil **819** mounted on one of the exterior legs of the "E" planar core **822** of the transformer **820**. (Preferably, the planar "E" core of the type shown in FIG. **8** is used.) When the AC input voltage exceeds a predetermined range such as one hundred and forty volts RMS, transistor **Q9** in cooperation with zener diode **VR1** will cooperate so that the center tap of the coil **819** will be selected. This permits the output Vbias of the regulator to be in an acceptable range for higher input voltages such as may be common outside of the United States. The output Vbias is used for supplying power to all of the internal integrated circuits on the primary side **824** of the transformer **820**, namely integrated circuits **U1** and **U2**. This permits these integrated circuits **U1**, **U2** to continue functioning even if the DC output voltage from the power supply **800** drops below the range necessary for the integrated circuits **U1** and **U2** to continue operating.

A controller integrated circuit **U1** provides the four control signals for powering the MOSFETs coupled to the two primary coils **825** and **827** with their center taps coupled to Vbias. The outputs of integrated circuit **U1** at pins **7** through **10** provide the control signals to a MOSFET driver circuit **U2** such that MOSFETs **Q1**, **Q2**, **Q4** and **Q5** provide the appropriate phase control as is described in connection with FIG. **8**. Integrated circuit **U2** may be for example a **4468** integrated circuit available from Micrel, Teledyne and Telcom.

Each of power switching MOSFET transistor pairs **Q1** and **Q2**, and **Q4** and **Q5** are coupled to center tapped primary coils **825** and **827**, respectively. These transistors preferably have heat sinks (not shown) coupled to their cases, and/or these heat sinks may also be thermally coupled to one of the heat sinks mounted immediately below and immediately above the top and bottom heat sinks for better thermal control. The capacitance of the MOSFETs **Q1**, **Q2**, **Q4** and **Q5** and the inductance of the coils **825** and **827** are selected to provide resonance at the frequency at which the drive signals are supplied, which may be about 1 MHz. Nonetheless, other frequencies may be used, for example, between a range of about 500 KHz to 2 MHz.

FIG. **11C** shows an alternative configuration in which the push pull approach on the primary side **824** of the circuit **800** is replaced with a half-bridge rectifier configuration. In particular, the half-bridge rectifier configuration includes transformers **T3** and **T4** for transferring power to primary windings **876** and **878** via transistors **Q101**, **Q102**, **Q104** and **Q105**. Transformers **T3** and **T4** act as isolation drivers for the gates of these transistors. In other embodiments, this circuitry could be replaced with a full bridge rectifier circuit with **8** transistors. One of ordinary skill in the art would understand that several other configurations are possible.

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FIG. **12** shows a timing diagram of the signals at nodes L through Q shown on FIG. **11A** and **11B**. The integrated circuit **U1**, as described in more detail below, through feedback, provides MOSFET driving signals L through O. The MOSFET driving signals provided to each primary winding, **825** and **827** (i.e., L and M for primary winding **825** and N and O for primary winding **827**) are preferably one hundred eighty degrees out of phase as shown in FIG. **12**. However, the relative phase relationship of driving signal pair L and M for primary winding **825** with respect to driving signal N and O for primary winding **827** may be changed by the integrated circuit controller **U1** in the manner described below to provide the regulated DC output voltage at connectors **846** and **848**. Maximum power is provided when the pairs of driving signals are in phase with each other. It should be noted that while the control signal provided at pins **7** through **10** are preferably at substantially a fifty percent duty cycle, the resistors **R10** through **R13** and the capacitors **C10** through **C13** combine with the integrated circuit **U2** to provide preferably driving pulses L through O with a duty cycle of less than 50 percent. This ensures that the FETS in a pair (i.e., **Q1** and **Q2** for winding **825** and **Q4** and **Q5** for winding **827**) are never both on at the same time to provide zero resonant switching and reduce power consumption.

Due to the zero volt resonant switching design of the circuit, MOSFET pair **Q1** and **Q2** are preferably never on at the same time and MOSFET pair **Q4** and **Q5** are preferably never on at the same time. MOSFET **Q1** will turn on just about when the voltage at node P, which is at the drain of transistor **Q1**, reaches a minimum and will turn off immediately after the voltage at the drain of transistor **Q1**, goes above that minimum level. Similarly, due to the phase relationship of drive signal pair L and M at nodes L and M, transistor **Q2** will only be on when the voltage at the drain is almost at the minimum. Transistor **Q4** will also only be on when the voltage at node Q is virtually at its minimum and the transistor **Q5** will only be on when the voltage at its drain is nearly at its minimum.

It should be noted that the duty cycle of signals L through O is selected so that the waveforms P and Q are substantially trapezoidal with clipping occurring by transistors **Q1**, **Q2**, **Q4** and **Q5**. This permits operation of the circuit over a wider range of input voltages. However, in alternative embodiments, transistors **Q1**, **Q2**, **Q4** and **Q5** need not clip so that the waveshapes at the drains of these transistors are substantially sinusoidal. Alternatively, using a low enough frequency for the drive signals, a square wave on the drains of the actual transistors could be used but would probably require larger cores.

For the secondary side **826** of the power supply circuit **800**, a single secondary winding **840** is located at the magnetic summing node of the core **822** (i.e., the center leg of the low profile "E" type core shown in FIG. **8**). That secondary winding **840** is coupled to a rectifier circuit **842** and then to an output filter **844** including a filter choke **L2** to provide the regulated DC output at connectors **846**, **848** in the manner described below.

The center tap of the secondary winding **842** is coupled through a coil in the filter coil **L2** sharing a common core with the coil in the output filter **844**. Through resistor **R23**, this center tap of winding **842** provides a current sense input to a summing amplifier **U3A**. A voltage sense of the output DC regulated voltage Vout is provided to an amplifier including amplifier **U3C**.

The sensed voltage signal at the output of amplifier **U3C** is provided to the summing amplifier **U3A** through amplifier

circuit U3B to provide the feedback necessary for the desired regulation of the DC output.

The output of the summing amplifier U3A is provided through an emitter follower transistor Q7 to the center tap of the secondary side 826 of the feedback transformer 850. This transformer is magnetically isolated from the transformer 820. The signal at the center tap of transformer 850 amplitude modulates a carrier signal provided by winding 852 provided on the same exterior leg of the core 822 as primary winding 827. Preferably also, this should be the opposite exterior leg of the core 822 on which coil 819 and winding 825 are mounted.

The primary side 824 coil of transformer 850 provides an amplitude modulated feedback signal that has an amplitude envelope. A diode detector comprised of diode CR5 and resistor R17 strip the carrier away, leaving the amplitude envelope as a feedback control signal to the VMOD input (pin 1 of U1) to provide the feedback useful for altering of the phase relationship between the drive signal pairs of signals L and M on the one hand, and signals N and O, on the other hand to regulate the DC power supply output at connectors 846, 848.

With the current control connector 860 and the voltage control connector 862 left unconnected (as shown), amplifiers comprising U3B and U3D along with the current and voltage sense signals cause the integrated circuit U1 to control the phase relationship between the drive signal pairs L and M, on the one hand, and N and O, on the other hand, to provide a constant power supply until the output voltage drops below about ten volts. Then, due to the feedback signal at pin 1 of the controller U1, the integrated circuit controller U1 controls the relative phase relationship between the pair of drive signals L and M, on the one hand, and N and O, on the other hand, to provide a constant current source down to a minimal voltage, which is preferably less than about one volt.

It should also be noted that the Vcc used by the amplifiers U3A through U3D in the integrated circuit U3 and the voltage regulator U4 to generate the +5 volts used in the control circuit (e.g. comprising amplifiers U3B, U3C and U3D) is supplied by a rectifier circuit 854. The rectifier circuit 854 is also coupled to secondary coil 852.

FIG. 13 shows a block diagram 900 of the controller integrated circuit U1. Pins 13, 14, and 15 cooperate together along with external components R3, R4, R5 and R6 to set the operational frequency of the oscillator 902 to be preferably at 2 MHZ, although other frequencies may be selected. An output of the oscillator 902 is coupled to an internal capacitor 901 to provide a triangle signal labeled Ramp on FIGS. 14A and 14B while another output of the oscillator 902 is a 2 MHZ square wave coupled to exclusive OR gate 904 and the clock input of a D flip flop 907. A Schmitt trigger comparator 906 compares the feedback signal VMOD at pin 1 with the ramp signal as is shown in FIGS. 14A and 14B. In FIG. 14A, the VMOD signal, which is the envelope of the feedback signal from the feedback transformer 850 is at the maximum level, while in FIG. 14B, the VMOD signal is somewhat less than the maximum. As can be seen in FIGS. 14A and 14B, the comparator 906 cooperates with the D flip flop 907, the exclusive OR gate 904, and the associated logic gates 908 to generate one shot control signals J and K. As can be seen by comparing FIGS. 14A, when VMOD is at a maximum, the one shot drive signals J and K are controlled so that both one shot control signals go high at the same time. When the amplitude of VMOD drops below the maximum, the timing of the one shot control signal J is

retarded and the timing of the one shot control signal K is advanced. These one shot control signals J and K are provided to one shot circuits 920 and 930 within the controller circuit U1, which have dual outputs VA and VC and VB and VD respectively. The one shots 920 and 930 trigger on the rising edge of signals J and K respectively, and the durations to the falling edge of the control signals J and K are irrelevant provided that they fall before the one shots need to be retriggered. Due to the inclusion of inverters 922 and 932, the output pair of signals VA and VC and VB and VD are approximately one hundred and eighty degrees out of phase. It should also be noted that the external capacitor C7 and resistor R7 are coupled to pins 5 and 4 of the controller U1 to control the duration of the output pulses at the one shot 920 and the one shot 930 to trigger them for the same duration. Further, these component values are selected to be as near as possible to provide a fifty percent duty cycle on the outputs L through O of the MOSFET driver circuit U2 at the frequency of operation.

The controller circuit U1 also includes a reference voltage generator 940 that provides the reference voltage for the over voltage protection circuit 942 and the comparator 944. As shown in FIG. 11, an over voltage protection circuit 830 having a coil 832 is located at or near the summing node of the E block core 822. The value of the components within over voltage protection circuit 830 are selected such that if the output voltage DC Output goes above a predetermined threshold, silicon controlled rectifier (SCR) Q3 will fire, shunting the Vbias to ground. This will cause the integrated circuits U1 and U2 to cease operating, thereby shutting down the output until the unit is recycled by temporarily removing the AC input voltage.

Thus, a small, highly efficient form factor power supply has been disclosed that may be readily mounted within a small container having a thickness of 0.436 inches or less and having dimensions suitable for holding in a typical shirt pocket or calculator pocket in a brief case at high power levels of up to about 75 watts DC output with a surface temperature of about 140 degrees Fahrenheit at the surface. Thicknesses of less than 0.436 inches may be attainable if thinner electrolytic or other types of filtering capacitors can be obtained using standard production techniques. Alternatively, a thinner case may be obtained by maximizing coupling of heat generating components to the heat sinks with maximum air flow through the openings defined by the louvers 302 and by making the top and bottom surface areas of the case larger. Regulation of the output voltage may be readily attained. Still further, the secondary coil can be positioned where the magnetic flux induced in the core from the two primary coils destructively interfere with each other and where the phase of the two driving signals is approximately one hundred eighty degrees out of phase at maximum output. In further alternatives, cooling methods other may be used, such as small electric fans, thermal-electric coolers or the like, to permit smaller form factor power supply configurations. Other alternatives will be readily apparent to those of skill in the art. It should be noted that in alternative embodiments, the various resistors, capacitors, frequencies and inductors may be different and other types of integrated circuits may also be used.

FIGS. 16-20 illustrate an improved transformer core 1010 in accordance with an embodiment of the present invention. FIG. 16A shows a top plan view of the transformer core 1010, which is formed by a base plate 1012, a secondary leg 1014 and a pair of primary legs 1016 and 1018. The secondary leg 1014 and the primary legs of the transformer 1010 may be bosses attached to the base plate 1012 by

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welds, magnetically permeable adhesives, or the like, or the entire assembly may be molded using magnetically permeable powder. FIG. 16B and 16C show two side plan views of how the transformer legs 1014, 1016, and 1018 are positioned on the base plate. FIG. 17A shows a top plan view of a transformer cap 1020, which is secured to the legs 1014, 1016, and 1018 of the transformer core 1010 to complete the transformer core once the bosses have been inserted through cutouts. The transformer legs 1014, 1016, and 1018 are secured to the transformer cap 1020 by magnetically permeable adhesives, welding or the like. FIGS. 17B and 17C show side plan views of the transformer cap 1020.

In preferred embodiments, the transformer core 1010 and transformer cap 1020 are formed from a ferrite material. The operational frequency range of the core is from about 0.5 to 1.0 MHz. Also, the initial magnetic permeability is preferably $1400 \pm 20\%$. In addition, the saturation flux density may be 5300 gauss, and the Curie temperature may be 250 degrees Centigrade. The core loss while operating at a frequency of 1 MHz should preferably be approximately 500 KW/m at 500 gauss. In other embodiments, different core parameters may be used.

In the disclosed embodiments, the base plate 1012 and the transformer cap are dimensioned to be $1.260 \times 1.260 \times 0.075$ inches. The secondary transformer leg 1014 is dimensioned to be 0.800×0.200 by 0.060 inches, and each primary transformer leg is $0.133 \times 0.700 \times 0.060$ inches. The secondary transformer leg 1014 is positioned away from the primary transformer legs 1016 and 1018, as shown in FIGS. 16A–16C, to maximize the cross-sectional area of each of the transformer legs (i.e., the length and width of the cross-sectional area of the transformer legs to the windings, thereby requiring less windings for the same magnetic coupling. Fewer windings means less area of a layer of a circuit board may be used so that the number of layers on the circuit board may be minimized. The improved transformer core also provides this maximized ratio while maintaining the ratio of the secondary to the primary windings at a constant value. However, in alternative embodiments, slightly different dimensions for the core parts may be used. Also, as described in the previous embodiments, the secondary coil is still positioned at a summing point of the primary coils.

FIG. 18 shows a printed circuit card layer 1030 without secondary or primary cores attached and having cutouts 1014', 1016' and 1018' to allow the corresponding transformer legs 1014, 1016 and 1018 to pass through the printed circuit board. FIG. 19 shows another printed circuit card layer 1030' in which a secondary coil pattern 1040 surrounding the cut-out 1014' for the secondary transformer leg 1014. FIG. 16 shows still another printed circuit card layer 1030' in which primary coil patterns 1042 and 1044 surround the cut-outs 1016' and 1018' for the to primary transformer legs 1016 and 1018, respectively.

FIGS. 21–26 illustrate an alternative embodiment using two transformer cores 1110 in accordance with the present invention. FIG. 21A shows a top plan view of bottom portion of the transformer core 1110, which is formed by a base plate 1112, a central leg 1114 and a pair of peripheral legs 1116 and 1118. The central leg 1114 and the peripheral legs of the transformer 1110 may be bosses attached to the base plate 1112 by welds, magnetically permeable adhesives, or the like, or the entire assembly may be molded using magnetically permeable powder. FIGS. 21B and 21C show two side plan views of how the transformer legs 1114, 1116, and 1118 are positioned on the base plate 1112. FIG. 22A shows a top

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plan view of a transformer cap 1120, which is secured to the legs 1114, 1116, and 1118 of the transformer core 1110 to complete the transformer core once the bosses have been inserted through cutouts. The transformer legs 1114, 1116, and 1118 are secured to the transformer cap 1120 by magnetically permeable adhesives, welds or the like. FIGS. 22B and 22C show side plan views of the transformer cap 1120.

In preferred embodiments, the transformer core 1110 and transformer cap 1120 are formed from a ferrite material that has properties and characteristics that are similar to those of the embodiment with the transformer core 1010, discussed above.

In the disclosed embodiments, the base plate 1112 and the transformer cap 1120 are dimensioned to be $1.113 \times 1.113 \times 0.075$ inches. The central transformer leg 1114 is dimensioned to be 0.300×0.300 by 0.060 inches, and each peripheral transformer leg is $0.075 \times 0.630 \times 0.060$ inches. The central transformer leg 1114 is positioned away from the peripheral transformer legs 1116 and 1118, as shown in FIGS. 21A–21C, to maximize the cross-sectional area of the central transformer leg 1114 (i.e., the length and width of the central transformer leg). This maximizes a ratio of the cross-sectional area of the central transformer leg 1114 to the windings, thereby requiring less windings for the same magnetic coupling. Fewer windings mean less area of a layer of a circuit board may be used so that the number of layers on the circuit board may be minimized. The improved transformer core also provides this maximized ratio while maintaining the ratio of the secondary to the primary windings at a constant value. Also, as described in the previous transformer core 1010 embodiment, the secondary coil is still positioned at a summing point of the primary coils.

FIG. 23 shows a printed circuit card layer 1130A defining a secondary coil 1040' and having cutouts 1114', 1116' and 1118' and cutouts 1114", 1116" and 1118" to allow the corresponding transformer legs 1114, 1116 and 1118 of two transformer cores 1110 to pass through the printed circuit board. The secondary coil pattern 1140' passes around both central leg cutouts 1114' and 1114" to magnetically couple the secondary coil pattern 1040' with the summing point of two primary coils (see FIGS. 24 and 25). FIG. 20 shows another layer 1130B of the printed circuit card in which two primary coil patterns 1142' and 1142" surround the corresponding central cutout 1114' and 1114", respectively. FIG. 25 shows another printed circuit card layer 1130C in which two additional primary coil patterns 1144' and 1144" surround the corresponding central cutout 1114' and 1114", respectively. It should be noted that primary coil patterns 1144' and 1144" are coupled to corresponding primary coil patterns 1142' and 1142" to form the two primary coils that drive the secondary coil. FIG. 26 shows still another printed circuit card layer 1130D in which a secondary coil pattern 1140" surrounds the corresponding central cut-out 1114' and 1114", respectively. It should be noted that secondary coil pattern 1140" is coupled to the corresponding secondary coil pattern 1140' to form the secondary coil that is coupled to the primary coils. Finally, it should be pointed out that the ancillary coil patterns 1146 surrounding the peripheral legs 1116' and 1116" are provided to produce a signal useful for protecting the circuit from over voltage.

The applicant has found that this characteristic power and current curve provides good charging of lithium ion, nickel metal hydride, nickel cadmium and other rechargeable batteries. Thus, the small form factor power supply is capable of supplying sufficient power to a personal computer or the like, even when the batteries are thoroughly discharged. The constant current at the output connectors 846, 848 can

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provide minimal voltages down to about less than one volt because the controller U1 can attain relative phase shifts between the drive signal pairs to between about one degree to one hundred eighty degrees (i.e., signal N lags signal L between about one degree to one hundred eighty degrees and signal O and lags signal M between about one degree and one hundred eighty degrees). Thus, as shown in FIG. 15, if one were to draw a power versus output current curve and an output voltage versus output current curve of such a power supply, the slope of the output voltage curve is relatively constant until the output current reaches approximately 2.0 amperes, then slopes down to 10 volts at which time the output current is essentially constant at approximately 3.6 amperes for voltages under 10 volts. The output power curve increases relatively linearly until the current level reaches approximately 2.2 amperes, at which time the output power curve tends to level off until the current reaches its maximum value of approximately 3.6 amperes. Therefore, the power supply is capable of providing constant current to the personal computer or the like, even if the battery is only capable of producing a fraction of a volt. This power curve is determined as a result of the selected amplifier configuration associated with integrated circuit U3, which may be an LM324 on the secondary side 826. The predetermined limit may be as high as 75 watts DC for a power supply having an upper and lower surface area within the case 300 of about 14 square inches and a thickness of about 0.436 inches or less so that the ratio of the top or bottom surface areas to the thickness is about 30:1.

However, the circuit can readily be programmed to provide other power/current characteristics, such as the power characteristics for lap top computers, appliances, cellular or portable telephones, notebook computers, game systems or the like. This may be accomplished by coupling additional resistors to ground and/or +5 volts (generated by a voltage regulator U4) to the current control and voltage control inputs. The small form factor power supplies described above are capable of charging various different types of batteries, such as NiCad and NiH. However, in alternative embodiments, the small form factor power supplies may charge batteries using Zinc air, Lead acid, alkaline or the like. The power supply may also be used to charge Lithium ion batteries, although a different control chip or circuitry may be required to handle the unique charging requirements of these batteries.

While the description above refers to particular embodiments of the present invention, it will be understood that many modifications may be made without departing from the spirit thereof. The accompanying claims are intended to cover such modifications as would fall within the true scope and spirit of the present invention.

The presently disclosed embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims, rather than the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. In a portable appliance having an operational load, a rechargeable battery, the rechargeable battery having at least one battery cell, a positive terminal and a negative terminal, and a connection adapted to mate with an external power supply, the improvement comprising:

- a circuit for generating a signal representative of a voltage between the positive and negative terminals; and
- a circuit for providing a signal to the connection in response to the signal representative of the voltage for

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programming the external power supply to provide a desired level of current to the connection.

2. The portable appliance of claim 1, the portable appliance further including a circuit for applying at least a portion of the desired level of current to the positive and negative terminals.

3. The portable appliance of claim 1, the portable appliance further including a circuit for applying a first portion of the desired level of current to the positive and negative terminals and a second portion of the desired level of current to the operating load, wherein the sum of the first and second portions of the desired level of current substantially equals the desired level of current.

4. The portable appliance of claim 1, wherein the at least one battery cell is one of a nickel cadmium battery cell and a lithium ion battery cell.

5. The portable appliance of claim 1, wherein the circuit providing the signal to the connection controls the power supply to provide the desired level of current so as to maintain the voltage between the positive and negative terminal within a set range to achieve optimum charging characteristics for the rechargeable battery.

6. A portable appliance, the portable appliance comprising:

- a dynamic operational load;
- a rechargeable battery;
- a connection adapted for mating with an external power supply for providing a current; and
- a circuit for providing a signal to the connection for programming the external power supply to provide a current to the connection for recharging the rechargeable battery and powering the dynamic operational load.

7. The portable appliance of claim 6, wherein the rechargeable battery is one of a nickel cadmium battery and a lithium ion battery.

8. The portable appliance of claim 6, wherein the circuit providing the signal to the connection controls the power supply to provide the current to the connection so as to maintain the voltage between the positive and negative terminal within a set range to achieve optimum charging characteristics for the rechargeable battery.

9. A rechargeable battery cartridge adapted to be removably installed in or coupled to a portable appliance, the battery cartridge comprising:

- a casing including a first set of terminals adapted for mating with conductors of the portable appliance and a second set of terminals adapted to be coupled to an external power supply;
- a rechargeable battery disposed within the casing, the rechargeable battery having a positive terminal and a negative terminal and at least one battery cell for storing a charge between the positive terminal and the negative terminal; and

a circuit disposed within the casing for generating a signal to program the external power supply to provide one of a desired current and a desired voltage to be applied to the second set of terminals based upon a voltage between the positive and negative terminals.

10. The rechargeable battery cartridge of claim 9, the rechargeable battery cartridge further including:

- a circuit for generating a signal representative of an optimal battery current based upon the voltage between the positive and negative terminals;
- a circuit for estimating a current applied to the rechargeable battery;

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- a circuit for generating a signal representative of a difference between the estimated current and the optimal battery current; and
- a circuit for providing the signal representative of the difference to the second set of terminals to program the power supply to provide the desired current.
- 11.** The rechargeable battery cartridge of claim **9**, the rechargeable battery cartridge further comprising:
- a circuit disposed within the casing for generating a signal representative of a current through the rechargeable battery; and
 - a circuit disposed within the casing for providing a signal to one of the terminals of the second set of terminals which representative of a comparison of the signal representative of the current through the rechargeable battery and a signal representative of the desired current through the rechargeable battery.
- 12.** The rechargeable battery cartridge of claim **10**, wherein the desired current substantially equals the sum of the optimal battery current and a current applied to a dynamic operational load in the portable appliance.
- 13.** The rechargeable battery cartridge of claim **10**, wherein the rechargeable battery is one of a nickel cadmium battery and a lithium ion battery.
- 14.** The rechargeable battery cartridge of claim **10**, wherein the circuit for generating the signal to program the external power supply controls the power supply to provide the desired current so as to maintain the voltage between the positive and negative terminal within a set range to achieve optimum charging characteristics for the rechargeable battery.

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- 15.** A method of powering a portable appliance, the method comprising:
- coupling a rechargeable battery cartridge to the portable appliance, the rechargeable battery cartridge including a rechargeable battery having a positive terminal and a negative terminal and at least one battery cell for storing a charge between the positive terminal and the negative terminal;
 - coupling an external power supply to a connector of the rechargeable battery cartridge; and
 - providing a signal to the connector of the rechargeable battery to program the external power supply to provide one of a desired level of current to be applied to the connector of the rechargeable battery cartridge based upon a voltage between the positive and negative terminals.
- 16.** The method of claim **15**, the method further including applying at least a portion of the desired level of current to the positive and negative terminals.
- 17.** The method of claim **15**, the method further including applying a first portion of the desired level of current to the positive and negative terminals and a second portion of the desired level of current to the operating load, wherein the sum of the first and second portions of the desired level of current substantially equals the desired level of current.
- 18.** The method of claim **15**, the method further including controlling the power supply to provide the desired level of current so as to maintain the voltage between the positive and negative terminal within a set range to achieve optimum charging characteristics for the rechargeable battery.

* * * * *

EXHIBIT G



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Park et al.

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(45) **Date of Patent:** **Sep. 6, 2011**

(54) **CONTACT-LESS CHARGEABLE BATTERY
AND CHARGING DEVICE, BATTERY
CHARGING SET, AND CHARGING
CONTROL METHOD THEREOF**

(75) Inventors: **Dong-Young Park**, Seoul (KR);
Sung-Wook Moon, Seoul (KR);
Sung-Wook Choi, Anyang-si (KR);
Gwang-Hee Gwon, Anyang-si (KR);
Sub Han, Yongin-si (KR); **Jung-Bum**
Kim, Anyang-si (KR)

(73) Assignee: **LS Cable & System Ltd.**, Anyang,
Gyeonggi-do (KR)

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(51) **Int. Cl.**

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H02J 7/04 (2006.01)

H02M 7/5383 (2007.01)

(52) **U.S. Cl.** **320/108; 320/109; 320/134; 320/136;**
320/139; 363/74; 363/84

(58) **Field of Classification Search** 320/108
See application file for complete search history.

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Primary Examiner — Edward Tso

Assistant Examiner — Yalkew Fantu

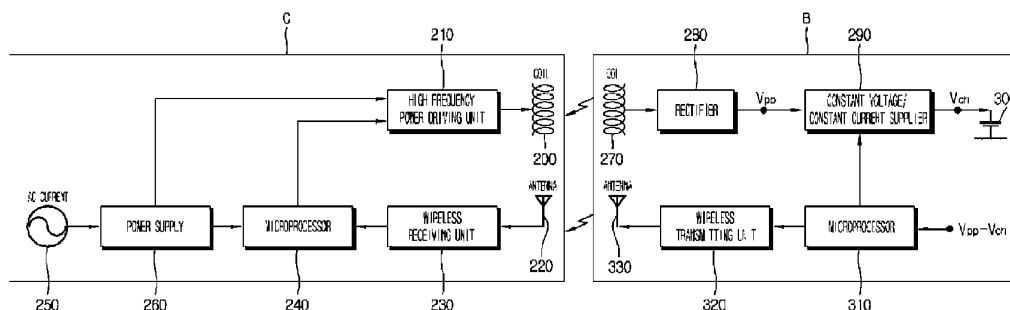
(74) *Attorney, Agent, or Firm* — Sherr & Vaughn, PLLC

(57) **ABSTRACT**

The present invention relates to a wireless charger for a mobile communication terminal, which allows charging a plurality of batteries in a conveniently way without any terminal connection of the batteries to chargers for various mobile communication terminals such as a cellular phone and PDA and also allows intercepting electromagnetic waves while the charger is used, by means of Faraday's law.

The wireless charger of the present invention includes a charger body having an electromagnetic wave intercepting means; a charging pad received in the charger body; and at least one battery that is to be charged by means of induced electromotive force generated by the charging pad, wherein the charger body includes a power supply means, a housing having a receiver for receiving the charging pad and connected to the power supply means, and a cover hinged to the housing.

24 Claims, 5 Drawing Sheets



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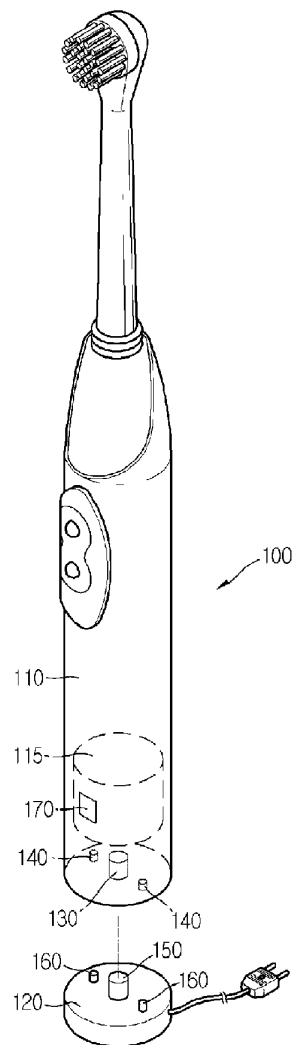
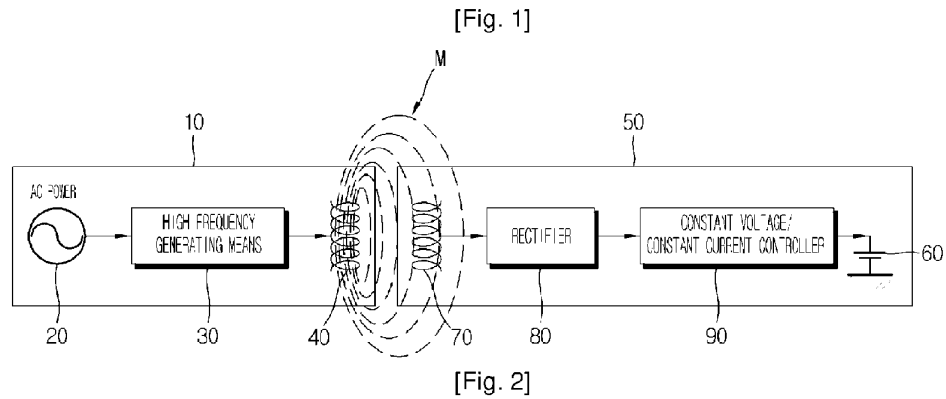
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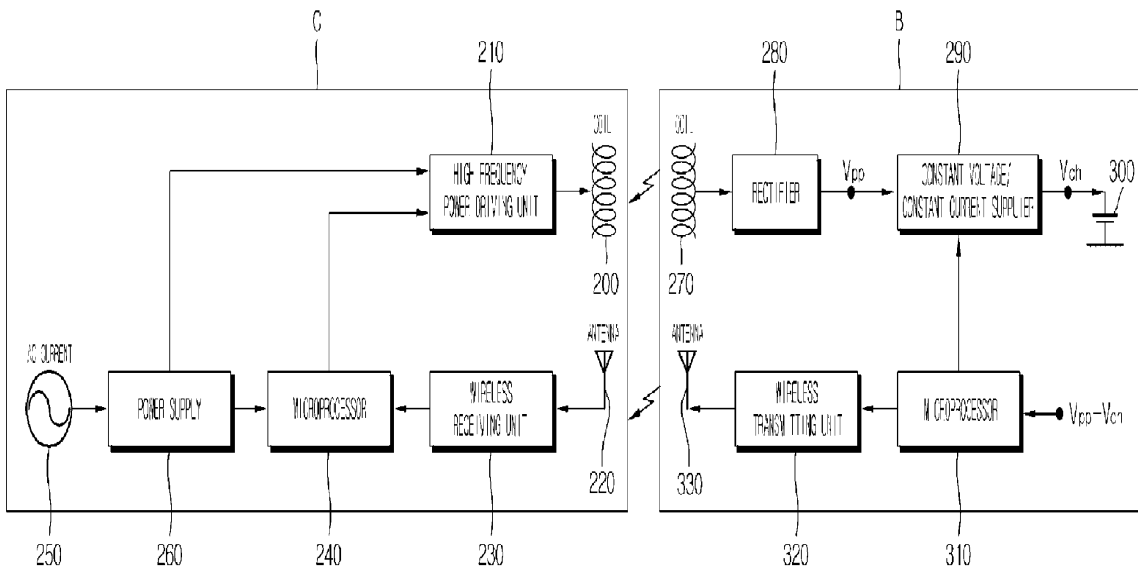
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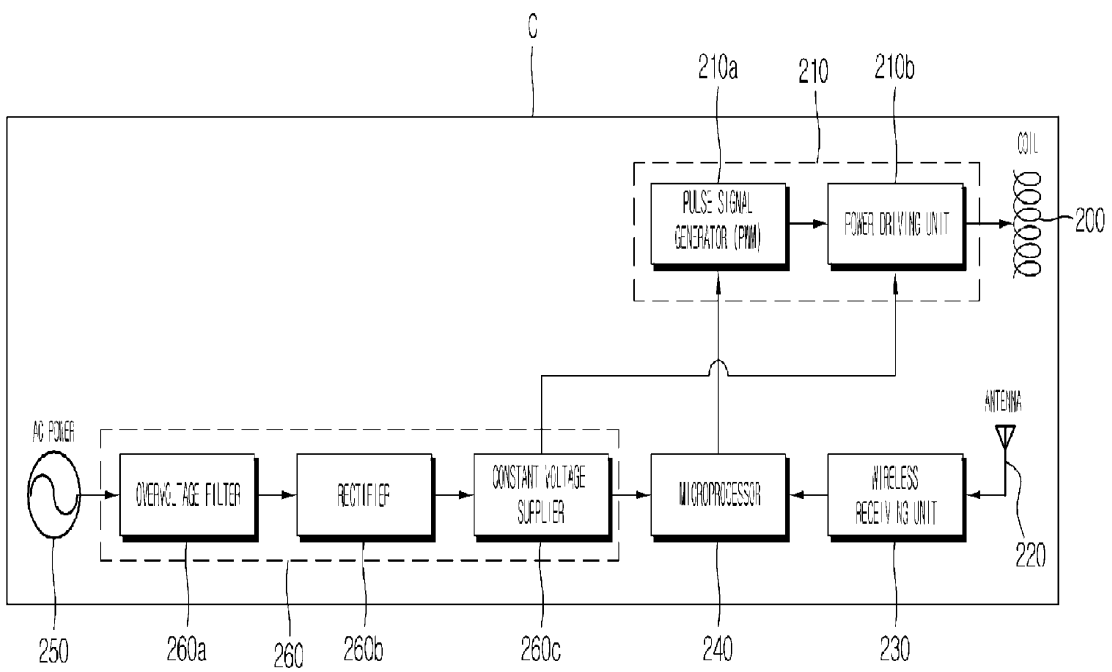
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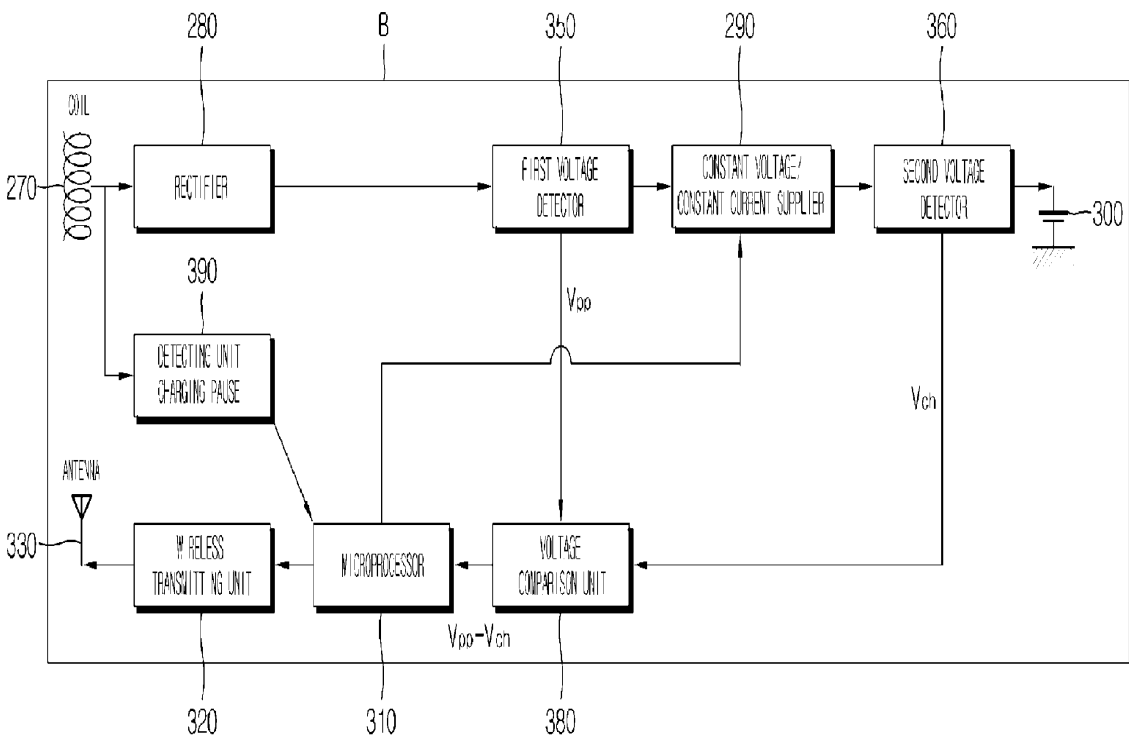


[Fig. 3]



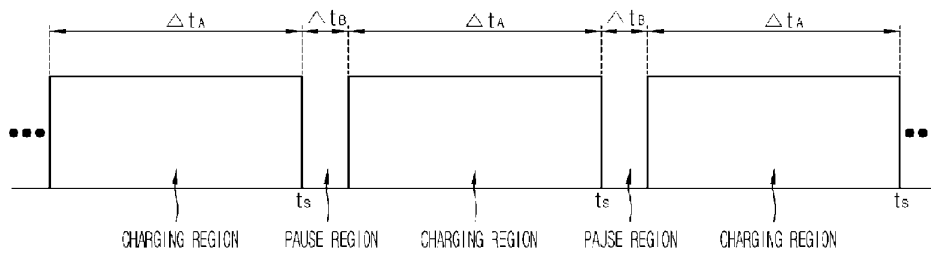


[Fig. 4]

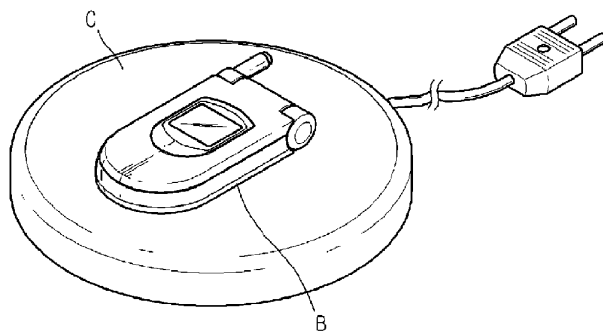


[Fig. 5]

[Fig. 6]



[Fig. 7]



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CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a national stage application under 35 U.S.C. 371 based on and claiming the benefit of International Application Serial No. PCT/KR2006/001713 filed on May 8, 2006 and the benefit of priority from Korean Application No. 10-2005-69871 filed on Jul. 29, 2005 and Korean Application No. 10-2006-38960 filed on Apr. 28, 2006, the entire contents of each of which are incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to a contact-less chargeable battery and a charging device using electromagnetic induction phenomenon, and its charging control method, and more particularly to a contact-less chargeable battery capable of solving an overvoltage state by means of a wireless feedback control though an overvoltage is applied to both ends of a circuit part that supplies a constant voltage or a constant current when charging a battery, a contact-less charging device for charging the battery, a battery charging set including them, and a charging control method thereof.

BACKGROUND ART

A personal portable device such as a cellular phone and a notebook is supplied with power through a chargeable battery. If a voltage of the battery is lowered than a pre-determined level, a user of the personal portable device charges the battery using a charging device and then uses the portable device again.

A battery of a general personal portable device has a contact terminal exposed out so that it may be electrically connected to a charging terminal prepared to a charging device. When charging the battery, the charging terminal of the charging device and the contact terminal of the battery are connected with each other and keep their electrically connected state.

However, since the charging terminal and the contact terminal are exposed out for their connection, they are easily contaminated by impurities and also easily worn away due to frictions between both terminals when the charging terminal and the contact terminal are connected. In addition, the charging terminal and the contact terminal easily corrode due to moisture in the art, so a contact between the charging terminal and the contact terminal becomes inferior. Also, if moisture is penetrated into the battery through a fine gap of the contact terminal while using the battery, the battery may be completely discharged due to a short circuit of its internal circuit, which may cause a fatal problem.

In order to solve these problems, a contact-less charging technique capable of charging a battery of a personal portable device while the battery is coupled with a charger in a wireless method by means of electronic induction phenomenon is recently proposed. The contact-less charging technique is currently widely utilized for daily goods such as electric toothbrushes and electric shavers.

FIG. 1 is a schematic view showing a battery and a charger adopting the conventional contact-less charging method.

Referring to FIG. 1, the charger 10 includes a high frequency power driving means 30 for receiving power from a

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common AC power source 20 to output a high frequency AC current, and a primary coil 40 supplied with the high frequency AC current from the high frequency power driving means 30 to form a magnetic field M.

In addition, the battery 50 includes a battery cell 60 charged with electric energy, a secondary coil 70 to which a high frequency AC current is induced according to the linkage of the magnetic field M generated in the primary coil 40, a rectifier 80 for converting the high frequency AC current induced in the secondary coil 70 into a DC current, and a constant voltage/constant current supplier 90 for applying the AC current rectified in the rectifier 80 to the battery cell 60.

Here, the constant voltage/constant current supplier 90 is a well-known circuit element widely used in a battery charging device. The constant voltage/constant current supplier 90 plays a role of supplying current to the battery cell 60 constantly at an initial charging stage, and then decreasing supply of current but keeping voltage constantly if a charging voltage of the battery cell 60 slowly increases and then exceeds a certain criterion level.

According to the charger 10 and the battery 50 adopting the contact-less charging method of the prior art, an intensity of the high frequency AC current induced to the secondary coil 70 is proportional to an intensity of the magnetic flux linked to the secondary coil 70. In addition, the intensity of the magnetic flux linked to the secondary coil 70 is changed according to a relative position with the primary coil 40. That is to say, as the secondary coil 70 is positioned closer to the primary coil 40 of the charger 10, an intensity of the magnetic flux linked to the secondary coil 70 is increased, and as a result an intensity of the high frequency AC current induced by the secondary coil 70 is also increased.

Meanwhile, standards of the constant current/constant voltage supplier 90, which is an essential element of a charging circuit module provided to the contact-less chargeable battery 50, are defined according to an intensity of the high frequency AC current induced by the secondary coil 70. However, the intensity of the AC current induced by the secondary coil 70 is changed according to a relative position between the primary coil 40 and the secondary coil 70 as mentioned above.

Thus, if standards of the constant current/constant voltage supplier 90 are defined using a small high frequency AC current, in case the battery 50 is positioned at a position where a large high frequency AC current is induced, overvoltage exceeding the standards may be applied to both ends of the constant current/constant voltage supplier 90 while charging the battery 10, thereby possibly causing a damage on parts.

Considering the above, the charger 10 and the battery 50 adopting the contact-less charging method of the prior art generally employs a structure capable of relatively fixing positions between them at a position where the standards of the constant current/constant voltage supplier 90 are defined.

FIG. 2 is a perspective view showing a coupling state of an electric toothbrush 100 adopting the conventional contact-less charging method.

Referring to FIG. 2, the electric toothbrush 100 includes a toothbrush body 110 having a battery 115 mounted to its lower end, and a charger 120 for charging the battery 115 in a contact-less method. A main groove 130 and an auxiliary groove 140 are prepared at a lower end of the toothbrush body 110, and a main protrusion 150 and an auxiliary protrusion 160 are respectively prepared to an upper portion of the charger 120 with shapes to be matched with the main groove 130 and the auxiliary groove 140.

The toothbrush body 110 and the charger 120 are closely fixed with each other by means of matching of the grooves

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130, 140 and the protrusions 150, 160, and as a result relative positions of the charger 120 and the battery 150 provided to the toothbrush body 110 are also closely fixed.

Standards of a constant voltage/constant current supplier 170 provided to the battery 115 are defined with the assumption that the toothbrush body 110 and the charger 120 are closely coupled. Thus, an overvoltage exceeding the standards is not applied to both ends of the constant voltage/constant current supplier 170, and as a result it may be prevented that the constant voltage/constant current supplier 170 is damaged due to an unexpected overvoltage.

However, relative positions of the battery 115 and the charger 120 are strictly restricted as mentioned above, any inconvenience may be caused to a user. That is to say, whenever charging the battery 115 provided to the toothbrush body 110, the user should repeatedly struggle for fixing the toothbrush body 110 at a fixed position based on the charger 120. Thus, in order to maximize the convenience of the user, a new technical alternative capable of overcoming the restriction of relative positions of the battery 115 and the charger 120 is needed.

DISCLOSURE OF INVENTION

Technical Problem

The present invention is designed in consideration of the above problems, and therefore it is an object of the invention to provide contact-less chargeable battery and charging device capable of preventing any damage of an internal battery circuit together with solving a restriction for relative positions between the chargeable battery and the charging device when charging the battery in a contact-less charging method, and a battery charging set including them.

Another object of the present invention is to provide a battery charging control method capable of preventing any damage of an internal battery circuit together with solving a restriction for relative positions between the battery and the charger that employ a contact-less charging method.

Technical Solution

In order to accomplish the above object, the present invention provides a contact-less chargeable battery including a charging circuit module for receiving a charging power from an external contact-less charging device by means of electromagnetic induction phenomenon and then charging an electric energy to a battery cell.

Specifically, the charging circuit module includes a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device; a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current; a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

In order to accomplish the above object, the present invention provides a contact-less charging device that transmits a charging power to a contact-less chargeable battery by means of electromagnetic induction phenomenon. For this purpose, the charging device includes a magnetic field generating unit

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for receiving an AC current and forming a magnetic field in an outer space; a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Preferably, the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit. In addition, the overvoltage monitoring unit of the battery wirelessly transmits the monitoring result to the charging power adjustment unit while a magnetic field is not generated through the magnetic field generating unit.

Preferably, the monitoring result is a charging power adjustment request signal, a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Preferably, the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked, and the magnetic field generating unit is a coil to both ends of which a high frequency AC current is applied.

Preferably, the overvoltage monitoring unit includes a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier; a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.

Preferably, the overvoltage monitoring unit further includes a charging pause detection unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the micro-processor. In this case, the micro-processor outputs the monitoring result to the wireless transmitting unit after the end time point is input.

Preferably, the charging power adjusting unit includes a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.

Preferably, the chargeable battery further includes a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, and the high frequency power driving unit includes a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.

Preferably, the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.

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Preferably, the constant voltage supplier includes an over-voltage filter for receiving a common AC current and intercepting an overvoltage current; a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.

In another aspect of the present invention, there is also provided a method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, which includes the steps of: intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region; linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current; rectifying the output high frequency AC current to be converted into a DC current; applying the DC current to a battery cell through a constant voltage/constant current element so as to charge the battery cell in a constant voltage/constant current mode; monitoring voltages at both ends of the constant voltage/constant current element and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of preferred embodiments of the present invention will be more fully described in the following detailed description, taken accompanying drawings. In the drawings:

FIG. 1 is a schematic block diagram showing a charging device and a battery adopting a conventional contact-less charging method;

FIG. 2 is a perspective view showing a coupling state of an electric toothbrush adopting the conventional contact-less charging method;

FIG. 3 is a schematic block diagram showing contact-less chargeable battery and charging device according to a preferred embodiment of the present invention;

FIG. 4 is a detailed block diagram showing the contact-less charging device of FIG. 3;

FIG. 5 is a detailed block diagram showing the contact-less battery of FIG. 3;

FIG. 6 is a graph showing that a charging power is intermittently output from a secondary coil of the contact-less chargeable battery; and

FIG. 7 shows a use state of the contact-less chargeable battery and charging device according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. Prior to the description, it should be understood that the terms used in the specification and the appended claims should not be construed as limited to general and dictionary meanings, but interpreted based on the meanings and concepts corresponding to technical aspects of the present invention on the basis of the principle that the inventor is allowed to define terms appropriately for the best explanation.

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tion. Therefore, the description proposed herein is just a preferable example for the purpose of illustrations only, not intended to limit the scope of the invention, so it should be understood that other equivalents and modifications could be made thereto without departing from the spirit and scope of the invention.

FIG. 3 is a schematic block diagram showing a contact-less charging device C and a contact-less chargeable battery B according to a preferred embodiment of the present invention.

Referring to FIG. 3, the contact-less charging device C of this embodiment includes a primary coil 200, a high frequency power driving unit 210, a primary antenna 220, a wireless receiving unit 230, a microprocessor 240, and a power supply 260.

The high frequency power driving unit 210 applies a high frequency AC current of several tens KHz to the primary coil 200 by means of rapid switching operation to generate a magnetic field. For example, the high frequency power driving unit 210 applies a high frequency AC current of 80 KHz to the primary coil 200. If a magnetic field is generated to the primary coil 200 by the high frequency AC current, a charging power is transferred to the chargeable battery B in a contact-less method by means of electromagnetic induction phenomenon.

Preferably, the high frequency power driving unit 210 employs a known SMPS (Switching Mode Power Supply), but not limitedly.

The wireless receiving unit 230 receives an adjustment request signal of charging power transmitted from the chargeable battery B through the antenna 220, and then inputs the signal to the microprocessor 240.

The adjustment request signal is transmitted when an excessive charging power is transferred to the battery to probably cause a damage on circuit parts that supply constant voltage/constant current. The adjustment request signal is modulated and transmitted from the chargeable battery B, and thus the wireless receiving unit 230 demodulates the adjustment request signal and then inputs it to the microprocessor 240.

Preferably, a carrier in a frequency band of 10 to 15 MHz is used for wireless transmission of the adjustment request signal. In addition, the wireless receiving unit 230 is configured using a photo coupler. However, the present invention is not limited to such frequency band of the carrier and such elements for configuring the wireless receiving unit 230.

When the adjustment request signal is wirelessly transmitted from the chargeable battery B, it is preferred that a high frequency AC current is not applied to the primary coil 200. If an adjustment request signal is wirelessly transmitted while a magnetic field is generated in the primary coil 200 due to the application of a high frequency AC current in several tens KHz band, the adjustment request signal may be screened due to the magnetic field and thus the adjustment request signal may not be properly received through the wireless receiving unit 230.

Thus, the high frequency power driving unit 210 periodically has suspension times, not applying the high frequency AC current continuously to the primary coil 200. For example, the high frequency power driving unit 210 does not apply a high frequency AC current to the primary coil 200 for 50 ms whenever 3 seconds passes while transmitting a charging power to the chargeable battery B. In this case, the adjustment request signal is wirelessly transmitted within 30 ms when a high frequency AC current is not applied to the primary coil 200.

The microprocessor 240 controls the whole operation of the charging device C, and particularly it controls the high

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frequency power driving unit 210 to adjust a power of the high frequency AC current applied to the primary coil 200 if an adjustment request signal of the charging power is received from the wireless receiving unit 230.

Preferably, the microprocessor 240 controls the high frequency power driving unit 210 for high frequency pulse width modulation, pulse frequency modulation, pulse number modulation, or pulse amplitude modulation so as to adjust the power of the high frequency AC current. Then, a level of the charging power transmitted to the chargeable battery B is adjusted to prevent any damage of circuits in the chargeable battery B.

The power supply 260 receives a common AC current 250, then converts it into a DC current, and then supplies an operating power to the high frequency power driving unit 210 and the microprocessor 240.

The contact-less chargeable battery B of this embodiment includes a charging circuit module composed of a secondary coil 270, a rectifier 280, a constant voltage/constant current supplier 290, a microprocessor 310, a wireless transmitting unit 320 and an antenna 330, and a battery cell 300 that is charged by the charging circuit module.

The secondary coil 270 generates a high frequency AC current by means of electromagnetic induction phenomenon while a high frequency AC current is applied to the primary coil 200 provided to the charging device C. At this time, the high frequency AC current induced to the secondary coil 270 has an intensity proportional to a magnetic flux linked to the secondary coil 270.

The rectifier 280 smoothes the high frequency AC current induced to the secondary coil 270 to convert it into a DC current.

The constant voltage/constant current supplier 290 applies the rectified DC current to the battery cell 300 according to the control of the microprocessor 310 so as to charge the battery cell 300. At this time, the constant voltage/constant current supplier 290 charges the battery cell 300 in a constant current mode at an initial charging stage, but, if a charging voltage exceeds a predetermined criterion, the constant voltage/constant current supplier 290 charges the battery cell 300 in a constant voltage mode, which keeps a charging voltage constantly instead of decreasing a current.

The microprocessor 310 controls the constant voltage/constant current supplier 290 to charge the battery cell 300, monitors whether an excessive voltage is applied to both ends of the constant voltage/constant current supplier 290, and outputs an adjustment request signal of the charging power to the wireless transmitting unit 320 if an excessive voltage is applied.

Preferably, the operation of monitoring voltages at both ends of the constant voltage/constant current supplier 290 is conducted in a way of measuring a front end voltage V_{pp} and a rear end voltage V_{ch} of the constant voltage/constant current supplier 290 and then checks whether a difference between them exceeds a criterion value.

The wireless transmitting unit 320 receives the adjustment request signal of the charging power output from the microprocessor 310, and then modulates the adjustment request signal and wirelessly transmits it to the antenna 220 of the wireless receiving unit 230 provided to the charging device C through the antenna 330. At this time, a carrier of 10 to 15 MHz is used, and the wireless transmitting unit 320 is realized using a photo coupler, like the wireless receiving unit 230.

If the adjustment request signal is transmitted to the charging device C, a power of the high frequency AC current output through the high frequency power driving unit 210 is reduced according to the control of the microprocessor 240. As a

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result, a power of the high frequency AC current induced to the secondary coil 270 by means of electronic induction phenomenon is decreased. Accordingly, a voltage applied to both ends of the constant voltage/constant current supplier 290 is also decreased. Preferably, the feedback control for the power of the high frequency AC current applied to the primary coil 200 is continued until an overcurrent is not applied to both ends of the constant voltage/constant current supplier 290.

FIG. 4 is a block diagram showing the contact-less charging device C according to the embodiment of the present invention in more detail.

Referring to FIG. 4, the power supply 260 includes an overvoltage filter 260a for intercepting an overvoltage applied from the common AC power source 250, a rectifier 260b for converting an AC current passing through the overvoltage filter 260a into a DC current, and a constant voltage supplier 260c for receiving the rectified DC current and supplying a constant voltage DC current to the microprocessor 240 and the high frequency power driving unit 210.

The high frequency power driving unit 210 includes a pulse signal generator 210a for receiving a pulse driving signal from the microprocessor 240 to generate a pulse signal, and a power driving part 210b for rapidly switching a constant voltage DC current input from the constant voltage supplier 260c using the pulse signal output from the pulse signal generator 210a to generate a high frequency AC current and then applying the high frequency AC current to the primary coil 200.

FIG. 5 is a block diagram showing the contact-less chargeable battery B according to the embodiment of the present invention in more detail.

Referring to FIG. 5, the contact-less chargeable battery B of this embodiment further includes a first voltage detector 350 and a second voltage detector 360 respectively provided to front and rear ends of the constant voltage/constant current supplier 290 to monitor whether an overvoltage is applied to both ends of the constant voltage/constant current supplier 290, and a voltage comparator 380 for inputting a comparison result of a first voltage V_{pp} and a second voltage V_{ch} respectively measured by the first and second voltage detectors 350, 360 to the microprocessor 310.

The voltage comparison result is a difference value of the first and second voltages, or a state of voltages at both ends, which indicates whether an overvoltage is applied. In the later case, the voltage comparator 380 compares a reference voltage difference for an overvoltage state with a difference between the first and second voltages.

Meanwhile, if it is determined that an overvoltage is applied after monitoring voltages at both ends of the constant voltage/constant current supplier 290, the microprocessor 310 uses the wireless transmitting unit 320 to transfer an adjustment request signal of the charging power to the charging device C in wireless.

However, if the adjustment request signal is wirelessly propagated while a charging power is transmitted from the primary coil 200 of the charging device C to the secondary coil 270 of the battery B, the adjustment request signal is screened by the magnetic field generated from the primary coil 200.

Thus, in order to solve the above problem, when a charging power is transmitted from the charging device C to the battery B, the transmission of charging power is temporarily interrupted in a regular cycle.

That is to say, as shown in FIG. 6, a charging region Δt_A in which a high frequency AC current is induced to the secondary coil 270 by means of electromagnetic induction phenomenon to charge electricity, and a pause region Δt_B in which

application of high frequency AC current to the primary coil 200 is intentionally intercepted to pause charging are periodically repeated. In addition, while the induction of high frequency AC current in the secondary coil 270 is interrupted to pause charging, an adjustment request signal of charging power is transmitted to the charging device C.

For this purpose, the battery B of this embodiment includes a charging pause detection unit 390 for receiving the high frequency AC current induced in the secondary coil 270 and detecting a time point t_s (see FIG. 6) when the charging region ends.

The charging pause detection unit 390 detects the end time point t_s (see FIG. 6) of the charging region and then inputs it to the microprocessor 310. Then, the microprocessor 310 wirelessly transmits an adjustment request signal for adjusting the charging power to the charging device C through the wireless transmitting unit 320 while the charging power is not transferred. Thus, it is possible to prevent the adjustment request signal of the charging power is screened due to the magnetic field generated by the primary coil 200.

If the adjustment request signal of the charging power is wirelessly transmitted to the charging device C, the power of high frequency AC current applied to the primary coil 200 is controlled by means of the feedback control mentioned above, so voltages at both ends of the constant voltage/constant current supplier 290 may be controlled to a suitable level.

The contact-less charging device and chargeable battery according to the present invention as described above reduce a charging power in real time by means of the feedback control though an overvoltage is applied to both ends of the constant voltage/constant current supplier 290, thereby capable of instantly solving the overvoltage state.

Thus, the contact-less charging device and chargeable battery of the present invention need not be fixed to a certain relative position as in the prior art so as to constantly keep an intensity of magnetic flux linked to the secondary coil 270. In addition, since the charging device C is designed in a pad shape as shown in FIG. 7, a user may conveniently charge a battery just by placing a subject such as a cellular phone coupled with a battery B onto a predetermined position of the pad, thereby allowing to make a convenient charger and battery set.

Hereinafter, a contact-less charging control method according to the present invention will be described in detail with reference to FIGS. 4 and 5.

First, in case of a non-charging mode, the high frequency power driving unit 210 of the charging device C applies a high frequency AC current to the primary coil 200 at regular time intervals according to the control of the microprocessor 240. For example, a high frequency AC current of 80 KHz is applied for 50 ms at 1 second intervals. Then, the primary coil 200 forms a magnetic field around it whenever a high frequency AC current is applied thereto.

A user places the battery B on the charging device C for the purpose of charging the battery B. After the battery B is positioned, if a high frequency AC current is applied to the primary coil 200 of the charging device C for a predetermined time, a magnetic field is generated to the primary coil 200, and as a result a magnetic flux is linked to the secondary coil 270 of the battery B. Accordingly, a high frequency AC current is induced to the secondary coil 270 for a predetermined time, and then the induction of high frequency AC current is temporarily intercepted due to disappearance of the magnetic field if the high frequency AC current is not applied to the primary coil 200.

Meanwhile, the charging pause detection unit 390 detects a time point when the induction of high frequency AC current is temporarily intercepted, and then inputs it to the microprocessor 310. In response to that, the microprocessor 310 outputs a response signal to the wireless transmitting unit 320. Here, the response signal is a signal used for informing the microprocessor 240 of the charging device C that the secondary coil 270 provided to the battery B is coupled with the magnetic field generated by the primary coil 200 of the charging device C. If the response signal is output to the wireless transmitting unit 320, the wireless transmitting unit 320 modulates the response signal and then wirelessly transmits it to the charging device C through the antenna 330.

If the response signal is wirelessly transmitted, the wireless receiving unit 230 of the charging device C demodulates the response signal and then inputs it to the microprocessor 240. Then, the microprocessor 240 starts transferring a charging power to the battery B. That is to say, the microprocessor 240 controls the high frequency power driving unit 210 to repeat operations of applying a high frequency AC current to the primary coil 200 at predetermined time intervals and pausing application of the high frequency AC current for a predetermined time. For example, a high frequency AC current of 80 KHz is applied for 3 seconds and then this application is paused for 50 ms.

While the high frequency AC current is applied to the primary coil 200, a high frequency AC current is induced to the secondary coil 270 of the battery due to the electromagnetic induction phenomenon. The time during which high frequency AC current keeps induced as mentioned above is substantially identical to the time during which the high frequency AC current keeps applied to the primary coil 200.

The high frequency AC current induced to the secondary coil 270 is converted into a DC current by the rectifier 280, and then applied to the battery cell 300 via the constant voltage/constant current supplier 290. Then, as the battery cell 300 is gradually charged, voltages at both ends of the battery cell 300 are raised till a full-charging state.

The microprocessor 310 controls the constant voltage/constant current supplier 290 to charge the battery cell 300 in a constant current mode until a charging voltage of the battery cell is increased to a certain level and also charge the battery cell 300 in a constant voltage mode if a voltage of the battery cell 300 is increased over a predetermined level.

Meanwhile, if the high frequency AC current applied to the primary coil 200 is paused, the induction of high frequency AC current in the secondary coil 270 is also temporarily intercepted, and thus the charging process is temporarily stopped. Then, the charging pause detection unit 390 detects a time point when the induction of high frequency AC current is intercepted, and then inputs it to the microprocessor 310. This process is repeated whenever it comes to time points when the induction of high frequency AC current is temporarily intercepted.

Separately from the charging process of the battery cell 300 as mentioned above, the microprocessor 310 monitors whether an overvoltage is applied to both ends of the constant voltage/constant current supplier 290.

For this purpose, the voltage comparator 380 periodically receives voltages measured by the first and second voltage detectors 350, 360 respectively provided to the front and rear ends of the constant voltage/constant current supplier 290 to compare the voltages with each other, and then inputs a voltage comparison result to the microprocessor 310. Here, the voltage comparison result is a voltage state signal indicating a difference value of both measured voltages or indicating whether or not in an overvoltage state.

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The microprocessor 310 receives the voltage comparison result from the voltage comparator 380 and then determines whether an overvoltage is applied to both ends of the constant voltage/constant current supplier 290.

As a result, if it is determined that an overvoltage is applied to both ends of the constant voltage/constant current supplier 290, the microprocessor 310 refers to the time point when the induction of high frequency AC current is temporarily intercepted, which is input by the charging pause detection unit 390, so as to determine whether or not a pause period at which a high frequency AC current is not currently applied to the primary coil.

As a result, if it is determined as a pause period, the microprocessor 310 outputs an adjustment request signal of charging power to the wireless transmitting unit 320. Then, the wireless transmitting unit 320 modulates the adjustment request signal of charging power and then wirelessly transmits it to the charging device C through the antenna 330.

In response to that, the wireless receiving unit 230 provided to the charging device C receives and demodulates the adjustment request signal of the charging power through the antenna 220, and then inputs it to the microprocessor 240. Then, the microprocessor 240 controls the high frequency power driving unit 210 to lower the power of the high frequency AC current applied to the primary coil 200 as much as a predetermined level.

If the power of the high frequency AC current applied to the primary coil 200 is decreased as mentioned above, the power of high frequency AC current induced to the secondary coil 270 by means of the electromagnetic induction phenomenon is also decreased.

Meanwhile, separately from the feedback control for the power of high frequency AC current, the microprocessor 310 periodically repeats monitoring an overvoltage state at both ends of the constant voltage/constant current supplier 290. As a result, if it is determined that an overvoltage state at both ends of the constant voltage/constant current supplier 290 is not yet solved through the first feedback control, the microprocessor 310 wirelessly transmits an adjustment request signal of charging power to the charging device C again so that the power of high frequency AC current applied to the primary coil 200 is lowered as much as a predetermined level once again. This process is continued until an overvoltage is not applied to both ends of the constant voltage/constant current supplier 290 through the feedback control.

A voltage difference at both ends of the constant voltage/constant current supplier 290 is kept in a suitable level through the above feedback control, so it is possible to prevent the constant voltage/constant current supplier 290 from being damaged due to an overvoltage while the battery B is charged in a contact-less method.

In the above embodiment, in order to prevent an overvoltage from being applied to both ends of the constant voltage/constant current supplier 290 of the contact-less chargeable battery B, the microprocessor 310 of the battery B monitors voltages measured at both ends of the constant voltage/constant current supplier 290 to directly check whether or not in an overvoltage state. In addition, if in an overvoltage state, the microprocessor 310 of the battery B transmits a charging power adjustment request signal to the microprocessor 240 of the charging device C by means of wireless communication. Then, the microprocessor 240 of the charging device C adjusts a power of the high frequency AC current applied to the primary coil 200 on the condition of receipt of the charging power adjustment request signal.

However, there may be another alternative. Specifically, referring to FIGS. 4 and 5, the microprocessor 310 of the

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battery B periodically monitors voltages at both ends of the constant voltage/constant current supplier 290 to obtain a voltage state.

Here, the voltage state is voltages at both ends of the constant voltage/constant current supplier 290, or a difference of the voltages. This voltage state may be input from the voltage comparator 380, or obtained by operating measured voltages V_{pp} , V_{ch} input from the first and second voltage detectors 340, 360.

The microprocessor 340 of the battery B refers to a time point when the charging pause detection unit 390 inputs a signal whenever a voltage state is obtained, and then transmits a voltage state of both ends of the constant voltage/constant current supplier 290 to the microprocessor 240 of the charging device C by means of wireless communication while a high frequency AC current is not induced to the secondary coil 270.

Then, whenever receiving a voltage state, the microprocessor 240 of the charging device C checks whether the voltage state is in an overvoltage state. This checking process is realized in a way of examining whether a difference of voltages at both ends of the constant voltage/constant current supplier 290 exceeds a predetermined reference value.

As a result, if the voltage state of both ends of the constant voltage/constant current supplier 290 corresponds to an overvoltage state, the high frequency power driving unit 210 is controlled to adjust a power of high frequency AC current applied to the primary coil 200, thereby adjusting a charging current transmitted to the battery B.

If a required number of such charging current adjustment processes are repeated, though an overvoltage is applied to both ends of the constant voltage/constant current supplier 290, the overvoltage state may be solved within a short time, thereby preventing the constant voltage/constant current supplier 290 from being damaged.

The present invention has been described in detail. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

INDUSTRIAL APPLICABILITY

According to the present invention, though an overvoltage is applied to both ends of the constant voltage/constant current supplier during the contact-less battery charging process, a charging power is adjusted in real time by means of the wireless feedback control, so it is possible to prevent the constant voltage/constant current supplier from being damaged due to the overvoltage applied to both ends thereof.

Accordingly, a limitation of relatively positions between a charging device and a battery adopting the contact-less charging method, and as a result the convenience of a user may be maximized.

The invention claimed is:

1. A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

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a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

2. The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

3. The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes:

- a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna;
- first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;
- a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and
- a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.

4. The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently,

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

5. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.

6. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.

7. A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:

- a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;
- a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;
- a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and
- an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external

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contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

8. The contact-less charging circuit module according to claim 7,

wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

9. The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes:

- a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna;
- first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;
- a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and
- a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.

10. The contact-less charging circuit module according to claim 9,

wherein a magnetic field generated by the contact-less charging device is generated intermittently,

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

11. The contact-less charging circuit module according to claim 1, wherein the monitoring result is a charging power adjustment request signal.

12. The contact-less charging circuit module according to claim 1, wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.

13. A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:

- a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;
- a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and
- a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

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14. The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.
15. The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes:
- a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and
 - a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.
16. The contact-less chargeable battery according to claim 15, further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes:
- a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and
 - a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.
17. The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.
18. The contact-less charging device according to claim 16, wherein the constant voltage supplier includes:
- an overvoltage filter for receiving a common AC current and intercepting an overvoltage current;
 - a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and
 - a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.
19. The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.
20. The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.
21. A battery charging set including a contact-less chargeable battery and a contact-less charging device, wherein the battery includes:
- a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;
 - a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

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- a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode;
 - and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,
- wherein the charging device includes:
- a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;
 - a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and
 - a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.
22. The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.
23. A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:
- (a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;
 - (b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;
 - (c) rectifying the output high frequency AC current to be converted into a DC current;
 - (d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;
 - (e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and
 - (f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.
24. The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

* * * * *

EXHIBIT H

Application No.: 11/997,272
First Named Applicant: Dong-Young Park
Atty. Docket No.: 0313071.00020

DECLARATION OF JAEYONG JUNG

I, Jaeyong Jung, am the General Manager, IP Center at LS Cable & System Ltd. ("LS Cable"). I submit this declaration in support of LS Cable's Request for Supplemental Examination of U.S. Patent No. 8,013,568 ("the '568 Patent"). Under penalty of perjury, I declare the following to be true to the best of my knowledge, information and belief:

1. I reside in Korea and have worked at LS Cable for twenty years.
2. As the General Manager of the IP Center for LS Cable, I primarily handle overseeing LS Cable's intellectual property holdings in the field of high-voltage electric power cable and communication cable, including reviewing invention disclosures and working with agents and attorneys both at LS Cable and outside firms to secure patent protection on those disclosures.
3. While I am involved in working with attorneys outside of the LS Cable organization to handle patent filings worldwide, I am not an attorney myself.
4. At the time of filing of the application issuing as the '568 Patent, LS Cable's external Korean counsel was responsible for communicating with U.S.-based patent counsel for filings made on LS Cable's (then "LS Cable Ltd.") behalf with the United States Patent and Trademark Office ("USPTO").
5. The patent application that issued as the '568 Patent was filed with the USPTO on January 29, 2008.
6. It was assigned Application Number 11/997,272 ("the '272 Application").

7. The '272 Application listed as inventors six Korean nationals: Dong-Young Park, Sung-Wook Moon, Sung-Wook Choi, Gwang-Hee Gwon, Sub Han, and Jung-Bum Kim.

8. The inventors invented the subject matter claimed in the '272 Application while employed with LS Cable.

9. At the time of the filing of the '272 Application, it was customary under the employment conditions between LS Cable and its employees that any invention made while working with LS Cable would be assigned to LS Cable as a matter of course upon creation and concurrent with the submission of an invention disclosure.

10. At the time of the filing of the '272 Application, an oath and declaration regarding inventorship was also submitted, but it was not executed.

11. On May 6, 2008, a notice was mailed by the USPTO indicating that the oath and declaration needed to be executed for the USPTO to accept the '272 Application. We needed to submit the executed oath and declaration within two months of May 6, 2008.

12. After receiving that notice, I was able to obtain signatures from one inventor, Sub Han, who worked at the same place with me.

13. The remaining five inventors, Dong-Young Park, Sung-Wook Moon, Sung-Wook Choi, Gwang-Hee Gwon and Jung-Bum Kim were located elsewhere or no longer employed at LS Cable.

14. Based on my understanding of the assignment arrangement from these five inventors to LS Cable, I signed the remaining five inventors' names to the oath and declaration submitted to the USPTO during the prosecution of the '272 Application on June 17, 2008.

15. I did not at the time understand that the inventors needed to sign the oath and declaration themselves where they had already, based on my understanding, assigned their rights to the invention to LS Cable.

16. I did not convey to LS Cable's external Korean counsel that I signed the oath and declaration on behalf of five of the inventors because I believed I had authority to sign the documents on their behalf given that each inventor was required to assign LS Cable his interest in the invention.

17. The '272 Application issued as the '568 Patent on September 6, 2011.

18. I later learned that the oath and declaration submitted with a U.S. patent application must be signed by the inventors even when they are already under an obligation to assign or have assigned their rights in the invention.

19. I then took steps to obtain all the inventors' original signatures on a supplemental oath and declaration for the invention claimed in the '568 Patent.

20. After doing so, I instructed outside U.S.-based counsel to file the supplemental oath and declaration with all six inventors' original signatures on August 4, 2020, with the USPTO. The filed oaths and declarations are attached as Exhibit A.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct and that this declaration was executed at Gunpo-si, Gyeonggi-do, Korea.

Dated: March 10, 2021



Jaeyong Jung
General Manager, IP Center
LS Cable & System Ltd.

EXHIBIT A

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**SUPPLEMENTAL
DECLARATION FOR UTILITY
OR DESIGN
PATENT APPLICATION
(37 CFR 1.67)**

Attorney Docket Number	0313071.00020
First Named Inventor	Dong-Young Park
COMPLETE IF KNOWN	
Application Number	11/997,272
Filing Date	June 17, 2008
Art Unit	2858
Examiner Name	FANTU, YALKEW

I hereby declare that:

Each inventor's residence, mailing address, and citizenship are as stated below next to their name.

I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND
CHARGING CONTROL METHOD THEREOF**

(Title of the invention)

the specification of which

☐ is attached hereto**OR**☒ was filed on (MM/DD/YYYY)

01/29/2008

as United States Application Number or PCT International

Application Number

11/997,272

and was amended on (MM/DD/YYYY)

01/29/2008

I hereby declare that the subject matter of the ☐ attached amendment ☒ amendment filed on 01/29/2008 was part of the invention and was invented before the filing date of the original application, above identified for such invention.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
10-2006-0038960	KR	04/28/2006	☐	☐	☒
10-2005-0069871	KR	07/29/2005	☐	☐	☒
PCT/KR2006/001713	PCT	05/08/2006	☐	☐	☒
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

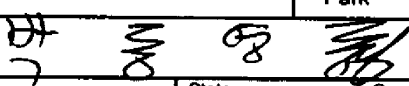
[Page 1 of 2]

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If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2

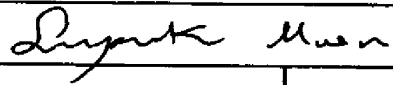
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SUPPLEMENTAL DECLARATION — UTILITY OR DESIGN PATENT APPLICATION

Direct all correspondence to: ☒ The address associated with Customer Number: 24573			
OR ☐ Correspondence address below			
Name			
Address			
Address			
City		State	ZIP
Country	Telephone		Email
WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.			
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further 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 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.			
Name of Sole or First Inventor:		☐ A petition has been filed for this unsigned inventor	
Given Name Dong-Young		Family Name or Surname Park	
Inventor's Signature 			Date 8.24.2020
Residence: City Seoul	State	Country Republic of Korea	Citizenship Republic of Korea
Mailing Address 1601, 13 Seoun-ro Seocho-gu			
Mailing Address			
City Seoul	State	ZIP 06732	Country Republic of Korea
☒ Additional inventor(s) or legal representative(s) are being named on the <u>3</u> supplemental sheet(s) PTO/SB/ 02A or 02LR attached hereto.			

[Page 2 of 2]

DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet
Page <u>1</u> of <u>3</u>	

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Sung-Wook		Moon	
Inventor's Signature 		Date <u>6.24.2020</u>	
Yongin-Si Residence: City	Gyeonggi-do State	Republic of Korea Country	Republic of Korea Citizenship
516-1404, 90 Jinsan-ro Suji-gu			
Mailing Address			
Yongin-Si City	Gyeonggi-do State	16923 Zip	Republic of Korea Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Sung-Wook		Choi	
Inventor's Signature 		Date <u>6.30.2020</u>	
Bucheon-Si Residence: City	Gyeonggi-do State	Republic of Korea Country	Republic of Korea Citizenship
112-1402, 108 Jungdong-ro			
Mailing Address			
Bucheon-Si City	Gyeonggi-do State	14613 Zip	Republic of Korea Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Gwang-Hee		Gwon	
Inventor's Signature 		Date <u>6.25.2020</u>	
Anyang-si Residence: City	Gyeonggi-do State	Republic of Korea Country	Republic of Korea Citizenship
115-301, 430 Gyeongsu-daero, Dongan-gu			
Mailing Address			
Anyang-si City	Gyeonggi-do State	14126 Zip	Republic of Korea Country

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DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet
Page <u>2</u> of <u>3</u>	

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Sub		Han	
Inventor's Signature 		Date <u>6.30.2020</u>	
Seoul Residence: City	State	Republic of Korea Country	Republic of Korea Citizenship
1302, World Meridian Venture Center 1cha, 254, Beotkkot-ro, Geumcheon-gu			
Mailing Address			
Seoul City	State	08511 Zip	Republic of Korea Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country

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DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet
Page <u>3</u> of <u>3</u>	

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Jung-Bum		Kim	
Inventor's Signature 		Date <u>7.20.2020</u>	
Troy Residence: City	Michigan State	United States of America Country	Republic of Korea Citizenship
1321 Hollins Hall Lane			
Mailing Address			
Troy City	Michigan State	48085 Zip	United States of America Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country

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EXHIBIT I

CERTIFICATION OF TRANSLATION

I, _____Somin Kim_____, hereby declare:

That I possess knowledge of the Korean and English languages. The English Language document attached hereto, is, to the best of my knowledge and belief, a true and accurate translation of the KR19950005819 publication, also attached hereto.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made of information and belief are believed to be true; and further that these statements were made with 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.

Signature _____

Printed Name _____Somin Kim_____

(19) Korean Intellectual Property Office (KR)
(12) Patent publication (B1)

(51) Int. Cl.⁶		(45) Announcement Date		May 31, 1995
H04B 1/38		(11) Announcement No.		Teuk-1995-0005819
(21) Application No.	Teuk-1991-0016415	(65) Laid-open Publication No.	Teuk-1993-0007117	
(22) Filing Date	September 19, 1991	(43) Laid-open Date	April 22, 1993	
(71) Applicant		Samsung Electronics Co. Ltd.	Jung Yong Mun	
		416 Maetan-dong, Gwonseon-gu, Suwon-si, Gyeonggi -do, Republic of Korea		
(72) Inventor		Hong Chung-Sik		
		1167-8 Gwonseon-dong, Gwonseon-gu, Suwon-si, Gyeonggi-do		
(74) Patent Attorney		Lee Gun-Ju		

(77) Examiner: Kim Min-Hee (Publication Document No. 1994)

(54) Title of Application Contactless Charge System of Radio-telephone

Abstract:
None.

Representative drawing:
FIG. 1

Specification

[TITLE OF THE INVENTION]

Contactless Charge System of a Radio-telephone

[DESCRIPTION OF DRAWINGS]

FIG. 1 is a block diagram of a contactless charge system of a radio-telephone according to the present invention.

FIG. 2 is a detailed circuit diagram of a contactless charge system according to an embodiment of the present invention.

FIGs. 3A and 3B are charging control flowcharts of a charger and a portable device according to the present invention.

[DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS]

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

Due to progress of the communication industry, current voice communication is gradually developing from wired terminal communication connected to wire communication channels to radio terminal communication using radio-telephones.

Radio-telephones may be broadly classified into portable radio-telephones for mobile communication using the radio-telephone call method and radio channels, and cordless-phones which use existing wired communication channels and wherein the cord between the hand-set and the body of the telephone has been replaced with a wireless connection.

The aforementioned radio-telephone and cordless-phone require a user to carry around a portable device capable of voice calls in order to communicate, and thus use a rechargeable battery as a power source for operating an internal electronic (electric) circuit. Thus, when a battery in a portable device is discharged to a voltage equal to or less than a predetermined level, it becomes necessary to charge the battery for smooth communication.

Ordinarily, a battery inside a portable device for making calls from a radio-telephone is charged using a charger. The charge function of a radio-telephone uses a method of transmitting power (voltage) using mechanical contact between a charge terminal of a portable device and a power transmitting terminal of a charger. That is, a battery of the portable device is charged while an electrically conductive voltage terminal connected to the battery, and a voltage output terminal of the charger, which outputs charging voltage and has a terminal spring structure, are in contact with each other.

However, as described above, a conventional circuit for charging a battery in a portable device with a voltage through mechanical (physical) contact between a power terminal of the portable device and a voltage output terminal of a charger has the following problems:

First, a power terminal of a portable device and a voltage output terminal of a charge device are formed of metal having good conductivity, and thus, the power terminals are oxidized or electrical contact is not achieved due to attachment of impurities, etc., thereby losing a charge function.

Second, when an anomaly occurs in the internal charge circuit, the current flowing inside the charge device may be output through the charging terminal, and user carelessness may result in electric shock. Third, there is the concern that the portable telephone may be damaged due to static electricity generated at the charge terminal of the charger.

Thus, an objective of the present invention is to provide a contactless charge system of a radio-telephone for charging a battery in a portable device, the system having no mechanical contact between a charger and a portable device.

Another objective of the present invention is to provide a system for charging a battery in a portable device by inductively coupling a voltage from a charger to a portable device.

Yet another objective of the present invention is to provide a contactless charge system for detecting a voltage of a rechargeable battery to control the charge between the charger and the portable device.

To achieve the above-stated objectives, the present invention comprises a charging device which comprises: a voltage switching unit that performs switching in response to a switching control signal SCTL having a predetermined period and switches and outputs a direct voltage at a certain level as an alternating voltage; and, an induced voltage generating unit which generates an induced voltage having an electromagnetic field corresponding to the alternating current output from the voltage switching unit, and a portable device in which is installed an induced voltage rectifying unit for detecting an induced voltage guided to an electromagnetic field from the induced voltage generating unit and rectifying the induced voltage to a DC voltage at a predetermined level, where the rectified output is connected to a rechargeable battery inside the portable device.

In the present invention, which is configured as explained in the foregoing, an electromagnetic field output from the induced voltage generating unit of the charging device is inductively coupled to the induced voltage rectifying unit within the portable device when the portable device is placed on the charging device. Here, the induced voltage rectifying unit in the portable device detects an induced voltage proportional to a time change ratio of a flux linkage and rectifies the detected induced voltage to a DC voltage at a predetermined level, and the rectified voltage is applied to the rechargeable battery inside the portable device. Thus, a voltage from the charge device is transferred to the battery inside the portable device for voice communication via an inductive coupling method.

Among the aforementioned components, the induced voltage generating unit corresponds to a charge voltage generating means for generating an induced voltage of an electromagnetic field corresponding to a current of the AC voltage. The induced voltage rectifying unit corresponds to an induced voltage detecting and rectifying unit for detecting an induced voltage of the electromagnetic field and rectifying the same to a DC voltage at a predetermined level, and alternatives to such operation will become self-evident through the following explanation of operation.

Hereinafter, the operation of an embodiment of the present invention will be described in detail with reference to the accompanying drawings.

FIG. 1 is a block diagram of a contactless charge system of a radio-telephone according to the present invention and shows an embodiment of a cordless radio-telephone in which a base unit 12 is connected to a wired channel, that is, a telephone line 14, and a radio channel is formed between the base unit 12 and a portable device (Hand-set Unit) 18 to perform radio communication between the base unit 12 and the portable device 18.

In the operation of the present embodiment of the present invention, an example of a radio-telephone comprised of a base unit 12 and a portable device 18 as that shown in FIG. 1 will be explained, however the same operation also applies to a mobile communication radio-telephone for radio-telephone calls using a radio channel. For example, when the portable device 18 is a mobile-phone for transmitting and receiving a voice signal to and from a radio channel, a charge device comprised of a power supply 20, a power transmitter 28, and a charge switch 30 may achieve the same operation.

In FIG. 1, the base unit 12 is comprised of a line interface 22 connected to the telephone line 14, a line interface 22 interfacing with the telephone line 14 under predetermined control, a radio unit 26 for demodulating and outputting a signal of a voice band that is wave-received and modulating and wave-transmitting a signal in the received voice band, an audio and logic unit 24 that is connected between the line interface 22 and the radio unit 26 and which interfaces audio and simultaneously controls the base unit 12, a power supply 20 that regulates a voltage (above 12 VDC) at a predetermined voltage through a power line 16 and provides the regulated voltage to each unit, a charge switch 30 that is switched by the mounting of the portable device 18 to output a start charge signal, and a power transmitter 28 for generating an induced voltage in response to the switching of the charge switch 30 of a voltage from the power supply 20. Here, the induced voltage output from the power transmitter 28 refers to an electromagnetic field.

The portable device 18 is comprised of a radio unit 34 for receiving and demodulating-outputting a transmitted signal, and wave-transmitting the received signal in a voice band, an audio and logic unit 36 that processes and regenerates-outputs a signal in a voice band that is demodulated and output from the radio unit 34 and supplies the received voice signal to the radio unit 34 and simultaneously controls the portable device 18, a battery 32 for providing an operating voltage to the radio unit 34 and the audio and logic unit 36, and a contactless charging unit 38 for detecting and rectifying an induced voltage output from the power transmitter 28 in the base unit 12 and applying the induced voltage as a charge voltage of the battery 32.

Among the elements of the portable device 18, the battery 32 is a rechargeable storage battery, and the line interface 22, the audio and logic unit 24, the radio unit 26 and the power supply 20 of the base unit 12, and a receiver 34 and the audio and logic unit 36 of the portable device 18 are voice processing circuits of a general-purpose radio-telephone.

As for charging of the battery 32 of the portable device 18 configured as shown in FIG. 1, the battery may be recharged only when the portable device 18 is installed on the base unit 12 having a charge function. First, with reference to FIG. 1, an example of the operation of the present invention will now be described.

Now, when power is input to the power line 16 from outside, the power supply 20 regulates the input power and provides the same to each of the circuits 22 to 28 in the base unit 12. In such an operational state, when a portion of the

contactless charging unit 38 of the portable device 18 is mounted (positioned) on the power transmitter 28 of the base unit 12, a charge switch 30 of the base unit 12 is started (turned "on") by the mounting of the portable device 18.

The power transmitter 28 of the base unit 12 converts a voltage which is input to a line 40 into an AC voltage in response to the "on" switching of the charge switch 30, converts the AC voltage into an electromagnetic field, and outputs the same as an induced voltage. Here, the contactless charging unit 38 in the portable device 18 detects and rectifies the induced voltage that is converted and output to the electromagnetic field from the power transmitter 28 of the base unit 12, and outputs the induced voltage as a DC voltage. The voltage rectified by the contactless charging unit 38 is applied as a charge voltage for the battery 32. Thus, when the portable device 18 is installed on the base unit 12, the contactless charging unit 38 of the portable device 18 rectifies the induced voltage which is output from the power transmitter 28 of the base unit 12 to charge the battery 32.

When the portable device 18 is separated from the base unit 12, the charge switch 30 is turned "off", and in this case, the power transmitter 28 detects the "off" state of the charge switch 30 and blocks output of the induced voltage. Thus, when the portable device 18 is separated from the base unit 12, operation of the contactless charging unit 28 and the power transmitter 28 are stopped to stop charging the battery 32.

Thus, it may be seen that the power transmitter 28 in the base unit 12 corresponds to a charge voltage generating means for converting a voltage supplied from the power supply 20 into an induced voltage of an electromagnetic field and outputting the induced voltage as a charge voltage. Further, it may be seen that the contactless charging unit 38 within the portable device 18 corresponds to the induced voltage detecting and rectifying means, which detects and rectifies the induced voltage generated at the power transmitter 28, which is the means by which the charging voltage is generated, to charge the voltage of the battery 32.

FIG. 2 is a detailed circuit diagram of a contactless charge system according to an embodiment of the present invention and shows the elements of the power transmitter 28, the charge switch 30, the contactless charging unit 38, and the battery 38 of FIG. 1 in further detail.

In the drawings, 42 is a constant voltage unit for regulating a voltage input to the power line 40 and outputting the voltage as a constant voltage, and includes a regulator 62 for regulating an input power voltage (Vcc) to outputting the same as a predetermined voltage, and noise removing capacitors 58 and 60 which are connected between the input and terminal ends of the regulator 62.

44 is a voltage switching unit for switching a power voltage at a predetermined level in response to an input of a control signal SCTL with a predetermined period and converting and outputting an AC voltage. The voltage switching unit 44 includes a first transistor 64 connected between a voltage supplying line (VSL) and an alternating current line (AVL) and switched by input of a power control signal, and a second transistor 70 connected between a base and a ground of the first transistor 64, switched in response to input of a control signal (SCTL) of a predetermined period, and supplying a power control signal to the first transistor 64.

According to an embodiment of the present invention, a transistor is used as the device for switching power in response to the control signal (SCTL), but any electronic switch having the same function may be used.

46 is an induced voltage generating unit for outputting an induced voltage of an electromagnetic field corresponding to current of an AC voltage output from the voltage switching unit 44. The induced voltage generating unit 46 for generating an induced voltage of an electromagnetic field corresponding to current of an input AC voltage includes a core 76 and a coil 77 wound around the core 76 a predetermined number of times and connected between the AVL and the ground. The induced voltage generating unit 46 as configured above corresponds to an induced voltage generating means.

74 is a thermostatic switch that is switched depending on a temperature of heat generated from the induced voltage generating unit 46 and is short-circuited when an ambient temperature of the core 76 increases to a specific temperature.

48 is a first microcomputer for providing the control signal (SCTL) to a control terminal of the voltage switching unit 44 in response to input of a hand-set status signal (HSS) of the aforementioned charge switch 30, and blocking output of the control signal (SCTL) according to a heat detection signal of the thermostatic switch 74.

Reference numeral 50 is an induced voltage rectifying unit for detecting, rectifying, and outputting an induced voltage generated from the induced voltage generating unit 46 when the portable device 18 is installed on the base unit 12. The induced voltage rectifying unit 50 corresponds to an induced voltage detecting means for detecting and rectifying the induced voltage output from the induced voltage generating means inside the aforementioned charge voltage generating means. The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting unit 81 that is inductively coupled to the induced voltage generating unit 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81.

52 is a charging unit configured in such a way that a resistor 84 and a diode 86 are connected in series to each other between the battery 32 and an output terminal of the rectifier 80, and which outputs a charge voltage of the battery 32 using output of the rectifier 80 in one direction.

54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL). In addition, 56 is a second microcomputer and is a microcomputer for controlling the portable device 18.

FIG. 3A is a flowchart of an operation of the base unit 12 of FIG. 1 and is a control flowchart of the first microcomputer 48. FIG. 3B is a flowchart of an operation of the portable device 18 and is a flowchart of an operation of the second microcomputer 56.

Hereinafter, the second operation will be described with reference to FIGs. 1, 3A, and 3B which are detailed circuit diagrams according to exemplary embodiments of the present invention, where it is assumed that the base unit 12 and the portable device 18 are separated from each other.

Now, when a DC voltage (about 12 VDC) at a predetermined level is input to the power voltage input line 16 of FIG. 1, the power supply 20 supplies the power voltage input to the line 16 to each circuit in the base unit 12. In this case, the power transmitter 28 inputs a power voltage through the line 40. The power of the line 40 may be filtered by a capacitor 58 in the constant voltage unit 42 and is input to the regulator 62. The regulator 62 (which is a model No. 78×8 regulator series according to the present invention) regulates the input voltage of 12 VDC and outputs the voltage to the power supplying line (VSL).

In the above operating state, the first microcomputer 48 in the power transmitter 28 outputs a low control signal SCTL to an output port P1 to block supply of current in operation 100 of FIG. 3A. In this case, a transistor 70 is "turned off" according to the "low" control signal (SCTL) of the first microcomputer 48, and a transistor 64, a base of which is connected to a collector of the transistor 70, is also "turned off". Thus, in an initial operation, a DC voltage of the voltage supplying line (VSL) is blocked by the transistor 64.

A first microcomputer 48 that performs an operation 100 in FIG. 3A scans an input port P3 in an operation 102 and searches for whether or not the portable device 18 is installed on the base unit 12 [whether or not the charge switch 30 is turned "on"]. A hand-set status signal (HSS) generated from a connection node of the charge switch 30 and a pull-up resistor 45 connected between the power voltage Vcc and the ground is input to the input port P3 of the first microcomputer 48.

When the portable device 18 is separated from the base unit 12, the charge switch 30 is turned "off", and when the two devices are coupled to each other, the charge switch 30 is switched "on". When the two devices are coupled to each other, the core 78 of the induced voltage detecting unit 81 installed on the contactless charging unit 38 in the portable device 18 is positioned on an opposite surface of the core 76 of the induced voltage generating unit 46 in the power transmitter 28 and is be space-coupled thereto. Thus, when the two devices are coupled to each other, the induced voltage generating unit 46 of the power transmitter 28 and the induced voltage detecting unit 81 of the contactless charging unit 38 are inductively coupled to each other in the manner that primary and secondary circuits of a general transformer are inductively coupled to each other.

In operation 102 above, if the logic of the hand-set status signal (HSS) input to the input port P3 is "high", the charge switch 30 is determined to be "off" and the aforementioned operation 100 is re-performed. In the above state, according to a user action, when the portable device 18 is installed on the base unit 12, the charge switch 30 is switched "on" according to mechanical input. In this case, the logic of the hand-set status signal (HSS) may be transitioned to "low" from "high". According to the above operation, when the logic of the input port P3 of the first microcomputer 48 is "low", the first microcomputer 48 recognizes the portable device 18 as installed on the base unit 12 in order to initiate charging.

The first microcomputer 48 that recognizes a charge initiation state outputs a control signal SCTL having a period of about 10 KHZ to the output port P1 during an operation 104 and outputs power information indicating a charge state to the line 49. In this case, the power information of the line 49 is applied to the audio and logic unit 24, and power information applied to the audio and logic unit 24 is modulated by the radio unit 26 and is wirelessly transmitted to the portable device 18. The radio unit 34 of the portable device 18 demodulates the spread power information and inputs the information to the audio and logic unit 36 in the portable device 18. The audio and logic unit 36 in the portable device 18 that receives the power information signal inputs the received power information to the second microcomputer 56 in the contactless charging unit 38 through the line 37.

The second microcomputer 56 that receives the power information transmitted from the first microcomputer 48 of the base unit 12 reads the output VDL of the comparator 96 and searches for whether or not a charge voltage of the battery 32 is normal in an operation 120 of FIG. 3B. The control signal (SCTL) output from the output port P1 is applied to a base of the transistor 70 through a resistor 72 and switches "on/off" the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between "low" and "high" depending on a period of the control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

In this case, AC flowing in the coil 77 in the induced voltage generating unit 46 changes over time, and thus, an AC voltage depending on a time change ratio of flux linkage is induced at both terminals of the coil 79 in the induced voltage detecting unit 81. That is, according to the principle of inductive coupling, an AC voltage in the coil 77 is inductively output to opposite ends of the coil 79 in the induced voltage detecting unit 81. The AC voltage output from the opposite terminals of the coil 79 is applied to an AC voltage terminal of a bridge diode 80, and is output with full-wave rectification. The DC voltage which is full-wave rectified at the bridge diode 80 is smoothened out by a capacitor 82 and is output as a ripple current voltage (IDC).

In this case, the rectified voltage IDC is input to a first voltage splitter 89, simultaneously limited to a predetermined level through the resistor 84 and the diode 86, then applied to the battery 32. That is, the battery 32 is charged. In the above case, the resistor 84 is a current limiter resistor, and the diode 86 is a diode for preventing countercurrent when the voltage IDC is lower than a voltage of the battery 32.

The first voltage splitter 89 for inputting the rectified voltage IDC splits the voltage IDC into a reference voltage V1 at a predetermined level using internal resistors 88 and 90, and inputs the voltage to an inverse terminal (-) of the comparator 46. A charge level detection voltage V2 from a split voltage circuit 93 which is connected between the cathode and ground of the diode 86 and which splits and detects the voltage of an output node of the charging unit 52 is applied to the non-inverting terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal (SCTL) of 10 KHZ to an output port P1, a charge voltage via inductive coupling between the induced voltage generating unit 46 and the induced voltage detecting unit 81 is applied to the battery 32 to initiate charge of the battery 32.

Meanwhile, the first microcomputer 48 which has performed the aforementioned operation 104 of FIG. 3A reads a state signal of the thermostatic switch 74 which is input to input port P2, and searches for whether or not the temperature is normal. In this case, the thermostatic switch 74 is a switch that is switched by detecting heat generated by the induced voltage generating unit 46. When the induced voltage generating unit 46 is overloaded, the temperature increases to a predetermined temperature, causing the internal switch to be opened. When the thermostatic switch 74 is opened, the input port P2 of the first microcomputer 48 is converted to a "high" state level from "low".

In the course of operation 106, the first microcomputer 48 searches for the output status of the thermostatic switch 74 whose operation is as described above, and when an input signal of the port P2 is "low", the temperature is determined to be normal, and when the input signal of the port P2 is "high", the temperature is determined to be abnormal. If the result of the search in operation 106 is an abnormal temperature (overheated temperature), the first microcomputer 48 jumps to operation 112 to block the control signal (SCTL) of 10 KHZ which is output to the output port P1. When the control signal (SCTL) is blocked, both the transistors 64 and 70 with respect to the voltage switching unit 44 are switched "off" to block a voltage of the AC line (AVL).

When the temperature is determined to be normal in operation 106, the first microcomputer 48 scans the input port P3 and searches for the status of the charge switch 30 in the process of operation 108. In operation 108, when the charge switch 30 is switched "off" and the hand-set status signal (HSS) is input as "high", the portable device 18 is determined to be separated and the aforementioned operation 112 is performed. In operation 108, when the charge switch 30 is turned "on", the first microcomputer 48 analyzes the data input to line 49 in operation 110 and searches whether or not the portable device is normal. In this case, the data input to the line 49 is input as data that is wirelessly transmitted from the portable device 18 when the battery 32 is completely charged. If analysis of input data in operation 110 indicates the portable device is abnormal (i.e. charge is incomplete), the first microcomputer 48 jumps to the aforementioned step 106 to continuously generate a charge voltage, and when the portable device is normal, the first microcomputer 48 jumps to operation 112 to stop charging.

When a charge level of the battery 32 is increased through the aforementioned operation, the charge level detection voltage V2 of a second voltage splitter 93 increases, and when the detection voltage V2 becomes higher than the reference voltage V1, the output VDL of the comparator 96 is transitioned to logic "high" from logic "low" and is input to the second microcomputer 56.

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

As described above, according to the present invention, a battery may be charged with a voltage through a configuration based on inductive coupling, thereby preventing loss of charge function, which may occur in a charging method involving electric contacts, and preventing risk of electric shock, allowing for stable charging.

(57) Claims

Claim 1. A contactless charge system for a radio-telephone capable of radio communication using voltage from a battery, comprising a portable device including:

a charge voltage generating means which generates an induced voltage of an electromagnetic field corresponding an alternating current input with a predetermined period; and

an induced voltage detection rectifier installed on the charge voltage generating means and inductively coupled thereto, and configured to detect the generated induced voltage of the electromagnetic field and rectify the voltage to a predetermined level, then provides the rectified voltage as a charge voltage of the battery,

characterized in that when the portable device is installed on the charge voltage generating means, the battery is charged by via inductive coupling using a voltage obtained by detecting and rectifying the induced voltage of the electromagnetic field.

Claim 2. The charge system for a radio-telephone of Claim 1, wherein the charge voltage generating means includes a voltage switch switched in response to input of a control signal SCTL with a predetermined periodicity and which converts

and outputs a DC voltage at a predetermined level as an AC voltage, and an induced voltage generating means which generates an inductive voltage of an electromagnetic field corresponding to an alternating voltage current output from the voltage switch.

Claim 3. The contactless charge system for a radio-telephone of Claim 2, wherein the induced voltage detecting and rectifying means includes an induced voltage detecting means which detects as a pulse voltage an induced voltage of an electromagnetic field generated by the induced voltage generating means, and a rectifier which rectifies the pulse voltage detected from the induced voltage detecting means and provides the voltage as a charge voltage for the battery.

Claim 4. The contactless charge system for a radio-telephone of Claim 2, wherein the voltage switch includes a first switch which switches the DC voltage at a predetermined level in response to input of a switching signal and inputs AC voltage to the induced voltage generating means, and a second switch which provides a switching control signal to the first switch in response to input of the control SCTL with a predetermined period.

Claim 5. The contactless charge system for a radio-telephone of any one of Claims 2, 3, or 4, wherein the induced voltage generating means includes a core 76 and a coil 77 wound around the core 76 a predetermined number of times and connected to a voltage output terminal of the voltage switch, and is characterized in that it generates a magnetic flux line of an electromagnetic field corresponding to the input alternating voltage current as an induced voltage.

Claim 6. The contactless charge system for a radio-telephone of Claim 5, wherein the induced voltage detecting means includes a core 78 and a coil 79 wound around the core 78 a predetermined number of times, and is characterized in that it is linked with the magnetic flux line from the coil 77, and in that it inputs to the rectifier an AC voltage proportional to a time change ratio of the flux linkage.

Claim 7. A contactless charge system for a radio-telephone capable of radio communication using voltage from a battery, comprising :

a charge voltage generating device including a charge control pulse generator which generates a pulse sequence with a predetermined period in response to input of a charge initiation signal, a voltage switch which converts and outputs a DC voltage at a predetermined level into an AC voltage in response to input of the generated pulse sequence, and a voltage generator which generates a charge voltage of an electromagnetic field corresponding to the AC current; and

a portable voice communication device which is installed on the charge voltage generating device and inductively coupled thereto, and which includes a charge voltage detector which detects the charge voltage of the generated electromagnetic field and rectifies the same to a voltage at a predetermined level, and which provides the rectified voltage as a charge voltage of the battery,

and characterized in that when the portable device is installed on the charge voltage generating means, the battery is charged by an induced coupling via inductive coupling.

Claim 8. The contactless charge system for a radio-telephone of Claim 7, wherein the charge voltage generating means further comprises a charge switch that is switched when the portable device is installed on the charge voltage generating means and generates the charge initiation control signal, and is characterized in the charge voltage is generated only when the portable device is installed.

Claim 9. The contactless charge system for a radio-telephone of Claim 8, characterized in that it further comprises a temperature-sensitive pulse controller which outputs a pulse output blocking control signal to the charge control pulse generator to block generation of the charge voltage in response the temperature of the charge voltage generating means rising to a preset temperature.

Claim 10. The contactless charge system for a radio-telephone of Claim 9, characterized in that the charge voltage detector includes a voltage detector which detects as a pulse voltage a charge voltage of an electromagnetic field generated from the charge voltage generating means, and a rectifier which rectifies the pulse voltage detected from the voltage detector and provides the voltage as a charge voltage of the battery.

Claim 11. The contactless charge system for a radio-telephone of Claim 9, characterized in that the voltage switch includes a first switch which switches the DC voltage at a predetermined level in response to a switching signal input and provides an AC voltage to the voltage generator, and a second switch which provides a switching control signal to the first switch in response to input of the control signal SCTL with a predetermined period.

Claim 12. The contactless charge system for a radio-telephone of any one of Claims 10 and 11, characterized in that the voltage generator includes a core 76 and a coil 77 wound around the core 76 a predetermined number of times and connected to a voltage output terminal of the voltage switch, and generates a magnetic flux line of an electromagnetic field corresponding to the current of the input AC voltage.

Claim 13. The contactless charge system for a radio-telephone of Claim 12, wherein the charge voltage detector includes an induced voltage detecting means that includes a core 78 and a coil 79 wound around the core 78 a predetermined number of times, is linked with the magnetic flux line from the coil 77, and detects an AC voltage proportional to a time change ratio of the flux linkage, and a rectifier connected between the induced voltage detecting means and the battery which rectifies the detected AC voltage and supplies the AC voltage to the battery.

Claim 14. A contactless charge system for a cordless radio-telephone, the system including a base unit connected to a telephone line and a portable device with integrated battery, wherein:

the base unit is comprised of a first transmission and reception device operated by an operating voltage at a predetermined level, and which wirelessly transmits a signal from the telephone line and transmits wave-received signals through the telephone line; and a charge voltage generating means which generates an induced voltage of an electromagnetic field corresponding to input of the operating voltage at a predetermined level; and,

the portable device is comprised of a second transmission and reception device operated by the voltage of the battery and which transmits and receives voice signals through the telephone line through wireless communication with the

base unit; and an induced voltage detecting means which detects and rectifies the induced voltage of the electromagnetic field and provides the same as a charge voltage of the battery.

and the system is characterized in that when the portable device is mounted on the base unit, the charge voltage generating means and the induced voltage detecting means are inductively coupled, so that the induced voltage from the charge voltage generating means is detected by the induced voltage detecting means and converted into a DC voltage at a predetermined level which charges the battery.

Drawings
FIG. 1

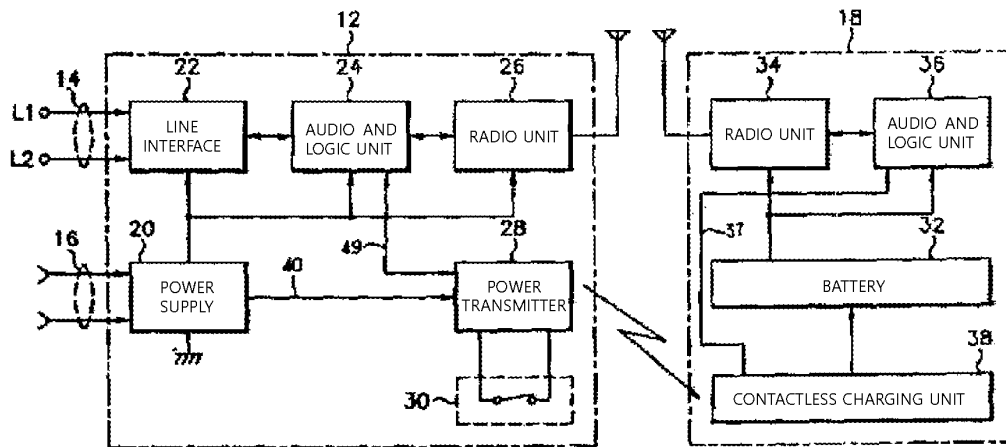


FIG. 2

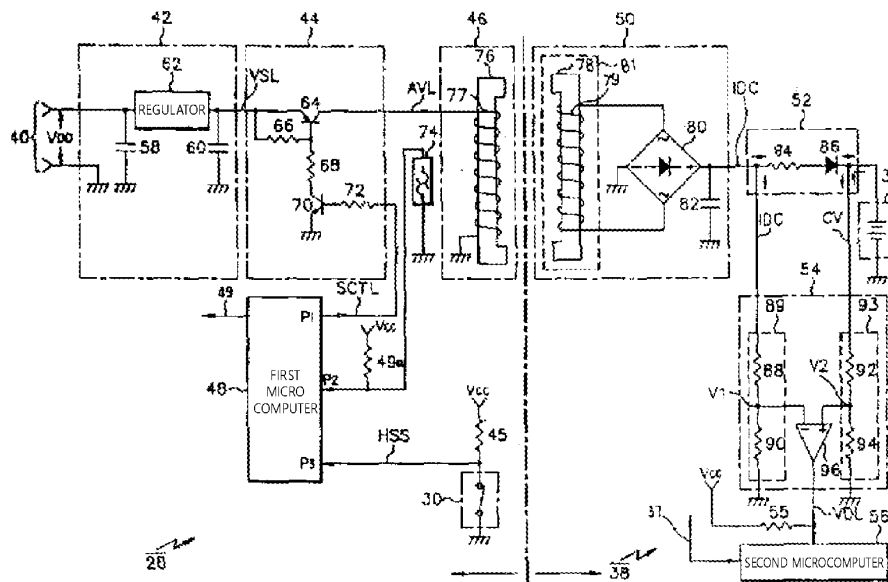


FIG. 3A

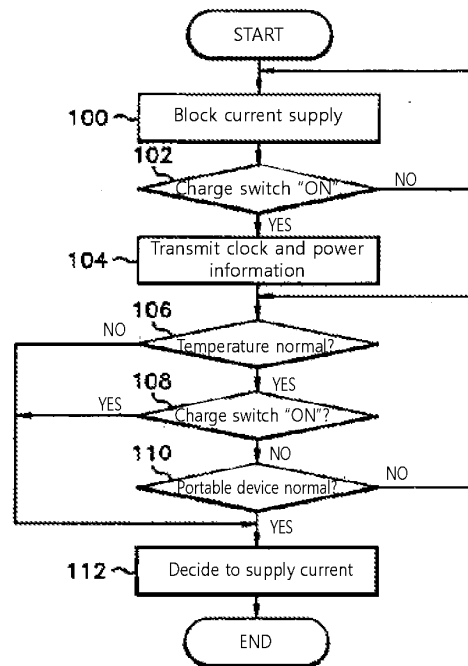
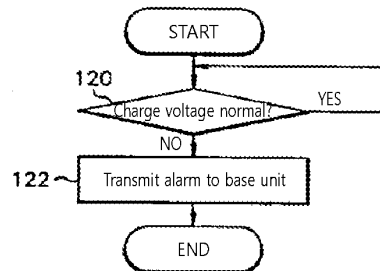


FIG. 3B



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REQUEST FOR SUPPLEMENTAL EXAMINATION TRANSMITTAL FORM

Address to:
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attorney Docket No.:

Date:

1. ☒ This is a request for supplemental examination pursuant to 37 CFR 1.610 of patent number 8,013,568 issued September 6, 2011. 37 CFR 1.610(b)(1).
2. ☒ Supplemental examination of claim(s) 1-24 is requested. 37 CFR 1.610(b)(4).
3. ☒ a. The name(s) of the patent owner(s) (not the patent practitioner(s)) is (are):
LS Cable & System Ltd.

☒ b. A submission by the patent owner(s) in compliance with 37 CFR 3.73(c), which establishes that the patent owner(s) has (have) the entirety of the ownership in the patent for which supplemental examination is requested, is included. 37 CFR 1.610(b)(9).
4. ☐ a. A check in the amount of \$_____ is enclosed to cover the fee for processing and treating a request for supplemental examination, the fee for reexamination ordered under 35 USC 257, and the fee for processing and treating each non-patent document over 20 sheets in length (37 CFR 1.20(k)(1 - 3));
☒ b. The Director is hereby authorized to charge all applicable fees as set forth in 37 CFR 1.20(k)(1 - 3) to Deposit Account No. 021818; or
☐ c. Payment by credit card. Form PTO-2038 is attached. 37 CFR 1.610(a).
5. ☒ Any refund should be made by ☐ check or ☒ credit to Deposit Account No. 021818. 37 CFR 1.26(c). If payment is made by credit card, refund must be to the credit card account.
6. ☒ A copy of the patent for which supplemental examination is requested, and a copy of any disclaimer or certificate issued for the patent are included. 37 CFR 1.610(b)(6).
7. ☐ CD-ROM or CD-R in duplicate, Computer Program (Appendix) or large table
☐ Landscape Table on CD
8. ☐ Nucleotide and/or Amino Acid Sequence Submission
If applicable, items a. - c. are required.
 - a. ☐ Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. ☐ CD-ROM (2 copies) or CD-R (2 copies); or
 - ii. ☐ paper
 - c. ☐ Statements verifying the identity of above copies
9. ☒ A list of no more than 12 items of information submitted as part of this request is provided in Part B of this form. Where appropriate, the list must meet the requirements of 37 CFR 1.98(b). 37 CFR 1.605(a), 1.610(b)(2).

[Page 1 of 2]

This collection of information is required by 37 CFR 1.610. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 0.3 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.

Patent No.

PTO/SB/59 (09-16)

Approved for use through 11/30/2021. OMB 0651-0064

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10. ☒ A legible copy of each item of information listed in Part B of this form, and an English language translation of all necessary and pertinent parts of each non-English language item of information are included.

Copies of items of information that form part of the discussion within the body of the request (see 37 CFR 1.605(b)), and copies of U.S. patents and patent application publications, are not required. 37 CFR 1.610(b)(7).

11. ☐ A summary of the relevant portions of each non-patent document that is over 50 pages in length (other than the request) is included. The summary includes the required citations to the particular pages containing the relevant portions. 37 CFR 1.610(b)(8).

12. ☒ A separate, detailed explanation of the relevance and manner of applying each item of information to each claim of the patent for which supplemental examination is requested, is included. 37 CFR 1.610(b)(5).

13. ☐ The below list includes all prior or concurrent post-patent Office proceedings (*ex parte* or *inter partes* reexamination, reissue, supplemental examination, post grant review, or *inter partes* review) involving the patent for which supplemental examination is being requested. 37 CFR 1.610(b)(3). An identifying number may be, e.g., a control no. or reissue application no. Any prior or concurrent post-patent Office proceedings not listed below are listed on a separate paper accompanying the request.

Type of Proceeding

Identifying Number

Filing Date

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

- ☐ See accompanying paper for a list of additional prior or concurrent post-patent Office proceedings involving the patent for which supplemental examination is requested. The paper should be a separate sheet titled "List of Prior or Concurrent Post-Patent Office Proceedings" and must provide the type, identifying number, and filing date of the post-patent Office proceeding.

14. Correspondence Address: Please recognize, or change, the correspondence address for the file of the patent for which supplemental examination is requested **and** for the supplemental examination proceeding to be:

- ☒ The address associated with Customer Number: OR

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15. **WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

/Matthew S. Dicke/

March 12, 2021

Authorized Signature

Date

Matthew S. Dicke

58819

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(Also referred to as FORM PTO-XXXX)

REQUEST FOR SUPPLEMENTAL EXAMINATION TRANSMITTAL FORM PART B – LIST OF ITEMS OF INFORMATION – Page 1

Patent number for which supplemental examination is requested 8,013,568 Issue Date September 6, 2011

All items of information (no more than 12) submitted herewith as part of this request for supplemental examination of the above-identified patent are included in the following list:

U. S. PATENT DOCUMENTS

Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	Number-Kind Code ² (if known)			
	US- 2004/0145342	2004-07-29	Lyon	see table in Request
	US- 7,211,986	2007-05-01	Flowerdew	see table in Request
	US- 6,912,137	2005-06-28	Berghegger	see table in Request
	US- 5,949,213	1999-09-07	Lanni	see table in Request
	US-			
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FOREIGN PATENT DOCUMENTS

Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ²
	Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	KR950005819B1	1995-05-31	Hong Chung-sik	see table in Request	
	WO02/15320	2002-02-21	Kim, et al.	see table in Request	

¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

(Also referred to as FORM PTO-XXXX)

Patent number for which supplemental examination is requested 8,013,568 Issue Date September 6, 2011
All items of information (no more than 12) submitted herewith as part of this request for supplemental examination of the above- identified patent are included in the following list:

[illegible]

¹ Applicant's unique citation designation number (optional). ² Applicant is to place a check mark here if English language Translation is attached.

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Litigation Search Report CRU 3999

Reexamination Control No. 96/000,355

To: DEB, Anjan	From: GRAVES, Monica A.
Location: OCRU	Location: OCRU
Art Unit: 3992	Phone: 2-7253
Date: <u>17 March 2021</u>	E-mail: monica.graves@uspto.gov

Search Notes

US PATENT NO: 8,013,568 - No litigation found

1. Performed a KeyCite Search in Westlaw, which retrieves all history on the patent including any litigation.
2. Performed a search on the patent in Lexis CourtLink for any open dockets or closed cases.
3. Performed a search in Lexis in the Federal Courts and Administrative Materials databases for any cases found.
4. Performed a search in Lexis in the IP Journal and Periodicals database for any articles on the patent.
5. Performed a search in Lexis in the news databases for any articles about the patent or any articles about litigation on this patent.

Citing References (30)

Treatment	Title	Date	Type	Depth	Headnote(s)
—	1. CONTACT-LESS CHARGEABLE BATTERY FOR E.G. ELECTRIC TOOTHBRUSH, HAS OVERVOLTAGE MONITORING UNIT MONITORING VOLTAGES AT BOTH ENDS OF CONSTANT VOLTAGE SUPPLIER AND TRANSMITTING MONITORED RESULT TO CHARGING DEVICE Out Of Page DWPI 2007-308679 ... a magnetic field so that the said both-ends voltage may not be in an overvoltage state.First Derwent Appearance:2011.38 Publication No. (Derwent): US 8013568 B2 Original Title (English):CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Publication Date:2011-09-06 ...	July 29, 2005	DWPI	—	—
—	2. RF 055487/0271 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—
—	3. RF 055487/0283 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—
—	4. RF 055487/0295 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—

List of 30 Citing References for CONTACT-LESS CHARGEABLE BAT...

Treatment	Title	Date	Type	Depth	Headnote(s)
—	5. RF 055487/0307 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—
—	6. RF 055487/0319 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—
—	7. RF 055487/0432 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—
—	8. RF 055487/0441 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—
—	9. RF 055487/0643 Out Of Page ... Modified 2021-03-05 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	Mar. 03, 2021	Assignments	—	—

Treatment	Title	Date	Type	Depth	Headnote(s)
—	10. RF 046367/0522 Out Of Place ... Modified 2018-07-18 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	July 17, 2018	Assignments	—	—
—	11. RF 046556/0633 Out Of Place ... Modified 2018-08-06 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	July 17, 2018	Assignments	—	—
—	12. RF 021107/0629 Out Of Place ... Modified 2011-09-06 PATENTS AFFECTED Title CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF Granted Patent Number US Pat. 8013568 Granted Patent Date 2011-09-06 Published Application Number US Pat. App. 20080303479 Published Application Date 2008-12-11 Application Number 11/997272 ...	June 17, 2008	Assignments	—	—
—	13. CONFIGURABLE WIRELESS TRANSMITTER DEVICE Out Of Place US PAT 10790699 , U.S. PTO Utility A wireless transmitter device is configurable and operable to transfer energy to multiple receiver devices at the same time. The transmitter device is configured to enable one or... ... 2011/05 Esaka et al.cited by applicant US United States US 7952322 B2 2011/05 Partovi et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8050063 B2 2011/11 Wagoner et al.cited by applicant US ...	Sep. 29, 2020	Patents	—	—

Treatment	Title	Date	Type	Depth	Headnote(s)
—	14. SHARED POWER CONVERTER FOR A WIRELESS TRANSMITTER DEVICE Out Of File US PAT 10734840 , U.S. PTO Utility A transmitter device is configured to transfer energy to multiple receiver devices. The transmitter device includes multiple transmitter coils, and a shared power converter is... ... 2011/05 Esaka et al.cited by applicant US United States US 7952322 B2 2011/05 Partovi et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8050063 B2 2011/11 Wagoner et al.cited by applicant US ...	Aug. 04, 2020	Patents	—	—
—	15. POWER STORAGE DEVICE AND SEMICONDUCTOR DEVICE PROVIDED WITH THE POWER STORAGE DEVICE Out Of File US PAT 10666093 , U.S. PTO Utility An object is to provide a power storage device provided with a battery that is a power storage means, for safe and accurate supply of electric power in a short period of time for... ... et al.cited by applicant US United States US 7839124 B2 2010/11 Yamazaki 320/134 G06K 19/0707 cited by examiner US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8283868 B2 2012/10 Inoue 320/108 H02J 5/00 cited ...	May 26, 2020	Patents	—	—
—	16. SELECTIVE ACTIVATION OF A WIRELESS TRANSMITTER DEVICE Out Of File US PAT 10651685 , U.S. PTO Utility A wireless transmitter device is configurable and operable to transfer energy to multiple receiver devices at the same time. The transmitter device includes at least one layer of... ... 2011/05 Esaka et al.cited by applicant US United States US 7952322 B2 2011/05 Partovi et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8050063 B2 2011/11 Wagoner et al.cited by applicant US ...	May 12, 2020	Patents	—	—
—	17. QUICK CHARGING METHOD, MOBILE TERMINAL, AND POWER ADAPTER Out Of File US PAT 10581262 , U.S. PTO Utility Methods and devices are provided for quick charging. In the method, after a mobile terminal recognizes a type of a power adapter, the mobile terminal transmits indication... ... 6675 cited by examiner US United States US 7956330 B2 2011/06 Nishino 250/370.09 A61B 6/00 cited by examiner US United States US 8013568 B2 2011/09 Park 320/108 H02J 7/025 cited by examiner US United States US 8148940 B2 2012/04 Liu 307/151 H02J ...	Mar. 03, 2020	Patents	—	—

Treatment	Title	Date	Type	Depth	Headnote(s)
—	18. COMMUNICATION ENABLED EMF SHIELD ENCLOSURES Out Of Page US PAT 10477741 , U.S. PTO Utility An inductive power transmission system electromagnetic field shielding apparatus includes an enclosure. The enclosure is configured to surround an electronic device and an... ... 2011/05 Esaka et al.cited by applicant US United States US 7952322 B2 2011/05 Partovi et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8050063 B2 2011/11 Wagoner et al.cited by applicant US ...	Nov. 12, 2019	Patents	—	—
—	19. POWER ADAPTOR, TERMINAL AND CHARGING SYSTEM Out Of Page US PAT 10424954 , U.S. PTO Utility A power adaptor (100) includes a power conversion unit (110) and a power line (121). The power conversion unit (110) charges a terminal (200) via the power line (121). The power... ... 11/1824 cited by examiner US United States US 7977919 B1 2011/07 Jaoude 320/129 H04B 1/05 cited by examiner US United States US 8013568 B2 2011/09 Park 320/108 H02J 7/025 cited by examiner US United States US 8022662 B2 2011/09 Eager 320/103 H02J ...	Sep. 24, 2019	Patents	—	—
—	20. POWER STORAGE DEVICE AND SEMICONDUCTOR DEVICE PROVIDED WITH THE POWER STORAGE DEVICE Out Of Page US PAT 9985464 , U.S. PTO Utility An object is to provide a power storage device provided with a battery that is a power storage means, for safe and accurate supply of electric power in a short period of time for... ... 2010/06 Sennami et al.cited by applicant US United States US 7822383 B2 2010/10 Miyagawa et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8283868 B2 2012/10 Inoue 320/108 H02J 5/00 cited ...	May 29, 2018	Patents	—	—
—	21. WIRELESS POWER MULTI-CHARGING METHOD AND POWER TRANSMITTER Out Of Page US PAT 9729000 , U.S. PTO Utility A power transmitter and method are provided for wireless multi-charging. A power transmitter includes a resonator configured to wirelessly transmit power to one or more power... ... US Patents and Applications:US United States US 7925308 B2 2011/04 Greene 455/343.1 G06K 19/0707 cited by examiner US United States US 8013568 B2 2011/09 Park 320/108 H02J 7/025 cited by examiner US United States US 8120311 B2 2012/02 Baarman 307/104 H02J ...	Aug. 08, 2017	Patents	—	—

Treatment	Title	Date	Type	Depth	Headnote(s)
—	22. POWER STORAGE DEVICE AND SEMICONDUCTOR DEVICE PROVIDED WITH THE POWER STORAGE DEVICE Out Of Page US PAT 9620988 , U.S. PTO Utility An object is to provide a power storage device provided with a battery that is a power storage means, for safe and accurate supply of electric power in a short period of time for... ... 2010/06 Sennami et al.cited by applicant US United States US 7822383 B2 2010/10 Miyagawa et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 2004/0080474 A1 2004/04 Kimura cited by applicant US United ...	Apr. 11, 2017	Patents	—	—
—	23. CHARGING MECHANISM WITH GROUND CONTACT AND NON-CONTACT COUPLING Out Of Page US PAT 9472975 , U.S. PTO Utility The embodiments provide a device including an enclosure having circuitry associated with the device and a battery configured to power the circuitry, and a power plug receiving unit... ... 06 Kuhlmann 320/104 H02J 7/0642 cited by examiner US United States US 7893655 B2 2011/02 Veselic cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8098043 B2 2012/01 Lin cited by applicant US United States ...	Oct. 18, 2016	Patents	—	—
—	24. CHARGING MECHANISM WITH GROUND CONTACT AND NON-CONTACT COUPLING Out Of Page US PAT 9368998 , U.S. PTO Utility The embodiments provide a device including an enclosure having circuitry associated with the device and a battery configured to power the circuitry, and a power plug receiving unit... ... 6028413 A 2000/02 Brockmann 320/108 cited by examiner US United States US 7893655 B2 2011/02 Veselic cited by applicant US United States US 8013568 B2 2011/09 Park et al.320/108 cited by examiner US United States US 8098043 B2 2012/01 Lin 320/108 cited by ...	June 14, 2016	Patents	—	—
—	25. WIRELESS OPTICAL CHARGING AND POWER SUPPLY Out Of Page US PAT 9318905 , U.S. PTO Utility Techniques for charging electronic devices are presented. A charger controller component controls supplying power to an electronic device having a solar cell component using... ... States US 7944171 B2 2011/05 Yeh cited by applicant US United States US 7948209 B2 2011/05 Jung cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 8024012 B2 2011/09 Cleverger et al.cited by applicant US ...	Apr. 19, 2016	Patents	—	—

Treatment	Title	Date	Type	Depth	Headnote(s)
—	26. POWER STORAGE DEVICE AND SEMICONDUCTOR DEVICE PROVIDED WITH THE POWER STORAGE DEVICE Out Of Page US PAT 9270229 , U.S. PTO Utility An object is to provide a power storage device provided with a battery that is a power storage means, for safe and accurate supply of electric power in a short period of time for... ... 2010/06 Sennami et al.cited by applicant US United States US 7822383 B2 2010/10 Miyagawa et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 2004/0080474 A1 2004/04 Kimura cited by applicant US United ...	Feb. 23, 2016	Patents	—	—
—	27. WIRELESS CHARGING SYSTEM AND RELATED METHOD FOR TRANSMITTING DATA Out Of Page US PAT 8947044 , U.S. PTO Utility The invention discloses a wireless charging system for transmitting data. The wireless charging system includes a charging device for wirelessly transmitting a source signal and... ... 11 Popescu-Stanesti cited by applicant US United States US 7812481 B2 2010/10 Isaka et al.307/104 cited by examiner US United States US 8013568 B2 2011/09 Park cited by applicant US United States US 8427330 B2 2013/04 Vorenkamp et al.340/636.2 cited by examiner ...	Feb. 03, 2015	Patents	—	—
—	28. WIRELESS POWER TRANSMISSION FOR PORTABLE WIRELESS POWER CHARGING Out Of Page US PAT 8901880 , U.S. PTO Utility Exemplary embodiments are directed to wireless power transfer. A portable wireless power charger includes an antenna configured to generate a magnetic near-field for coupling of... ... 7741734 2010/06 Joannopoulos et al.US US 7825543 2010/11 Karalis et al.307/104 US US 7826873 2010/11 Telefunken 455/573 US US 8013568 2011/09 Park et al.320/108 US US 8040103 2011/10 Hui et al.320/108 US US 8339096 2012/12 Osada 320 ...	Dec. 02, 2014	Patents	—	—
—	29. POWER STORAGE DEVICE AND SEMICONDUCTOR DEVICE PROVIDED WITH THE POWER STORAGE DEVICE Out Of Page US PAT 8847556 , U.S. PTO Utility An object is to provide a power storage device provided with a battery that is a power storage means, for safe and accurate supply of electric power in a short period of time for... ... 2010/06 Sennami et al.cited by applicant US United States US 7822383 B2 2010/10 Miyagawa et al.cited by applicant US United States US 8013568 B2 2011/09 Park et al.cited by applicant US United States US 2004/0080474 A1 2004/04 Kimura 345/082 cited by examiner ...	Sep. 30, 2014	Patents	—	—

Treatment	Title	Date	Type	Depth	Headnote(s)
—	30. WIRELESS CHARGER AND WIRELESS CHARGING METHOD THEREOF Out Of Page US PAT 8120317 , U.S. PTO Utility A wireless charger for charging an electronic device includes a holder with a primary coil and a number of holding coils fixed thereon and a resilient member sleeved thereon. The... ... Tang et al.320/108 cited by examiner US United States US 7683572 B2 2010/03 Toya 320/108 cited by examiner US United States US 8013568 B2 2011/09 Park et al.320/108 cited by examiner US United States US 2009/0153098 A1 2009/06 Toya et al.320 ...	Feb. 21, 2012	Patents	—	—



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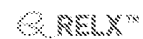


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K&L Gates LLP-Chicago
P.O. Box 1135
Chicago, IL 60690



Patent Number: 8013568

Control Number: 96/000,355

Date Mailed: 03/17/2021

NOTICE OF SUPPLEMENTAL EXAMINATION REQUEST FILING DATE

The patent owner is hereby notified that the filing date of the request for supplemental examination is 03/12/2021, the date that a request meeting all of the applicable requirements of 37 CFR §§ 1.605, 1.610, and 1.615 was received by the Office.

A supplemental examination certificate will issue within three months from the filing date of the request for supplemental examination. See 37 CFR 1.625.

This notice is being sent to the official correspondence address of record which, in a supplemental examination proceeding, is the official correspondence address of record in the patent file. See 37 CFR 1.33.

/TPLOVELACE/

Central Reexamination Unit
(571) 272-1027, FAX NO. (571)273-9900

Patent Assignment Abstract of Title

Total Assignments: 11

Application #: 11997272 Filing Dt: 06/17/2008 Patent #: 8013568 Issue Dt: 09/06/2011
PCT #: NONE Intl Reg #: Publication #: US20080303479 Pub Dt: 12/11/2008
Inventors: Dong-Young Park, Sung-Wook Moon, Sung-Wook Choi, Jung-Bum Kim, Gwang-Hee Gwon, Sub Han
Title: CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF

Assignment: 1

Reel/Frame: 021187 / 0529 Received: 06/17/2008 Recorded: 06/17/2008 Mailed: 06/17/2008 Pages: 5

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignors: PARK, DONG-YOUNG Exec Dt: 02/22/2008
MOON, SUNG-WOOK Exec Dt: 02/22/2008
CHOI, SUNG-WOOK Exec Dt: 02/22/2008
GWON, GWANG-HEE Exec Dt: 02/22/2008
HAN, SUB Exec Dt: 02/22/2008
KIM, JUNG-BUM Exec Dt: 02/22/2008

Assignee: LS CABLE LTD.
19-20F ASEM TOWER 159 SAMSUNG-DONG, GANGNAM-GU,
SEOUL, KOREA, REPUBLIC OF 135-090

Correspondent: STROOCK & STROOCK & LAVAN LLP
180 MAIDEN LANE
ALISON KRUGER
NEW YORK, NY 10038

Assignment: 2

Reel/Frame: 046355 / 0522 Received: 07/17/2018 Recorded: 07/17/2018 Mailed: 07/18/2018 Pages: 2

Conveyance: CHANGE OF NAME (SEE DOCUMENT FOR DETAILS).

Assignor: LS CABLE LTD. Exec Dt: 07/11/2018

Assignee: LS CORPORATION
19-20F ASEM TOWER 159 SAMSUNG-DONG, GANGNAM-GU
SEOUL, KOREA, REPUBLIC OF 135-090

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

Assignment: 3

Reel/Frame: 046355 / 0633 Received: 07/17/2018 Recorded: 07/17/2018 Mailed: 08/06/2018 Pages: 4

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: LS CORPORATION Exec Dt: 07/11/2018

Assignee: LS CABLE & SYSTEM LTD.
(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignors: PARK, DONG-YOUNG Exec Dt: 03/13/2019
MOON, SUNG-WOOK Exec Dt: 04/12/2019
CHOI, SUNG-WOOK Exec Dt: 09/17/2018
GWON, GWANG-HEE Exec Dt: 09/17/2018
HAN, SUB Exec Dt: 03/22/2019

KIM JUNG-BUM

Exec Dt: 03/28/2019

Assignee: LS CABLE & SYSTEM LTD.
(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignor: MOON SUNG-WOOK

Exec Dt: 06/24/2020

Assignee: LS CABLE & SYSTEM LTD.
(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignor: GWON GWANG-HEE

Exec Dt: 06/25/2020

Assignee: LS CABLE & SYSTEM LTD.
(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignor: PARK DONG-YOUNG

Exec Dt: 06/29/2020

Assignee: LS CABLE & SYSTEM LTD.
(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignor: HAN SUB

Exec Dt: 06/30/2020

Assignee: LS CABLE & SYSTEM LTD.
(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignor: CHOI SUNG-WOOK

Exec Dt: 06/30/2020

Assignee: LS CABLE & SYSTEM LTD.
(HOGYE-DONG) 127, LS-RO, DONGAN-GU

ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignor: LS CORPORATION

Exec Dt: 07/03/2020

Assignee: LS CABLE & SYSTEM LTD.

(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Assignor: KIM JUNG-SUM

Exec Dt: 07/20/2020

Assignee: LS CABLE & SYSTEM LTD.

(HOGYE-DONG) 127, LS-RO, DONGAN-GU
ANYANG-SI, GYEONGGI-DO, KOREA, REPUBLIC OF 14119

Correspondent: K&L GATES LLP
PO BOX 1135
CHICAGO, IL 60690

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Foreign Priority claimed ☐ Yes ☐ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and Acknowledged _____ Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
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TITLE CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF						
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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REASONS FOR SUBSTANTIAL NEW QUESTION OF PATENTABILITY

DETERMINATION

1.0 REVIEW OF FACTS

- a. A supplemental examination request was filed on 03/12/2021 and assigned control number 96/000,355 ("the '355 request").
- b. On 03/17/2021, the Office mailed a "Notice of Supplemental Examination Request Filing Date" indicating that the '355 request was granted a filing date.
- c. Supplemental examination is requested for claims 1-24 of U.S. Patent No. 8,013,568 ("the '568 patent"), which issued on September 06, 2011 from Application no. 11/997,272 ('272 Application) based on PCT/KR2006/001713 FILED: June 17, 2008.

As noted on its front page, the '568 patent claims priority from:

KR 10-2005-0069871 filed July 29, 2005

KR 10-2006-0038960 filed April 28, 2006

2.0 PERTINENT PROSECUTION HISTORY

During prosecution of Application No. 11/997,272 examiner allowed the case in a first office action giving the following reasons for allowance:

Regarding independent claims 1 and 7, the examiner cited prior art reference Park et al. al. (US 6,683,438) for disclosing contactless charger between a battery pack and the battery charger including a converter and the charging unit. The converter converts a commercial electric power to a high frequency square wave, applies the converted frequency to the primary side of a transformer, and controls generation of a charge current depending on charge state information provided. (Fig. 2).

Furthermore, regarding independent claims 1 and 7, the examiner cited prior art reference Kubota et al. (US 7,208,915) for disclosing a constant current battery charger that includes a power supply for supplying a charge current to secondary battery, and a current monitor for monitoring a charge current being supplied to the secondary battery. The controller generates the demand repeatedly at regular on varying intervals for varying the charge current.

The Examiner then concluded that both of the above cited references fails to disclose or suggest the following limitations recited in claims 1 and 7:

a contactless chargeable battery including a charging circuit for charging a battery cell, a high frequency AC current inducing unit to which a high frequency AC current is induced by means of magnetic field generated,

rectifier for receiving the induced high frequency AC current and converting into DC current,

constant voltage and constant current supplier for receiving DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage and constant current charge mode,

over voltage monitoring unit for monitoring voltages at both ends of the constant current supplier and transmitting a monitoring result to the external contactless charging device,

in combination with the remaining claim elements as set forth in Claims 1 and 7, and their depending claims 2-6 and 8-12. (See Application Number 11/997,272, Examiner's Notice of Allowance mailed 6/24/2011, Reasons for Allowance page 3).

Regarding independent claims 13, 21, and 23, the examiner cited prior art reference Park et al. (US 6,683,438) for disclosing a contactless charger between a battery pack and the battery charger including a converter and charging unit. The converter includes a primary side of a

transformer. The converter converts a commercial electric power to a high frequency square wave, applies the converted frequency to the primary side of the transformer, and controls generation of a charge current depending on charge state information provided.

Furthermore, regarding claims 13, 21, and 23, the examiner cited prior art reference Kubota et al. (US 7,208,915) for disclosing a constant current battery charger includes a power supply for supplying a charge current to a secondary battery, and a current monitor for monitoring a charge current being supplied to the secondary battery. The controller generates the demand repeatedly at regular on varying intervals for varying the charge current.

The Examiner then concluded that both of the above cited references fails to disclose or suggest the following limitations recited in claims 13, 21, and 23:

a contactless chargeable battery including a charging circuit for charging a battery cell,

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of magnetic field generated,

a charging power adjusting unit for receiving the monitoring result from the contactless chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied,

a constant voltage/constant current supplier for receiving DC current, and supplying a charging power to the battery cell in a constant voltage/constant current charge mode,

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer part,

in combination with the remaining claim elements as set forth in claims 13, 21, and 23, and their depending claims 14-20, 22 and 24. (See Application Number 11/997,272, Examiner's Notice of Allowance mailed 6/24/2011, Reasons for Allowance page 4).

Therefore claims 1-24 are allowed.

From the above reasons for allowance, and in consideration of the prior art, Examiner considers the following key limitation in claims 1, 7, 13, 21, and 23 as raising an SNQ:

Regarding claims 1 and 7,

A contactless chargeable battery including a charging circuit for charging a battery cell, a high frequency AC current inducing unit to which a high frequency AC current is induced by means of magnetic field generated,

a rectifier for receiving the induced high frequency AC current and converting into DC current,

a constant voltage/constant current supplier for receiving DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current charge mode, and

an over voltage monitoring unit for monitoring voltages at both ends of the constant voltage/current supplier and

transmitting a monitoring result to the external contactless charging device by means of wireless communication so as to induce a change of intensity of the magnetic field. (Recited in claims 1 and 7).

Regarding claims 13,

A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, a charging power adjusting unit for receiving the monitoring result from the contactless chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied.

(Recited in claim 13).

Regarding claim 21,

A contact-less chargeable battery and a contact-less charging device, a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device, a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode; and an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier, and

transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced, and

a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and

controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted". (Recited in claim 21).

Regarding claim 23,

A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:

intermittently applying a high frequency AC current to a primary coil provided to the charging device

rectifying the output high frequency AC current to be converted into a DC current;

applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;

monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and

adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result. (Recited in claim 23).

3.0 ITEMS OF INFORMATION

Supplemental examination is requested based on the following items of information:

1. Korean Patent No. KR950005819Bl to Hong Chung-Sik, English Language Translation ("Chung-Sik")
2. PCT Publication No. WO 02/15320 to Kim et al. ("Kim")
3. U.S. Patent Publication No. 2004/0145342 to Lyon ("Lyon")
4. U.S. Patent No. 7,211,986 to Flowerdew et al. ("Flowerdew")
5. U.S. Patent No. 6,912,137 to Berghegger ("Berghegger")
6. U.S. Patent No. 5,949,213 to Lanni ("Lanni")

4.0 ISSUES

4.1 Issue 1 (KR950005819Bl to Hong Chung-Sik, "Chung-Sik")

Whether claims 1-24 of the '568 Patent raise an SNQ as being obvious over Chung-Sik (KR950005819Bl).

4.2 Issue 2 (Kim-WO 02/15320)

Whether claims 1-24 of the '568 raise an SNQ as being obvious over Kim (WO 02/15320).

4.3 Issue 3 (Lyon-US2004/0145342)

Whether claims 1-24 of the '568 raise an SNQ as being obvious over Lyon (US 2004/0145342).

4.4 Issue 4 (Flowerdew-US 7,211,986)

Whether claims 1-24 of the '568 raise an SNQ as being obvious over Flowerdew (US 7,211,986).

4.5 Issue 5 (Berghegger-US 6,912,137)

Whether claims 1-24 of the '568 raise an SNQ as being obvious over Berghegger (US 6,912,137).

4.6 Issue 5 (Lanni-US 5,949,213)

Whether claims 1-24 of the '568 raise an SNQ as being obvious over Lanni (US 5,949,213).

5.0 SUBSTANTIAL NEW QUESTION OF PATENTABILITY (SNQ)

5.1 Issue 1: SNQ over Chung-Sik (cl. 1-24)

The request indicates whether claims 1-24 of the '568 patent raises an SNQ regarding independent claims 1, 7, 13, 21, and 23 and their respective dependent claims 2-6, 11, 12, 14-20, 21, and 24 respectively of the '568 Patent on the issue of obviousness over Chung-Sik. (See Request pages 4-26).

Chung-Sik is new art that was not considered during original prosecution of the '568 patent.

Chung-Sik does raise an SNQ affecting claims 1-24 of the '568 Patent.

Regarding independent claims 1 and 7 of the '568 Patent, Chung-Sik discloses constant voltage/constant current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See "constant voltage unit", page 8-3, paragraph 5). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See "voltage V1 is constant", page 8-5 line 5).

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field (page 8-2, paragraphs 7-8) of the induced voltage generating unit 46 (Fig. 2) (page 8-3, paragraph 8; page 8-5, paragraph 6) (Fig. 2).

Thus Chung-Sik discloses,

A contactless chargeable battery including a charging circuit for charging a battery cell, a high frequency AC current inducing unit to which a high frequency AC current is induced by means of magnetic field generated,

a rectifier for receiving the induced high frequency AC current and converting into DC current,

a constant voltage/constant current supplier for receiving DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current charge mode, and

an over voltage monitoring unit for monitoring voltages at both ends of the constant voltage/current supplier and

transmitting a monitoring result to the external contactless charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

The examiner considered the above key limitations in the reasons for allowance of claims 1 and 7 of the '568 patent requested for Supplemental Examination. Therefore, Chung-Sik does raise an SNQ affecting claims 1-12 of the '568 patent.

Regarding independent claims 13, 21 and 23, of the '568 Patent, as discussed above, Chung-Sik discloses battery charging set and method for controlling charging of a contact-less chargeable battery 32 comprising constant voltage/constant current unit for supplying a charging power to the battery cell in a constant voltage/constant current charge mode and a voltage monitoring unit for monitoring voltages at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) (Fig. 2).

Additionally, with respect to independent claims 13, 21, and 23, Chung-Sik discloses a charging power adjusting unit (FIRST MICRO COMPUTER 48) for receiving the monitoring result from the contact-less chargeable battery 32 by means of wireless communication (RADIO UNIT 34) and controlling the high frequency power driving unit 46 to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted (page 8-5, paragraphs 1, 5 and 6).

Thus Chung-Sik discloses all of the limitations considered by the Examiner in the reasons for allowance of claims 13, 21 and 23, said limitations including,

a contactless chargeable battery including a charging circuit for charging a battery cell;

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of magnetic field generated;

a charging power adjusting unit for receiving the monitoring result from the contactless chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied;

a constant voltage/constant current supplier for receiving DC current, and supplying a charging power to the battery cell in a constant voltage/constant current charge mode; and,

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer part.

Therefore, Chung-Sik does raise an SNQ affecting claims 13-24 of the '568 patent.

In light of the prosecution history of the '272 Application that led to the '568 patent, a reasonable examiner would consider the above teaching of Chung-Sik (KR 950005819B1) important in deciding the patentability of claims 1-24 of the '568 patent. Therefore **Chung-Sik (KR950005819B1) does raise an SNQ affecting claims 1-24 of the '568 patent.**

5.2 Issue 2: SNQ over Kim (cl. 1-24)

The request indicates whether claims 1-24 of the '568 patent raises an SNQ regarding independent claims 1, 7, 13, 21, or 23 and their respective dependent claims 2-6, 11 and 12 of the '568 Patent on the issue of obviousness over Kim (WO 02/15320)(see Request pages 26-48).

Kim is new art that was not considered during original prosecution of the '568 patent.

Kim does raise an SNQ affecting claims 13-20 of the '568 Patent.

Kim does not raise an SNQ affecting claims 1-12 and 21-24 of the '568 Patent.

Kim discloses battery charging apparatus and method that make use of an induced voltage in charging a battery without terminal contact between a battery pack and the charging apparatus (page 3, lines 10-12). Kim also teaches supplying constant voltage and constant

current to a battery for proper charging of the battery and specifically disclosed microcontroller (controller 3) has built-in algorithm programmed to supply a constant voltage or a constant current to the battery 2 (Fig. 1). (Abstract and page 3, lines 5 and 6, and page 5, lines 11-16).

Kim further teaches controller 3 monitors the voltage and the current supplied to the battery 2 (Fig. 2 and Fig. 7 step S207, page 10, lines 17-18) and transmits the monitored signals wirelessly by generating an optical signal and a signal receiver 17 receives the optical signal and supplies the received signal to a charging power adjusting unit (power controller 16). The power controller 16 outputs a signal for controlling the high frequency power driving unit (switching power section 13) to adjust a power of the high frequency AC current applied in order to effect proper charging of the battery (page 7, lines 3-7) (Fig. 2).

Thus Kim teaches a contactless chargeable battery including a charging circuit for charging a battery cell 2, a high frequency AC current inducing unit (induction coil 1) (Fig. 1) to which a high frequency AC current is induced by means of magnetic field generated and supplying a charging power to the battery cell in a constant voltage and constant current charge mode, monitoring voltages supplied to the battery, and adjusting charging power transmitted to the battery that are key limitations in the reasons for allowance of claim 13.

In light of the prosecution history of the '272 Application that led to the '568 patent, a reasonable examiner would consider the above teaching of Kim (WO 02/15320) important in deciding the patentability of claims 13-20 of the '568 patent. Therefore **Kim (WO 02/15320) does raise an SNQ affecting claims 13-20 of the '568 patent.**

Although Kim discloses induction unit (induction coil 1) that make use of an induced voltage in charging a battery, Kim fails to disclose a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current

that is a key limitations in the reasons for allowance of claims 1, 7, 21, and 23. Therefore **Kim (WO 02/15320) does not raise an SNQ affecting claims 1, 7, 21, and 23 and respective dependent claims 2-6, 11, 12; 22 and 24 of the '568 patent.**

5.3. Issue 3: No SNQ over Lyon (cl. 1-24)

The request indicates whether claims 1-24 of the '568 patent raises an SNQ regarding independent claims 1, 7, 13, 21, or 23 and their respective dependent claims 2-6, 11 and 12 of the '568 Patent on the issue of obviousness over Lyon (US 2004/0145342)(see Request pages 48-74).

Lyon is new art that was not considered during original prosecution of the '568 patent.

Lyon does not raise an SNQ affecting claims 1-24 of the '568 Patent.

Regarding independent claims 1, 7, 13, 21, and 23, Lyon discloses contact-less charging a battery using high frequency AC current inducing unit (inductive coils 210) and rectifier (Controlled Rectifier 230) for receiving the induced high frequency AC current and converting the induced high frequency AC current into DC current for charging a battery 234 (Fig. 2).

Lyon further disclosed transmitting the charging status of the battery to the external contactless charging device by means of wireless communication (communication channel 220) [0022] (Fig. 2). Lyon also disclosed output voltage control 236 and voltage sensing to ensure components receive proper output voltage levels [0025] (Fig. 2).

Lyon fails to disclose,

“constant voltage/constant current supplier for receiving DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current charge mode”, and

“an over voltage monitoring unit for monitoring voltages at both ends of the constant voltage/current supplier and transmitting a monitoring result to the external contactless charging device by means of wireless communication so as to induce a change of intensity of the magnetic field” as required in independent claim 1, and similar limitations in each of the independent claim 7, 13, 21, and 23.

Since Lyon fails to disclose the key limitations considered by the Examiner for allowance of the claims during prosecution history of the '272 Application that led to the '568 patent, **Lyon does not raise an SNQ affecting claims 1-24 of the '568 patent.**

5.4 Issue 4: No SNQ over Flowerdew (cl. 1-24)

The request indicates whether claims 1-24 of the '568 patent raises an SNQ regarding independent claims 1, 7, 13, 21, or 23 and their respective dependent claims 2-6, 11 and 12 of the '568 Patent on the issue of obviousness over Flowerdew (US 7,211,986)(see Request pages 74-105).

Flowerdew is new art that was not considered during original prosecution of the '568 patent.

Flowerdew does not raise an SNQ affecting claims 1-24 of the '568 Patent.

Regarding independent claims 1, 7, 13, 21, and 23, Flowerdew discloses contact-less charging a battery using high frequency AC current inducing coil (charging coil 316) and rectifier (Rectifier Diode 318) for receiving the induced high frequency AC current and converting the induced high frequency AC current into DC current for charging a battery 320 (col. 5, lines 15-60) (Fig. 2). Flowerdew also disclosed that charging is accomplished by constant current and a regulator circuit for monitoring the battery voltage (col. 6, lines 3-8) (Fig. 2).

Flowerdew further disclosed wireless communication by radio link between charger 302 and secondary unit 304 and the regulator circuit is responsive to voltage of battery 320 to limit the charging current (col. 6, lines 4-10, col. 15, lines 1-6).

Although Flowerdew disclosed monitoring a voltage of the battery and wireless communication between charger 302 and secondary unit 304, Flowerdew fails to disclose,

“an over voltage monitoring unit for monitoring voltages at both ends of the constant voltage/current supplier and transmitting a monitoring result to the external contactless charging device by means of wireless communication so as to induce a change of intensity of the magnetic field” as required in independent claim 1, and similar limitations in each of the independent claim 7, 13, 21, and 23.

Since Flowerdew fails to disclose the key limitations considered by the Examiner for allowance of the claims during prosecution history of the ‘272 Application that led to the ‘568 patent, **Flowerdew does not raise an SNQ affecting claims 1-24 of the ‘568 patent.**

5.5 Issue 5: No SNQ over Berghegger (cl. 1-24)

The request indicates whether claims 1-24 of the ‘568 patent raises an SNQ regarding independent claims 1, 7, 13, 21, or 23 and their respective dependent claims 2-6, 11 and 12 of the ‘568 Patent on the issue of obviousness over Berghegger (US 6,912,137)(see Request pages 105-129).

Berghegger is new art that was not considered during original prosecution of the ‘568 patent.

Berghegger does not raise an SNQ affecting claims 1-24 of the ‘568 Patent.

Berghegger discloses contact-less charging a battery 8 (Fig. 2) (col. 1, lines 30-32) using high frequency AC current inducing unit (coil 212) and rectifier GL for receiving the induced high frequency AC current and converting the induced high frequency AC current into DC current for charging a battery (Load RL) (col. 8, lines 52-65) (Fig. 4).

Berghegger fails to disclose the claimed "overvoltage monitoring unit" that monitors a voltage at both ends of a constant voltage/constant current supplier and fails to disclose monitoring of voltages at both ends of a constant voltage/constant current supplier. Detection means 42 of Berghegger detects load voltage (e.g., battery voltage) (see Figs. 4, 5) but fails to detect two voltages, voltage and both ends of the constant voltage/constant power supply.

While claim 14 of Berghegger discloses keeping a voltage constant without a constant current, it is on the transmitting side of the power supply and cannot be the considered same as the claimed constant voltage/constant current supplier which receives "the DC voltage from the rectifier" which has to be located on the receiving end of the power supply. Thus, Berghegger fails to disclose the claimed constant voltage/constant current supplier that receives a DC current from the rectifier and supplies a charging power to the battery cell in a constant voltage/constant current mode.

Berghegger also does not disclose transmitting a monitoring result to the external contact-less charging device by means of wireless communication as required in each of the independent claims 1, 7, 13, 21, and 23 of the '568 patent.

Since Berghegger fails to disclose the key limitations considered by the Examiner for allowance of the claims during prosecution history of the '272 Application that led to the '568 patent, **Berghegger does not raise an SNQ affecting claims 1-24 of the '568 patent.**

5.6 Issue 6: No SNQ over Lanni (cl. 1-24)

The request indicates whether claims 1-24 of the '568 patent raises an SNQ regarding independent claims 1, 7, 13, 21, or 23 and their respective dependent claims 2-6, 11 and 12 of the '568 Patent on the issue of obviousness over Lanni (US 5,949,213) (see Request pages 129-153).

Lanni is new art that was not considered during original prosecution of the '568 patent.

Lanni does not raise an SNQ affecting claims 1-24 of the '568 Patent.

Regarding independent claims 1, 7, 13, 21, and 23, Lanni discloses charging a battery 8 (Fig. 2) (col. 1, lines 30-32, col. 4, lines 35-36) using high frequency AC current inducing unit (winding 840 in secondary side of power supply) and rectifier 842 for receiving the induced high frequency AC current and converting the induced high frequency AC current into DC current output at connectors 846 (Fig. 1) for charging battery 8 (col. 12, lines 51-58) (Fig. 11A, 11C).

Lanni discloses integrated circuit 15 regulates constant current to apply a maximum current to the battery 18 until the voltage measured across the battery meets a final voltage level. The integrated circuit 15 then transitions to a second phase which regulates constant voltage (i.e., the final voltage) until the charging current falls below a programmed threshold (Lanni, col. 6, lines 40-52, Fig. 4).

Thus Lanni discloses high-frequency AC current inducing unit and rectifier for converting the induced high frequency AC current into DC current and a constant voltage/constant current supplier as required in each of the independent claims 1, 7, 13, 21, and 23 of the '568 patent.

Lanni fails to disclose contact-less charging as required in the claims, because Lanni requires a hard wired connector 85 (Fig. 6A) for charging by a cable between power supply and battery (Lanni col. 8, lines 1-13).

Lanni fails to disclose the claimed "overvoltage monitoring unit" for monitoring voltage at both ends of a constant voltage/constant current supplier. The over voltage protection circuit 830 disclosed by Lanni only monitors a single voltage at the DC output and compares that monitored voltage to a predetermined threshold (Lanni, col. 14 lines 20-32) (Fig. 11A).

Lanni also does not disclose transmitting a monitoring result by means of wireless communication to external charging device.

Since Lanni fails to disclose the key limitations considered by the Examiner for allowance of the claims during prosecution history of the '272 Application that led to the '568 patent, **Lanni does not raise an SNQ affecting claims 1-24 of the '568 patent.**

6.0 CONCLUSION

In the instant case, the '355 Request raises a substantial new question of patentability affecting at least one claim of the '568 Patent, as discussed above. Accordingly, ex parte reexamination will be ordered pursuant to 35 U.S.C. 257.

Claims 1-24 of the '568 Patent requested for Supplemental Examination will be examined.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANJAN DEB whose telephone number is (571)272-2228.

The examiner can normally be reached on 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hetul Patel can be reached on 571-272-4184. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ANJAN K DEB/
Primary Examiner, Art Unit 3992

Conferees:
Fred Ferris /FF/

Michael Fuelling /MF/



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,355	03/12/2021	8013568	0313071.00020	1538
24573	7590	04/21/2021	EXAMINER	
K&L Gates LLP-Chicago			DEB, ANJAN K	
P.O. Box 1135			ART UNIT	
Chicago, IL 60690			PAPER NUMBER	
			3992	
			MAIL DATE	
			DELIVERY MODE	
			04/21/2021	
			PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

(12) **SUPPLEMENTAL EXAMINATION CERTIFICATE**

United States Patent
Park et al.

(10) **Number:** **US 8,013,568 F1**
(45) **Certificate Issued:** **Apr. 21, 2021**

Control No.: 96/000,355

Filing Date: Mar. 12, 2021

Primary Examiner: Anjan Deb

A substantial new question of patentability affecting at least one claim of the patent is raised in the request for supplemental examination. See the Reasons for Substantial New Question of Patentability Determination in the file of this proceeding. Accordingly, ex parte re-examination will be ordered pursuant to 35 U.S.C 257.

(56) Items of Information

U.S. PATENT DOCUMENTS

2004/0145342	7/2004	Lyon
7,211,986	5/2007	Flowerdew
6,912,137	6/2005	Berghegger
5,949,213	9/1999	Lanni

FOREIGN PATENT DOCUMENTS

KR	950005819B1	5/1995
WO	02/15320 A1	2/2002



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,355	03/12/2021	8013568	0313071.00020	1538
24573	7590	04/23/2021	EXAMINER	
K&L Gates LLP-Chicago			DEB, ANJAN K	
P.O. Box 1135				
Chicago, IL 60690				
			ART UNIT	PAPER NUMBER
			3992	
			MAIL DATE	DELIVERY MODE
			04/23/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<i>Ex Parte Reexamination Ordered Pursuant to 35 U.S.C. 257</i>	Control No. 96/000,355	Patent Under Reexamination 8013568	
	Examiner Anjan Deb	Art Unit 3992	AIA (FITF) Status No
<i>--The MAILING DATE of this communication appears on the cover sheet with the correspondence address--</i> The supplemental examination proceeding filed on <u>03/12/2021</u>, concluded with the issuance of the supplemental examination certificate on <u>21 April 2021</u>. The certificate indicated that one or more items of information submitted as part of the request for supplemental examination raises a substantial new question of patentability. See the Reasons for Substantial New Question of Patentability Determination in the file of this proceeding. Accordingly, <i>ex parte</i> reexamination of claim(s) <u>1-24</u> of U.S. Patent No. <u>8013568</u> is ordered. See 35 U.S.C. 257(b) and 37 CFR 1.625(b). This <i>ex parte</i> reexamination proceeding is hereby initiated by the mailing of this order. <i>Ex parte</i> reexamination under 35 U.S.C. 257 will be conducted in accordance with 37 CFR 1.530 through 1.570, which govern <i>ex parte</i> reexamination, subject to the exceptions enumerated in 37 CFR 1.625(d), and, in addition, to the exception that a patent owner's statement, including any amendment, under 37 CFR 1.530(a)-(c) may not be filed. For this reason, no amendment in an <i>ex parte</i> reexamination proceeding ordered under 35 U.S.C. 257 may be filed until after the mailing of a first Office action on the merits. This reexamination proceeding has been assigned to the art unit listed above. All future correspondence should be directed to the assigned art unit and should be identified by the control number listed above, which is identical to the control number assigned to the now-concluded supplemental examination proceeding.			
/MICHAEL FUELLING/ Supervisory Patent Examiner, Art U			

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	3	"8013568".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/04/01 02:44 PM
L2	5	"7208915".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/04/01 07:13 PM
L3	1	"6,683,438".pn.	(USPAT)	OR	ON	ON	2021/04/01 07:13 PM
L4	0	(WO ADJ "200215320").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/04/07 03:12 PM
L5	0	(WO200215320).pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/04/07 03:13 PM
L6	3	("200215320").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/04/07 03:13 PM
L7	0	(WO02/15320).pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/04/07 03:15 PM
L8	0	(02/15320).pn.	(US-PGPUB; USPAT;	OR	ON	ON	2021/04/07

			USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				03:15 PM
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L12	1	"7211986".pn.	(USPAT)	OR	ON	ON	2021/04/08 10:54 AM
L13	1	"6,912,137".pn.	(USPAT)	OR	ON	ON	2021/04/08 01:37 PM
L14	1	"5949213".pn.	(USPAT)	OR	ON	ON	2021/04/08 07:12 PM
L17	749	(contactless OR contact-less) ADJ battery ADJ charg\$3	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/14 05:28 PM
L18	130	((contactless OR contact-less) ADJ battery ADJ charg\$3).ti.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/14 05:28 PM
L19	54	L18 AND @pd<"20060428"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/14 05:32 PM
L20	1	L19 AND antenna	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/06/14 05:32 PM

L21	1	L19 AND ((pulse ADJ width) OR PWM)	JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 09:54 AM
L22	3	KR ADJ "100451606"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/17 03:08 PM
L26	3	"8013568".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
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L30	0	(WO200215320).pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
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L32	0	(WO02/15320).pn.	DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L33	0	(02/15320).pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L34	11	("0215320").pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
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L36	0	"7211986".pn.	(US-PGPUB)	OR	ON	ON	2021/06/21 03:17 PM
L37	1	"7211986".pn.	(USPAT)	OR	ON	ON	2021/06/21 03:17 PM
L38	1	"6,912,137".pn.	(USPAT)	OR	ON	ON	2021/06/21 03:17 PM
L39	1	"5949213".pn.	(USPAT)	OR	ON	ON	2021/06/21 03:17 PM
L40	0	deb.in. AND (expert ADJ system).ti.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L41	48	deb.in. AND (expert ADJ system)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM

L42	749	(contactless OR contact-less) ADJ battery ADJ charg\$3	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L43	130	((contactless OR contact-less) ADJ battery ADJ charg\$3).ti.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L44	54	L18 AND @pd<"20060428"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L45	1	L19 AND antenna	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L46	1	L19 AND ((pulse ADJ width) OR PWM)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L47	3	KR ADJ "100451606"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:17 PM
L48	48	L16	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:33 PM

L49	3	L22	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:38 PM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

CONTACTLESS BATTERY CHARGING SYSTEM USING INDUCTION COUPLING METHOD

PATENT NUMBER	DOCUMENT ID	DATE PUBLISHED	SOURCE
100451606	KR-100451606-B1	2004-10-08	FIT

PATENT FAMILY ID
37330528

INVENTOR INFORMATION

NAME	CITY	STATE	ZIP CODE	COUNTRY
	N/A	N/A	N/A	KR
	N/A	N/A	N/A	KR

DATE FILED
2002-09-30

CPC ISSUED

TYPE	CPC	DATE
CPOI	H04B5/0037	2013-01-01
CPOI	H02J50/40	2016-02-01
CPOI	H02J50/12	2016-02-01
CPOI	H02J7/025	2020-01-01
CPOA	Y02E60/10	2013-01-01

CPC CURRENT

TYPE	CPC	DATE
CPCI	H04B5/0037	2013-01-01
CPCI	H02J50/40	2016-02-01
CPCI	H02J50/12	2016-02-01
CPCI	H02J7/025	2020-01-01
CPCA	Y02E60/10	2013-01-01

Abstract

The present invention relates to a system for charging a battery of a portable device through inductive coupling by generating a high frequency magnetic field, the primary side of the high frequency transformer for inductive coupling is configured by winding the winding using a concentric ferrite core, The secondary side is made by installing a thin flat winding on a thin and flat ferrite sheet with a certain gap between the primary side so that it is easy to install in a device that is small in volume and weight and light like a mobile

phone. Is transmitted in a non-contact manner by electromagnetic inductive coupling without an electrical contact point from the primary side to the secondary side. In addition, the state of charge of the battery uses a method of transmitting wirelessly from the secondary side to the primary side, but also by wrapping the primary and secondary windings of the planar shape and facing each other with a slight gap therebetween to transmit and receive. This was done.

Description

INVENTION-TITLE

BACKGROUND-ART

The present invention relates to a compact and lightweight charging system for non-contact charging of a battery used in a portable device, and more particularly, to generate a high frequency magnetic field from the charging mother to the battery side to induce a thin planar separated space therebetween. The present invention relates to a contactless charging system for charging a storage battery in a portable device without using a contact terminal by using a method of transferring energy through coupling.

In general, portable devices are equipped with a storage battery so that a user can use it while moving. In order to charge such a battery, a charging matrix for supplying energy to a battery of a portable device in connection with a general power source is required. Typically, the charging base and the storage battery are provided with separate contact terminals, respectively, so that the two contact terminals are connected to each other to selectively charge the storage battery as necessary.

However, when the contact terminals are formed in the battery and the charging matrix, the contact terminals protrude from the outside, which is not aesthetically pleasing, and the contact terminals may be contaminated with foreign substances, resulting in a poor contact state. In addition, charging energy may be lost when the battery is short-circuited or exposed to moisture due to carelessness of the user.

Conventionally, in order to solve this problem, a method has been developed in which the battery and the charging matrix can be charged in a non-contact manner without configuring contact terminals, and are used in some application fields (for example, electric toothbrushes and electric shavers). It is becoming. The conventional non-contact charging method also includes a method of providing a storage battery of a portable device by magnetic coupling of a primary circuit of a transformer operating at a high frequency in a charging matrix and a secondary circuit in a portable device by magnetic coupling. In this respect, there is a common point with the present invention.

However, the non-contact charging method is generally used a ferrite core with a weight and volume in the secondary circuit as well as the primary circuit of the transformer, and because of the weight and volume of the ferrite core is not suitable for small devices such as mobile phones. There was a problem.

TECHNICAL-FIELD

In order to solve the above problems, the present invention provides a charging system for charging a storage battery in a portable device using an inductive coupling of a high frequency converted magnetic field with a small gap between the charging mother and the portable device. It is an object of the present invention to provide a non-contact charging system of a compact and lightweight by manufacturing the coupling portion to be installed in a flat type.

In addition, it is an object of the present invention to provide a non-contact type charging device that checks the state of charge and discharge of the battery and controls it in real time.

DISCLOSURE

TECH-SOLUTION

In order to solve the above object, the present invention provides a non-contact charging system for charging a battery mounted in a portable device from a charging matrix by using an inductive coupling method, wherein the charging matrix receives a low frequency AC input voltage and converts the voltage into a DC voltage. Low frequency AC / DC rectifier output; A pre-volt DC / DC converter which generates and outputs a constant DC voltage regardless of the magnitude of the DC voltage; A high frequency parallel resonant inverter configured to receive the constant DC voltage and convert it into high frequency AC power; A ferrite core connected to the high frequency parallel resonant inverter; And a primary winding installed

between the central protrusion and the outer protrusion of the ferrite core and receiving the high frequency alternating current power and transferring the inductive coupling to the portable device. The portable device includes: a thin ferrite sheet; A thin-film secondary winding installed on the ferrite sheet so as to face the primary winding to receive the AC power from the primary winding; And a high frequency AC / DC rectifier for converting the AC power received by the secondary winding into DC power and providing the battery to a storage battery.

The portable apparatus may further include a charge control circuit configured to inspect a state of charge of the battery and generate and output a control signal; And an RF modulation and transmission circuit for receiving the control signal and modulating the RF signal into an RF signal and wirelessly transmitting the RF signal, wherein the charging mother receives and demodulates the RF signal to detect and output the control signal. As your inquiry; And a PWM control circuit configured to receive the control signal and generate a pulse width modulated signal to be applied to the prevolt DC / DC converter to adjust the DC voltage.

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings.

FIG. 1A simultaneously shows a cross-sectional view 102 and a plan view 101, 103 of a core portion for transferring energy in a non-contact manner via magnetic lines of force, which is the principle of a transformer in a charging system according to the invention.

The charging system proposed in the present invention can be thought of as being divided into the charging matrix 1 side and the portable device 2 side as shown in the sectional view 102. The charging matrix 1 is provided with a primary winding of a split type transformer for transmitting energy, and includes a main winding 4 for forming a magnetic field and an auxiliary winding 10 for inducing AC power from a magnetic field formed by the main winding. . In addition, a fourth winding 6 for receiving an RF (high frequency) signal is provided at a predetermined interval from the first winding 4. On the other hand, the portable device 2 is provided with a secondary winding 5 of a transformer for energy transfer and a tertiary winding 7 for transmitting an RF signal at regular intervals.

The plan view 101 shows the shape of each transformer winding 5, 7 installed in the portable device 2, and the cross-sectional view 102 shows the transformer with the portable device 2 placed on the charging matrix 1. The cutaway is shown in the center, and the plan view 103 shows the respective transformer windings 4 and 6 installed in the charging matrix 1.

The primary side of the transformer for energy delivery is implemented with a cylindrical ferrite core 3 consisting of a central projection 3-1 and an outer projection 3-2 on the charging matrix. Control between the main winding 4 on the primary side of the transformer and the power circuit for transferring energy to the secondary side of the transformer is provided between the central protrusion 3-1 and the outer protrusion 3-2 of the ferrite core 3. The auxiliary winding 10 as a means for winding is wound up.

The corresponding transformer secondary winding 5 for energy transfer is configured on the ferrite sheet 8 under the portable device. The secondary windings 5 are formed at a slight interval perpendicular to the position opposite to the primary winding 4 for energy transmission transformer of the charging matrix 1. The smaller the vertical gap is, the better, but the ferrite sheet 8 is mounted inside the portable device 2, so that the space is about 1 mm due to the space inevitably generated by the thickness of the outer wall of the case of the portable device.

The position on which the secondary winding 5 of the energy-receiving transformer is wound on the ferrite sheet 8 is located at a position corresponding between the central protrusion 3-1 and the outer protrusion 3-2 of the cylindrical ferrite core 3. Is installed. For this reason, it is preferable to use a thin film winding as the secondary winding 5.

The tertiary winding 7 for transmitting the RF signal is separately installed at a horizontal distance from the secondary winding 5 of the energy receiving transformer on the ferrite sheet 8 of the portable device 2. Alternatively, it should be possible to minimize the magnetic coupling with the secondary winding as much as possible. On the other hand, the fourth winding (6) for receiving the RF signal should be installed on the charging matrix (1) side so that it can be magnetically coupled with the third winding (7), the ordinary PCB board (9). These two windings (6, 7) are installed for the purpose of transmitting and receiving the information about the state of charge of the battery to the RF signal, and because it is not intended for the transmission of power, using a small winding using a small winding. Or it can be implemented as a polygon.

FIG. 1B is a view for implementing the secondary winding 5 as a thin film-type winding, using both sides on a thin flexible substrate. In particular, it is helpful to obtain one desirable characteristic if formed at regular intervals between the winding and the winding of the secondary winding (5) as shown. In a practical situation, when a user places a portable device 2 on the charging matrix 1 to charge a battery in the portable device 2, the portable device on the position of the primary winding 4 of the charging matrix 1. It is not easy to put the secondary windings (5) in (2) exactly in position. If the two windings are out of position, the efficiency of energy transfer from the primary side to the secondary side becomes worse. In the present invention, in consideration of such a case in advance by forming a predetermined interval between the winding and the winding of the secondary winding (5), even if there is a significant position error when the user puts the portable device on the charging matrix. And to minimize the impact on charging.

1C shows the primary winding 5 of the portable device 2 with the distance (horizontal axis: d_2) from the primary winding 4 of the charging matrix 1 shifted from 0 mm to 6 mm, respectively. 4) is a graph showing the terminal voltage V_o appearing at both ends of the secondary winding 5 when a high frequency AC voltage of a certain magnitude is applied. In addition, a, b, c, and d show the cases where the spacing between the windings of the secondary windings 5 and the windings is changed to several values, respectively. As shown, the smallest change with respect to the change of d_2 is in the case of c, which means that it is most preferable to set the distance between the winding of the secondary winding 5 and the winding to about 4 mm.

2 is a block diagram of a structure and a control circuit of a non-contact charging system according to the present invention. Hereinafter, the configuration and function of each block will be described in detail.

The low frequency AC / DC rectifier 11 receives a low frequency AC input voltage, such as 110V or 220V, and converts it into direct current. The converted DC voltage V_{dc} varies according to a change in the input voltage.

The Free Volt DC / DC converter 12 outputs a constant DC voltage V_s despite the change in the DC voltage V_{dc} obtained from the low frequency AC / DC rectifier 11.

The high frequency parallel resonant inverter 13 receives the DC voltage V_s input from the prevolt DC / DC converter 12 and converts the DC voltage into high frequency AC power.

The converted high frequency AC output belongs to the charging matrix 1, and in order to transfer this energy to the spatially separated portable device 2, the distance existing between the two devices must be overcome. This is possible through magnetic coupling, and for this purpose, the primary winding 4 wound around the primary core 3 is installed on the charging matrix 1 side to form a magnetic field by the high frequency alternating current power. The secondary winding 5 of the portable device 2 for receiving the AC power from the primary winding 4 at the position is provided above the ferrite sheet 8.

The high frequency AC / DC rectifier 15 serves to convert high frequency AC power received through the secondary winding 5 into DC power and provide the same to the storage battery 16 in the portable device 2.

The charging control circuit 17 detects information indicating the state of charge of the battery 16 and controls the current flowing through the high frequency AC / DC rectifier 15 and the voltage across the battery 16 for the purpose of controlling the charging mode. It detects and decides whether to control in either current mode or voltage mode to make and output a control signal.

The RF modulation and transmission circuit 18 is for wireless transmission of the state of charge received from the charge control circuit 17. The RF modulation and transmission circuit 18 modulates the input data into a radio signal and applies the modulated signal to the tertiary winding 7. . The tertiary winding 7 is for forming a high frequency magnetic field at a predetermined position on the ferrite sheet 8.

The RF reception and demodulation circuit 20 is separated from the tertiary winding 7 and receives a signal through the quaternary winding 6 for receiving an RF signal from the high frequency magnetic field formed by the tertiary winding. Demodulate

A pulse width modulation (PWM) control circuit 21 receives a demodulated signal from the RF reception and demodulation circuit 20 and receives a pulse width modulated signal to control the prevolt DC / DC converter 12. Make.

Finally, the compensation circuit 14 removes the ripple component by directly returning only the ripple component from the output voltage V_s of the prevolt DC / DC converter 12 to the PWM control circuit 21. For example, when the low-frequency AC input power frequency is 60 Hz in the output waveform of the low-frequency AC / DC rectifier 11, a ripple component corresponding to 120 Hz is mainly generated, and the compensation circuit 14 charges the battery 16. In order to prevent the phenomenon affecting the current, it is removed beforehand.

3 illustrates a circuit of a low frequency AC / DC rectifier 11. This is a conventionally used circuit, the AC input power is rectified through the four diodes (D1-D4) is converted into a direct current power supply (V_{dc}) across the capacitor (C1).

4 illustrates a specific circuit of a prevolt DC / DC converter 12 implemented using a power MOSFET (Metal-Oxide-Semiconductor Field-Effect-Transistor: M1). Such a circuit is also commonly used as a flyback converter. In the flyback converter, when the MOSFET M1 conducts, V_{dc} is applied to the primary N11 side of the transformer 22 so that current is increased, and energy is stored in the excitation inductance of the transformer 22. When the MOSFET M1 is turned off, current flows through the diode D6 on the secondary N12 side and the voltage of the capacitor C2 rises. In this way, the energy stored in the excitation inductance in the primary circuit is released to the secondary circuit to generate a DC voltage (V_s) across C2. The magnitude of the DC voltage V_s can be controlled by adjusting the conduction time of the MOSFET M1 by the PWM control circuit 21.

5 shows a specific structure of the high frequency parallel resonance inverter 13. The role of this circuit is to receive the DC output voltage (V_s) of the prevolt DC / DC converter 12 and convert it into high frequency AC power. The parallel resonant inverter has two MOS transistors M2 and M3, and the L-C resonant circuit composed of the magnetizing inductance of the primary side 4 of the separate transformer and the capacitor C3 is connected to the two transistors. The center point of the primary winding 4 of the separate transformer is connected to the inductor L1, and the other terminal of the inductor L1 is connected to the output voltage V_s of the prevolt DC / DC converter 12.

The operation of the parallel resonant inverter 13 is as follows. The two transistors M1 and M2 are alternately turned on and off, and when the inductor L1 connected to the power supply side is large enough, a current close to the square wave flows to the primary winding 4 of the transformer. The L-C resonant circuit ensures that only the voltage of the fundamental wave component included in such square wave current appears well across the transformer. Therefore, the voltage waveform appearing on both ends of the

primary winding 4 becomes a sine wave, and switching losses of the two transistors M1 and M2 coincide with the resonance period can minimize the switching loss and greatly increase the switching frequency. Considering the operating frequency of the existing power MOS switch, it can be said that this operating frequency ranges from about several hundred kHz to several MHz.

If the parallel resonant inverter 13 is composed of a bipolar transistor, it can be operated by the auxiliary winding 10 of the separate transformer. However, in the case of using the MOS transistor as in the present invention, self-operation does not work well. The reason for this is, firstly, in such a parallel resonant inverter, a very high voltage appears at both ends of the primary winding 4, but the MOS transistor is weak in high voltage as compared to the bipolar transistor. Second, since the MOS transistor has a high threshold voltage between the gate sources, it is difficult to easily drive only the voltage waveform appearing across the auxiliary winding 10. For this reason, it can be said that the bipolar transistor has been mainly used in the parallel resonant inverter.

One of the characteristics of the present invention is implemented to be operable using a MOS transistor in a parallel resonant inverter, the reason for doing so is as follows. First, since the power to be implemented in the present invention is only a few W, the MOS transistor is suitable because the power to be delivered is not large. Secondly, by adopting the method in front of the pre-volt DC / DC converter 12, it is possible not only to obtain a constant DC output voltage V_s despite the change of the AC input power, but also to control the DC voltage V_s low. This is because control is possible to operate in the breakdown voltage range of the MOS transistors M1 and M2. Finally, and most importantly, MOS transistors have a faster switching speed than bipolar transistors, allowing them to operate at higher frequencies. In other words, MOS transistors are advantageous for operating at several MHz, because higher frequencies of high-frequency magnetic fields are more effective for delivering energy at high density with low weight and volume for portable devices that are spatially separated.

However, in order for the circuit using the MOS transistor to operate autonomously, additional gate amplifiers A1 and A2 associated with the auxiliary winding 10 are additionally required. There are two main roles of gate amplifiers here. One is that since the voltage waveform generated in the primary winding 4 is a sinusoidal waveform, the signal appearing in the auxiliary winding 10 is also in the form of a sinusoidal waveform. The circuit does not operate well because the threshold voltage, which is the threshold voltage of the gate, is determined. Thus, the role of the gate amplifier in this circuit is to reliably switch the MOS transistor on and off by changing the sinusoidal wave to a square wave at high speed. Second, in normal operation, the maximum voltage applied to the gate of the MOS transistor is applied to an appropriate value to ensure safe operation below the maximum rating that the gate can withstand.

FIG. 6 illustrates the structure of the gate amplifiers A1 and A2 that may be used in the parallel resonant inverter of FIG. 5, and may be implemented using a conventional high speed analog comparator chip. One example is a form constructed using a transistor. Transistor Q1 is responsible for amplification, and Q2 and Q3 are output transistors for current amplification. Two resistors R2 and R3 are connected in series between the auxiliary winding 10 of the separate transformer and the base of the transistor Q1, the middle of which is a diode D7 connected between the ground and one across the resistor R2. Capacitors C4 are connected in parallel. In addition, the center point of the auxiliary winding 10 is connected to the power supply V_{cc} of the control circuit through the resistor R1. Therefore, initially, the oscillation starts as charging of the parallel resonant circuit starts due to a current flowing from V_{cc} through the path formed by the bases of the resistors R1, R2, R3 and Q1. In the steady state switching operation, the high-speed operation is possible since the turn-on or turn-off of Q1 is possible at a high speed by the role of C4.

7A to 7C illustrate three structures of the high frequency AC / DC rectifier 15 installed in connection with the secondary winding 5 of the portable device side split type transformer. These circuits are also characteristic circuits of the present invention. FIG. 7A is a structure in which full-wave rectification is performed using two diodes D8 and D9 using the center point of the secondary winding 5 of the split-type transformer. Secondary winding (5) having no center point is used, but the structure is full-wave rectified using four diodes (D81,

D82, D91, D92). On the other hand, Figure 7c is a slightly different form from the previous two structures by using the two diodes (D81, D91) and two capacitors (C61, C62) to obtain the output voltage waveform in the form of full-wave rectification while doubling at the same time It is a structure back rectified.

The structure of the full-wave rectification or back-pressure rectification circuit as described above is well known in the art, but the present invention is characterized by using a form consisting of passive elements. That is, there is a feature of the present invention in the configuration of a filter section formed of C6 (or C61, C62) and L2 as a filter connected after being converted into direct current, including R5 and C5 connected between both ends of the secondary winding 5. This configuration appears when operating in conjunction with the high frequency parallel resonance type inverter unit 13. In general, the structure of the filter is that the inductor is connected immediately after the diode rectifier, and then the capacitor is connected, but the reason why the order is reversed in the present invention is in this way in connection with the high frequency parallel resonance inverter unit 13. In operation, the voltage across C6 (or C61, C62) is much lower than in the conventional structure, and the capacitance is also smaller, which is effective in reducing the ripple of the current flowing in the inductor L2. to be. Lowering the voltage across the capacitors C6 (or C61, C62) also has the effect of lowering the voltage between the primary windings 4 on the side of the high frequency parallel resonance inverter 13, which is also the MOS switch (M2, M3). This will reduce the maximum voltage stress at both ends.

In addition, R5 and C5 connected to both ends of the secondary winding 5 in FIGS. 7A to 7C are blocked by reverse recovery current flowing when the rectifying diodes are turned from on to off. It acts as a snubber to reduce the voltage and at the same time reduce the turn-off losses of the diodes. Finally, the role of the capacitors C61 and C62 in the back pressure rectifier circuit is different in that it doubles the DC voltage of the output, but the remaining role is the same as that of C6. If the back pressure rectification circuit is adopted, there is an advantage that the number of secondary windings 5 can be minimized.

The last issue to be mentioned in FIGS. 7A to 7C is for the structure of the inductor L2. That is, since the inductance of the inductor L2 must act as a filter, a large value of inductance is required. However, since the charging current must flow through the inductor L2, the inductor L2 must not be saturated even when a large charging current flows. In implementing the charging circuit, if the inductor L2 that satisfies these conditions is to be implemented by using a separate element, it becomes a big obstacle in pursuing light and small size of the portable device due to the size problem. Therefore, in the present invention, as illustrated in FIG. 1B, the inductor L2 is solved by a planar shape in which the inductor L2 is separated from the secondary winding 5 of the split type transformer at a predetermined distance by a flat shape. By implementing in this manner, the inductor L2 is not saturated even when a large DC current for charging flows, so that it is possible to maintain a considerable inductance and perform a good role as a filter.

FIG. 8 illustrates the charging control circuit 17 in detail, and may be regarded as an implementation of a concept generally used in a circuit for charging an existing battery.

That is, if the voltage V_{bb} of the battery is lower than the reference voltage V_r , the output of the voltage comparator 31 is in a 'high' state, and thus the output signal V_f of the gate 33 is the current comparator 32. Follow the output of). In this case, it is charged in the form of a constant current source by the role of the current comparator 32, the charging current (I_{bb}) is constantly controlled to the value of the reference current source (I_r).

On the other hand, when the voltage V_{bb} of the battery increases and tries to be higher than the reference voltage V_r , the charging mode is changed in the form of a constant voltage source while the role of the voltage comparator 31 appears. In this case, since the magnitude of the charging current I_{bb} becomes smaller than the value of the reference current source I_r and the output of the current comparator 32 remains in a high state, the output signal V_f of the gate 33 in this case is maintained. Is followed by the output of the voltage comparator 31 as it is.

9 illustrates an RF modulation and transmission circuit 18, in which a gate for modulating the high frequency signal of the RF generator 36 and sending it to the buffer 35 in accordance with the output signal Vf of the charge control circuit 17 is shown. 34 are connected. The output of the buffer 35 is applied to the tertiary winding 7 provided on the ferrite sheet 8 of the portable device 2.

FIG. 10 illustrates an RF reception and demodulation circuit unit 20, which receives and demodulates an RF signal through a fourth winding 6 installed on a PCB substrate 9 of a charging matrix 1, and outputs a final output signal. The signal Vp is such that the control signal Vf sent from the charging control circuit 17 is restored. The circuit for signal processing includes a high pass filter (HPF), a peak detector (PD), and a comparator 36. Each operation is as follows. First, the reason why the high pass filter (HPF) is required is that the RF signal received through the 4th winding (6) contains low frequency band noise, especially the high frequency parallel resonance type inverter (13) to receive a large switching frequency. Therefore, it is necessary to remove this component. That is, even if the inverter 13 operates at a high frequency, it corresponds to a low frequency compared to the RF signal, and thus a high pass filter is required to separate and receive the RF signal. After this, the peak detector PD and the comparator 36 are used to restore the control signal Vf of the charge control circuit 17 at the output Vp.

11A and 11B illustrate a block diagram and a circuit diagram of a pulse width modulation (PWM) control circuit 21, respectively, and receive a demodulated signal Vp from the RF reception and demodulation circuit 20 to receive a pre-volt DC / DC. Produce a pulse width modulated (PWM) signal for controlling the converter 12. This circuit consists of an integrator 41, a triangle wave generator 42, and a comparator 43. The integrator 41 receives and demodulates the demodulated signal Vp, and the output of the integrator 41 is compared with the output of the triangular wave generator 42 in the comparator 43 to generate a PWM signal. The PWM signal generated in this way is applied to the MOSFET (M1) gate of the pre-volt DC / DC converter 12 to control the DC output voltage (Vs).

ADVANTAGEOUS-EFFECTS

In the non-contact charging system according to the present invention, the secondary side of the split-type transformer forming an inductive coupling for the compact and light weight of the charging device is easy to be mounted on the battery of the portable device, and the state of charge of the battery is wirelessly charged. It can be transferred to the parent and controlled. Therefore, the charging system according to the present invention can be said to have a great effect of providing a variety of designs for convenience, safety and aesthetics for portable devices such as mobile phones, MP3 players, etc. to be further miniaturized and lightweight.

Claims

In a non-contact charging system for charging a battery mounted in a portable device from a charging mother using an inductive coupling method,

The charging matrix may include a low frequency AC / DC rectifier that receives a low frequency AC voltage and converts the DC voltage into a DC voltage;

A pre-volt DC / DC converter which generates and outputs a constant DC voltage regardless of the magnitude of the DC voltage;

A high frequency parallel resonant inverter for receiving the constant DC voltage and converting the same into high frequency AC power;

A ferrite core connected to the high frequency parallel resonant inverter; And

And a primary winding installed between the center protrusion and the outer protrusion of the ferrite core and receiving the high frequency AC power and transferring the inductive coupling to the portable device.

The portable device includes a thin ferrite sheet;

A thin-film secondary winding installed on the ferrite sheet so as to face the primary winding to receive the AC power from the primary winding; And

And a high frequency AC / DC rectifier for converting the AC power received by the secondary winding into

DC power and providing the battery to a storage battery.

The method of claim 1,

The portable device may include a charge control circuit configured to inspect a state of charge of the battery and generate and output a control signal; And

And an RF modulation and transmission circuit for receiving the control signal and modulating it into an RF signal for wireless transmission.

The charging matrix may include: an RF reception and demodulation circuit configured to receive and demodulate the RF signal to detect and output the control signal; And

And a PWM control circuit configured to receive the control signal and generate a pulse width modulated signal to be applied to the pre-volt DC / DC converter to adjust the DC voltage.

The method of claim 2,

The portable device may further include a tertiary winding installed on the ferrite sheet at a predetermined distance from the secondary winding and connected to the RF modulation and transmission circuit to form a high frequency magnetic field by the RF signal.

The charging matrix, the fourth winding is installed in a position opposite to the third winding and connected to the RF receiving and demodulation circuit to wirelessly receive the high frequency magnetic field and to transmit to the RF receiving and demodulation circuit; Non-contact charging system characterized in that it comprises.

The method of claim 2,

The charging matrix further comprises a compensation circuit for detecting the ripple component from the output voltage of the pre-volt DC / DC converter and fed back to the PWM control circuit.

The method of claim 2,

The RF receiving and demodulation circuit includes a high-pass filter for removing a driving frequency component of the high frequency parallel resonance inverter input together with the RF signal before demodulating a control signal from the RF signal. system.

The method according to claim 1 or 2,

The high frequency parallel resonant inverter includes an inductor (L1); Capacitor C3; Two MOS transistors M2 and M3; And two gate amplifiers A1 and A2;

DC power supply (Vs) is connected to the middle terminal of the three terminals of the primary winding through the inductor, and the capacitor and the drain of the two MOS transistors to form a resonance at both ends of the primary winding Connected,

The sources of both MOS transistors are grounded,

And the two gate amplifiers are respectively connected to gates of the two MOS transistors to amplify and apply signals received from the primary winding and the auxiliary winding of the primary winding.

The method of claim 6,

And the gate amplifier converts a sinusoidal voltage waveform generated from the auxiliary winding into a square wave shape.

The method of claim 1,

The secondary winding has a center point, and the high frequency AC / DC rectifier uses the center point to perform full-wave rectification using two diodes (D8 and D9).

The method of claim 1,

The secondary winding has no center point, and the high frequency AC / DC rectifier is full-wave rectified using four diodes (D81, D82, D91, D92).

The method according to claim 8 or 9,

The high frequency AC / DC rectifier further comprises a filter comprising a capacitor (C6) connected behind the rectifier of the diode and an inductor (L2) connected behind the capacitor.

The method of claim 10,

The inductor (L2) is a non-contact charging system, characterized in that the planar structure of the shape separated by a certain distance on the same plane as the secondary winding.

The method according to claim 8 or 9,

The high frequency AC / DC rectifier further comprises a resistor (R5) and a capacitor (C5) connected in series.

The method of claim 1,

The high frequency AC / DC rectifier is provided with two diodes (D81, D91) and two capacitors (C61, C62), to obtain a form of full-wave rectification of the output voltage waveform, and at the same time to increase the voltage back to double rectification, characterized in that Contactless charging system.

The method of claim 13,

And the high frequency AC / DC rectifier further comprises a filter comprising two capacitors (C61, C62) connected behind the rectifier of the diode and an inductor (L2) connected behind the capacitor.

The method of claim 14,

The inductor (L2) is a non-contact charging system, characterized in that the planar structure of the shape separated by a certain distance on the same plane as the secondary winding.

The method of claim 15,

The high frequency AC / DC rectifier further comprises a resistor (R5) and a capacitor (C5) connected in series.

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(73) 특허권자 한국과학기술원
대전 유성구 구성동 373- 1

(72) 발명자 조규형
대전광역시 서구 둔산1동 크로바아파트 117동 201호

이민철
대구광역시수성구황금동신천지타운203- 1102

(74) 대리인 이원희

심사관 : 이창용

(54) 유도 결합에 의한 비접촉식 충전 시스템

요약

본 발명은 고주파 자계를 발생시켜 유도 결합을 통하여 휴대형 장치의 축전지를 충전하기 위한 시스템에 관한 것으로, 유도 결합을 위한 고주파 변압기의 1차 측은 동심원 형태의 페라이트 코어를 사용하여 권선을 감아서 구성하고, 2차 측은 1차측과는 일정한 간극을 사이에 두고 얇고 편평한 페라이트 시트 상에 역시 얇은 평면형으로 권선을 설치해서 구성하여 휴대폰과 같이 부피와 무게가 작고 가벼운 장치에 설치가 용이하도록 하였으며, 충전을 위한 에너지는 1차 측으로부터 2차측으로 전기적 접촉점이 없이 전자 유도결합에 의해 비접촉 방식에 의하여 전달된다. 또한, 축전지의 충전상태는 2차 측으로부터 1차 측으로 무선으로 전달하는 방식을 사용하되 역시 평면형의 1차 및 2차권선을 각각 감아서 서로 약간의 간극을 사이에 두고 대향시켜 배치함으로써 송신과 수신이 이루어지도록 하였다.

대표도

도 2

색인어

충전기, 유도 결합, 비접촉식, 고주파 병렬공진형 인버터, 무선통신

명세서

도면의 간단한 설명

도 1a는 본 발명에 따른 비접촉식 충전 시스템의 충전 모체 위에 휴대형 장치를 올려놓은 상태에서 변압기를 중심으로 하여 도시한 단면도(102) 및 각각의 평면도(101, 103),

도 1b는 휴대형 장치내의 분리형 변압기 2차권선을 얇은 박막형태의 권선으로 구현하기 위한 방안으로 얇은 플렉시블(flexible) 기판 상에 양면을 이용하여 구현한 모습을 예시한 도면,
 도 1c는 휴대형 장치내의 2차권선을 충전 모체의 1차권선으로부터의 거리(d2)가 어긋나게 하면서, 1차권선에 일정 크기의 고주파 교류전압을 인가할 때 2차권선 양단에 나타나는 단자전압을 도시한 그래프,
 도 2는 본 발명에 따른 비접촉식 충전 시스템의 구성 및 제어방식을 보여주는 블록도,
 도 3은 저주파 AC/DC 정류기의 회로를 예시한 도면,
 도 4는 파워 MOSFET 을 사용하여 구성한 프리볼트 DC/DC 컨버터의 회로를 예시한 도면,
 도 5는 고주파 병렬공진형 인버터의 회로를 도시한 도면,
 도 6은 도 5의 게이트증폭기의 구조를 예시한 도면,
 도 7a 내지 도 7c는 휴대형 장치 내의 분리형 변압기 2차권선에 연결하여 설치한 고주파 AC/DC 정류기의 세가지 다른 구조를 예시한 도면,
 도 8은 전류모드와 전압모드 중에서 하나를 선택하여 충전하도록 하기 위한 제어회로를 도시한 도면,
 도 9는 본 발명에 따른 RF 변조 및 송신회로를 예시한 도면,
 도 10은 본 발명의 RF 수신 및 복조회로를 예시한 도면,
 도 11a 및 도 11b는 각각 PWM 제어회로의 구성 및 회로를 예시한 도면.

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 휴대형 장치에 사용되는 축전지를 비접촉식으로 충전하기 위한 소형경량화된 충전 시스템에 관한 것으로, 더욱 상세하게는 충전 모체로부터 축전지측에 고주파 자계를 발생시켜 얇은 평면형의 분리된 공간을 사이에 두고 유도 결합을 통하여 에너지를 전달하는 방식을 사용함으로써 휴대형 장치내의 축전지에 접촉단자를 통하지 않고 충전하기 위한 비접촉식 충전 시스템에 관한 것이다.

일반적인 휴대형 장치에는 축전지가 장착되어 있어서 사용자가 이동하면서 사용할 수 있도록 되어 있다. 이러한 축전지를 충전하기 위해서는 일반 전원과 연결하여 휴대형 장치의 축전지에 에너지를 공급하기 위한 충전 모체가 필요하다. 통상적으로 충전 모체와 축전지에는 외부에 각각 별도의 접촉 단자가 구성되어 있어서, 두 접촉 단자를 서로 접촉 시킴으로써 필요에 따라 선택적으로 축전지를 충전할 수 있도록 되어 있다.

그러나, 축전지와 충전 모체에 접촉 단자를 구성하면 접촉 단자가 외부에 돌출됨에 따라 미관상 좋지 않고, 접촉 단자가 외부의 이물질에 오염되어 접촉 상태가 불량해질 수 있는 단점이 있다. 또한, 사용자의 부주의로 인해 축전지에 단락이 발생하거나 습기에 노출되면 충전 에너지가 소실될 수 있다.

종래에도 이러한 문제를 해결하기 위하여, 축전지와 충전 모체에 각각 접촉 단자를 구성하지 않고 비접촉식으로 충전할 수 있는 방식이 개발되어 있으며, 일부 응용 분야 (예를 들어, 전동 칫솔, 전기 면도기 등)에서 이용되고 있다. 이러한 종래의 비접촉식 충전 방법도 역시 고주파로 동작하는 변압기의 1차 회로를 충전 모체에 구성하고, 2차 회로를 휴대형 장치 내에 구성함으로써 충전 모체로부터 에너지를 자기 결합에 의하여 휴대형 장치의 축전지에 제공하는 방식이라는 점에서는 본 발명과 공통되는 점이 있다.

그러나 상기의 비접촉식 충전 방식은 통상적으로 변압기의 1차 회로뿐만 아니라 2차 회로에도 무게와 부피가 있는 페라이트 코어가 이용되며, 페라이트 코어의 무게와 부피 때문에 휴대폰과 같이 초소형 기기에 적용하기에는 적합하지 못하다는 문제가 있었다.

발명이 이루고자 하는 기술적 과제

본 발명은 상기 문제점의 해결을 위해, 충전 모체와 휴대형 장치 사이에 약간의 간극을 두고 고주파로 변환시킨 자기장의 유도 결합을 이용하여 휴대형 장치 내의 축전지를 충전하기 위한 충전 시스템에 있어서, 휴대형 장치 측에 설치되는 결합부를 평면형으로 제작하여 소형경량화한 비접촉식 충전 시스템을 제공함을 목적으로 한다.

또한, 축전지의 충전 상태를 체크하여 실시간으로 제어하는 비접촉식 방식의 충전 장치를 제공함을 목적으로 한다.

발명의 구성 및 작용

본 발명은 상기 목적의 해결을 위해, 유도 결합 방식을 사용하여 충전 모체로부터 휴대형 장치에 장착된 축전지를 충전하는 비접촉식 충전 시스템에 있어서, 상기 충전 모체는, 저주파 교류입력 전압을 받아 직류전압으로 변환하여 출력하는 저주파 AC/DC 정류기; 상기 직류전압의 크기에 관계없이 일정한 직류전압을 만들어 출력하는 프리볼트 DC/DC 컨버터; 상기 일정한 직류전압을 받아 고주파 교류 전력으로 변환하여 출력하는 고주파 병렬공진형 인버터; 상기 고주파 병렬공진형 인버터에 연결되는 페라이트 코어; 및 상기 페라이트 코어의 중앙돌출부와 외곽돌출부 사이에 설

치되고, 상기 고주파 교류 전력을 받아 유도결합에 의해 상기 휴대형 장치 측으로 전달하는 1차권선;을 구비하고, 상기 휴대형 장치는, 얇은 페라이트 시트; 상기 1차권선으로부터 상기 교류 전력을 수수하기 위하여 상기 1차권선에 대향하도록 상기 페라이트 시트 상에 설치되는 얇은 박막형의 2차권선; 및 상기 2차권선이 수수한 교류 전력을 직류 전력으로 변환하여 축전지에 제공하는 고주파 AC/DC 정류기;를 구비하는 것을 특징으로 하는 비접촉식 충전 시스템을 제공한다.

또한, 상기 휴대형 장치는, 상기 축전지의 충전상태를 검사하여 제어신호를 생성하고 출력하는 충전제어회로; 및 상기 제어신호를 받아 RF 신호로 변조하여 무선 송출하는 RF 변조 및 송신회로;를 더 구비하고, 상기 충전 모체는, 상기 RF 신호를 수신하고 복조하여 상기 제어신호를 검출하여 출력하는 RF 수신 및 복조회로; 및 상기 제어신호를 받아 펄스폭 변조 신호를 만들어 상기 프리볼트 DC/DC 컨버터에 인가함으로써 직류전압을 조정하도록 하는 PWM 제어회로;를 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템을 제공한다.

이하에서 첨부된 도면을 참조하여 본 발명의 실시예들을 설명한다.

도 1a는 본 발명에 따른 충전 시스템에 있어서 변압기의 원리인 자력선을 매개로 하여 비접촉 방법으로 에너지를 전달하기 위한 코어 부분에 대한 단면도(102)와 평면도(101, 103)를 동시에 도시하고 있다.

본 발명에서 제안하는 충전 시스템은 단면도(102)에 도시된 바와 같이 충전 모체(1) 측과 휴대형 장치(2) 측으로 나누어서 생각할 수 있다. 충전 모체(1)에는 에너지 송출을 위한 분리형 변압기의 1차권선이 설치되는데, 자계를 형성하는 주권선(4)과 주권선에 의해 형성된 자계로부터 교류 전력을 유도하는 보조권선(10)으로 구성된다. 또한, RF(고주파)신호 수신을 위한 4차권선(6)이 1차권선(4)과 일정한 간격을 두고 설치된다. 한편, 휴대형 장치(2)에는 에너지 수수를 위한 변압기의 2차권선(5)이 설치되며 RF 신호 송출을 위한 3차권선(7)이 일정한 간격을 두고 설치된다.

평면도(101)는 휴대형 장치(2)에 설치된 각각의 변압기 권선(5, 7)의 형태를 도시한 것이고, 단면도(102)는 충전 모체(1) 위에 휴대형 장치(2)를 올려놓은 상태에서 변압기를 중심으로 하여 절단한 모습을 도시한 것이며, 평면도(103)는 충전 모체(1)에 설치된 각각의 변압기 권선(4, 6)을 도시한 것이다.

에너지 송출을 위한 변압기의 1차 측은 충전 모체에 중앙 돌출부(3-1)와 외곽 돌출부(3-2)로 구성되는 원통형의 페라이트 코어(3)로 구현된다. 페라이트 코어(3)의 중앙 돌출부(3-1)와 외곽 돌출부(3-2) 사이에는 변압기의 2차 측으로 에너지를 전달하기 위한 변압기의 1차 측의 주권선(4)과 전력회로의 제어를 위한 수단으로서의 보조권선(10)이 권취된다.

이에 대응하는 에너지 수수를 위한 변압기 2차권선(5)은 휴대형 장치 하부의 페라이트 시트(8) 상에 구성된다. 2차권선(5)은 충전 모체(1)의 에너지 송출용 변압기 1차권선(4)과 대향하는 위치에 수직으로 약간의 간격을 두고 형성된다. 이 수직 간격은 작을수록 바람직하지만, 페라이트 시트(8)가 휴대형 장치(2) 내부에 장착되게 됨으로써 휴대형 장치의 케이스 외벽 두께에 의하여 불가피하게 발생하는 공간 때문에 약 1mm 내외의 간격을 두게 된다.

페라이트 시트(8) 위에서 에너지 수수용 변압기의 2차권선(5)이 권취되는 위치는 원통형 페라이트 코어(3)의 중앙 돌출부(3-1)와 외곽 돌출부(3-2) 사이에 대응하는 위치에 설치된다. 때문에, 2차권선(5)으로는 얇은 박막형태의 권선을 이용하는 것이 바람직하다.

RF 신호의 송신을 위한 3차권선(7)은 휴대형 장치(2)의 페라이트 시트(8) 상에 에너지 수수용 변압기의 2차권선(5)과 수평으로 일정한 거리를 두고 별도로 설치되며, 1차 또는 2차권선과는 가급적 자기적인 결합을 최소화할 수 있도록 하여야 한다. 한편, RF 신호의 수신을 위한 4차권선(6)은 충전 모체(1) 측에 설치되되 3차권선(7)과는 자기적으로 잘 결합될 수 있도록 하여야 하며, 보통의 PCB기판(9) 상에 설치가 가능하다. 이 두 권선(6, 7)은 배터리의 충전 상태에 관한 정보를 RF 신호로 변조시켜 송수신하기 위한 목적으로 설치되는 것이며, 전력의 전달을 목적으로 하지 않기 때문에 가느다란 권선을 사용하여 작은 크기의 원형 또는 다각형으로 구현할 수 있다.

도 1b는 2차권선(5)을 얇은 박막형태의 권선으로 구현하기 위한 방안으로 얇은 플렉시블(flexible) 기판 상에 양면을 이용하여 구현한 모습을 예시한 것이다. 특히, 도시된 바와 같이 2차권선(5)의 권선과 권선사이에 일정한 간격을 두고 형성시킨다면 하나의 바람직한 특성을 얻는데 도움이 된다. 실제 상황에서 사용자가 휴대형 장치(2)내의 축전지를 충전하기 위하여 충전 모체(1) 위에 휴대형 장치(2)를 올려놓는다고 할 때, 충전 모체(1)의 1차권선(4) 위치 위에 휴대형 장치(2)의 2차권선(5) 위치를 정확하게 일치시켜서 올려놓는 일이 쉽지 않다. 이 두 권선 간의 위치가 어긋나게 되면 1차 측에서 2차 측으로의 에너지 전달 효율이 나빠지게 된다. 본 발명에서는 이와 같은 경우를 미리 고려하여 2차권선(5)의 권선과 권선 사이에 일정한 간격을 두고 형성시킴으로써, 사용자가 휴대형 장치를 충전 모체 위에 올려놓을 때 상당한 위치의 오차가 존재하는 경우에도 불구하고 충전에 미치는 영향을 최소화하도록 하였다.

도 1c는 휴대형 장치(2)의 2차권선(5)을 충전 모체(1)의 1차권선(4)으로부터의 거리(가로축:d2)가 각각 0mm에서 6mm 까지 어긋나게 위치시키면서, 1차권선(4)에 일정 크기의 고주파 교류전압을 인가할 때 2차권선(5) 양단에 나타나는 단자전압(Vo)을 도시한 그래프이다. 또한, a, b, c, d는 각각 2차권선(5)의 권선과 권선사이에 간격을 몇가지 값으로 변화시킨 경우를 도시한 것이다. 도시된 바와 같이 d2의 변화에 대하여 가장 변화가 적은 것은 c의 경우이며, 이는 2차권선(5)의 권선과 권선사이에 간격을 4mm 정도로 하는 것이 가장 바람직함을 의미한다.

도 2는 본 발명에 따른 비접촉식 충전 시스템의 구조 및 제어회로를 블록다이어그램 형태로 정리한 것이다. 이하 각 블록의 구성 및 기능에 대하여 상술한다.

저주파 AC/DC 정류기(11)는 상용의 110V 또는 220V 등의 저주파 교류입력 전압을 받아서 직류로 변환하기 위한 것이며, 이렇게 변환된 직류전압(Vdc)은 입력전압의 변화에 따라 달라진다.

프리볼트(Free Volt) DC/DC 컨버터(12)는 상기 저주파 AC/DC 정류기(11)부터 얻어지는 직류전압(Vdc)의 변화에도 불구하고 일정한 직류전압(Vs)을 출력한다.

고주파 병렬공진형 인버터(13)는 상기 프리볼트 DC/DC 컨버터(12)에서 입력 되는 직류전압(Vs)을 받아서 고주파 교류 전력으로 변환한다.

이렇게 변환된 고주파 교류 출력은 충전 모체(1)에 속한 것이며, 이 에너지를 공간적으로 분리되어 있는 휴대형 장치(2)에 전달하기 위해서는 두 장치간에 존재하고 있는 간격을 극복하여야 한다. 이 것은 자기 결합을 통하여 가능하며, 이러한 목적으로 충전 모체(1) 측에는 1차 코어(3)에 권취된 1차권선(4)이 설치되어 상기 고주파 교류 전력에 의한 자계를 형성하며, 이에 대향하는 위치에 상기 1차권선(4)으로부터의 상기 교류 전력을 수수하기 위한 휴대형 장치(2)의 2차권선(5)이 페라이트 시트(8) 상부에 설치되어 있다.

고주파 AC/DC 정류기(15)는 상기 2차권선(5)을 통하여 수수한 고주파 교류 전력을 직류 전력으로 변환하여 휴대형 장치(2)내의 축전지(16)로 제공하는 역할을 한다.

충전제어회로(17)는 상기 축전지(16)의 충전상태를 나타내는 정보를 검출하여 충전모드를 제어하기 위한 목적으로, 고주파 AC/DC 정류기(15)에 흐르는 전류와 축전지(16) 양단의 전압을 검출하고 전류모드 또는 전압모드 중 어느 하나로 제어할 것인지를 결정하여 제어신호를 만들어 출력한다.

RF 변조 및 송신회로(18)는 상기 충전제어회로(17)로부터 입력받은 충전상태를 무선 송출하기 위한 것으로, 입력 데이터를 무선신호로 변조하고 이렇게 변조된 신호를 3차권선(7)에 인가한다. 3차권선(7)은 페라이트 시트(8) 상의 일정 위치에 고주파 자계를 형성하도록 하기 위한 것이다.

RF 수신 및 복조회로(20)는 상기 3차권선(7)과 분리되어 있고, 3차권선에 의 해 형성된 상기 고주파 자계로부터 RF 신호를 수신하기 위한 4차권선(6)을 통하여 신호를 수신하고 복조한다.

PWM(Pulse Width Modulation) 제어회로(21)는 상기 RF 수신 및 복조회로(20)에서 복조된 신호를 입력 받고, 상기 프리볼트 DC/DC 컨버터(12)를 제어하기 위하여 펄스폭 변조된 신호를 만든다.

마지막으로 보상회로(14)는 상기 프리볼트 DC/DC 컨버터(12)의 출력전압(V_s)으로부터 리플성분만을 PWM 제어회로(21)에 직접 귀환시켜 줌으로써 리플성분을 제거한다. 예컨대, 저주파 AC/DC 정류기(11)의 출력파형에서 저주파 교류 입력 전류 주파수가 60Hz라고 할 때 120Hz에 해당하는 리플성분이 주로 발생하는데, 보상회로(14)는 이 성분이 축전지(16)의 충전 전류에 영향을 주는 현상을 방지하기 위하여 이를 미리 제거하는 것이다.

도 3은 저주파 AC/DC 정류기(11)의 회로를 예시한 것이다. 이것은 기존에 많이 사용되는 회로로서 교류입력 전원이 네 개의 다이오드(D1- D4)를 통하여 정류되어 캐패시터(C1) 양단에 직류전원(V_{dc})으로 변환된다.

도 4는 파워 MOSFET(Metal- Oxide- Semiconductor Field- Effect- Transistor: M1)을 사용하여 구현한 프리볼트 DC/DC 컨버터(12)의 구체적인 회로를 예시한 것이다. 이와 같은 회로 역시 기존에 많이 사용되는 구조로서, 플라이백(flyback) 컨버터라고 부르기도 한다. 플라이백 컨버터는 MOSFET(M1)이 도통할 때 변압기(22)의 1차(N11) 측에 V_{dc} 가 인가되어 전류가 증가하면서 변압기(22)의 여자 인덕턴스 내에 에너지가 저장된다. MOSFET(M1)이 꺼지면 2차(N12) 측에서 전류가 다이오드 D6를 통하여 흐르고 캐퍼시터 C2의 전압은 상승한다. 이와 같은 방식으로, 1차 회로에서 여자 인덕턴스 내에 저장되는 에너지가 2차 회로로 방출되면서 C2 양단에 직류전압(V_s)을 발생시킨다. 직류 전압(V_s)의 크기는 PWM 제어회로(21)에 의해서 MOSFET(M1)의 도통시간을 조절하여 제어가 가능하다.

도 5는 고주파 병렬공진형 인버터(13)의 구체적인 구조를 도시한 것이다. 이 회로의 역할은 상기 프리볼트 DC/DC 컨버터(12)의 직류출력 전압(V_s)을 받아서 고주파 교류 전력으로 변환하는 것이다. 병렬공진형 인버터는 두 개의 MOS 트랜지스터 M2, M3를 구비하고 있고, 이 두 트랜지스터에 분리형 변압기의 1차 측(4) 자화인덕턴스와 캐퍼시터(C3)로 구성된 L- C 공진회로가 연결되어 있다. 분리형 변압기의 1차권선(4)의 중앙점은 인덕터(L1)에 연결되며, 이 인덕터(L1)의 다른 단자는 프리볼트 DC/DC 컨버터(12)의 출력전압(V_s)에 연결된다.

병렬공진형 인버터(13)의 동작은 다음과 같다. 두 개의 트랜지스터 M1, M2는 교대로 온/오프되며, 전원측에 연결된 인덕터(L1)가 충분히 클 경우 구형파에 가까운 전류가 변압기의 1차권선(4)에 흐르게 한다. L- C 공진회로는 이와 같은 구형파 전류에 포함되어 있는 기본파 성분의 전압만 변압기 양단에 잘 나타나도록 한다. 따라서, 1차권선(4) 양단에 나타나는 전압파형은 정현파 형태가 되며 두 개의 트랜지스터 M1, M2의 스위칭이 공진주기와 일치하여 일어나도록 하면 스위칭 손실이 극소화되고 스위칭 주파수를 크게 높일 수 있다. 현존하는 파워 MOS 스위치의 동작 주파수를 고려할 때, 이 동작 주파수는 대략 수백 kHz 이상 수 MHz의 범위가 적당하다고 할 수 있다.

이 병렬공진형 인버터(13)가 만일 바이폴라 트랜지스터로 구성되어 있다면, 분리형 변압기의 보조권선(10)에 의해 자려식으로 동작할 수 있다. 그러나, 본 발명에서와 같이 MOS 트랜지스터를 사용하여 구현하고자 하는 경우에는 자려식 동작이 잘 되지 않는다. 그 이유는 첫째, 이와 같은 병렬 공진형 인버터에서는 1차권선(4) 양단에 매우 높은 전압이 나타나는데 MOS 트랜지스터는 바이폴라 트랜지스터에 비해서 고압에 약한 단점이 있다. 둘째, MOS 트랜지스터는 게이트 소스간의 임계전압이 높기 때문에 보조권선(10) 양단에 나타나는 전압파형만으로는 쉽게 구동하기가 어렵다는 단점이 있기 때문이다. 이상의 이유로 병렬공진형 인버터에서는 바이폴라 트랜지스터를 주로 사용하여 왔다고 할 수 있다.

본 발명의 특징 중 하나는 병렬공진형 인버터에 MOS 트랜지스터를 사용하여 동작 가능하도록 구현한 것이며, 그러한 이유는 다음과 같다. 첫째는, 본 발명에서 구현하고자 하는 전력이 수W 정도에 불과하므로 전달하고자 하는 전력이 크지 않기 때문에 MOS 트랜지스터가 적당하기 때문이다. 둘째는, 프리볼트 DC/DC 컨버터(12)를 앞에 두는 방식을 채택함으로써 교류입력전원의 변화에도 불구하고 일정한 직류출력전압(V_s)을 얻을 수 있을 뿐아니라, 직류전압(V_s)을 낮게 제어함으로써 MOS 트랜지스터(M1, M2)의 내압범위에서 동작가능하도록 제어가 가능하다는 점 때문이다. 마지막으로 가장 중요한 이유는, MOS 트랜지스터가 바이폴라 트랜지스터에 비해서 스위칭 속도가 빠르기 때문에 더욱 높은 고주파에서 동작시키는 것이 가능하다는 점이다. 즉 수MHz에서 동작하도록 하는데는 MOS 트랜지스터가 유리한데, 공간적으로 분리되어 있는 휴대형기기에 무게와 부피가 작으면서 고밀도로 에너지를 전달하기 위해서는 고주파 자계의 주파수가 높을수록 효과적이기 때문이다.

그러나, MOS 트랜지스터를 사용한 회로가 자려식으로 동작하기 위해서는 보조권선(10)과 연계시킨 별도의 게이트 증폭기(A1, A2)가 추가로 필요하게 된다. 여기에서 게이트 증폭기의 역할은 크게 두가지이다. 하나는, 1차권선(4)에

서 발생하는 전압파형이 정현파 형태이기 때문에 보조권선(10)에서 나타나는 신호 또한 정현파의 형태인데, 이것이 그대로 MOS 트랜지스터의 게이트에 인가되는 경우에는 MOS의 도통과 차단 상태를 결정하는 게이트의 경계전압인 문턱전압이 높아서 회로가 잘 동작하지 않는다. 따라서, 이 회로에서 게이트 증폭기의 역할은 정현파를 구형파로 바꾸어줌으로써 MOS 트랜지스터의 온/오프 상태를 빠른 속도로 변화시키면서 확실하게 스위칭하여 주는 것이다. 두 번째는 정상동작시 MOS 트랜지스터의 게이트에 인가되는 최대전압이 게이트가 견딜 수 있는 최대정격 이하에서 안전한 동작이 이루어지도록 하기 위하여 적절한 값으로 인가해 주는 역할을 하는 것이다.

도 6은 도 5의 병렬공진형 인버터에서 사용될 수 있는 게이트 증폭기(A1, A2)의 구조를 예시한 것으로서, 기존에 상용화되어 있는 고속의 아날로그 비교기 칩을 사용해서도 구현이 가능하지만, 여기에서는 바이폴라 트랜지스터를 사용하여 구성된 형태를 한가지 예시한 것이다. 트랜지스터 Q1이 증폭을 담당하며, Q2 및 Q3는 전류 증폭을 위한 출력 트랜지스터이다. 분리형 변압기의 보조권선(10)과 트랜지스터 Q1의 베이스 사이에는 두 개의 저항(R2, R3)을 직렬로 연결하고, 그 중간은 다이오드(D7)가 접지와 사이에 연결되며, 저항 R2 양단에는 하나의 캐패시터(C4)가 병렬로 연결되어 있다. 또한, 보조권선(10)의 중앙점은 저항(R1)을 통하여 제어회로의 전원(Vcc)에 연결되어 있다. 따라서, 초기에는 Vcc로부터 저항 R1, R2, R3 및 Q1의 베이스로 형성되는 경로를 통해서 흐르는 전류로 인하여 병렬공진회로의 충전이 시작되면서 자력발진이 시동된다. 정상상태의 스위칭 동작에서는 C4의 역할에 의해서 Q1의 턴온 또는 턴오프가 빠른 속도로 가능하게 되므로 고주파 동작이 가능하게 된다.

도 7a 내지 7c는 휴대형 장치 측 분리형 변압기의 2차권선(5)에 연결하여 설치한 고주파 AC/DC 정류기(15)의 세가지 구조를 예시한 것이다. 이 회로들 역시 본 발명의 특징적인 회로들로서, 도 7a는 분리형 변압기의 2차권선(5)의 양단을 이용하여 다이오드(D8, D9) 두 개를 사용하여 전파정류한 구조이고, 도 7b는 중앙점이 없는 2차권선(5)을 사용하되, 네 개의 다이오드(D81, D82, D91, D92)를 사용하여 전파정류한 구조를 보인 것이다. 한편, 도 7c는 앞의 두 구조와는 약간 다른 형태로써 두 개의 다이오드(D81, D91)와 두 개의 캐패시터(C61, C62)를 사용하여 출력전압파형을 전파정류한 형태로 얻으면서 동시에 2배로 상승시켜 배압 정류한 구조이다.

상술한 바와 같은 전파정류 또는 배압정류 회로의 구조는 이미 기존에 잘 알려진 방식이나, 본 발명에서는 수동소자로 구성된 형태를 사용함에 그 특징이 있다. 즉, 2차권선(5)의 양단간에 연결한 R5 및 C5를 포함하여 직류로 변환된 뒤에 연결된 필터로서 C6(또는 C61, C62)와 L2로 형성된 필터부의 구성에 본 발명의 특징이 있다. 이러한 구성은 고주파 병렬공진형 인버터부(13)와 연계하여 동작할 때 그 특징이 나타난다. 일반적인 필터의 구성은 다이오드 정류부 바로 다음에 인덕터가 연결되고 그 다음에 캐패시터가 연결되는 것이 보통이나, 본 발명에서 이렇게 순서를 서로 바꾸어 놓은 이유는 이렇게 함으로써 고주파 병렬공진형 인버터부(13)와 연계하여 동작할 때 C6(또는 C61, C62)양단의 전압이 기존의 구조를 채택하는 경우에 비해서 훨씬 낮아지게 되며, 캐패시터의 크기 또한 작아지면서 인덕터(L2)에 흐르는 전류의 리플을 더욱 작게 하는데 효과적이기 때문이다. 캐패시터 C6(또는 C61, C62) 양단의 전압이 낮아지는 것은 고주파 병렬공진형 인버터(13) 측에서도 1차권선(4) 양단간의 전압을 낮아지게 하는 효과가 있으며, 이것은 또 MOS 스위치(M2, M3) 양단의 최대 전압 스트레스를 낮추어 주는 효과가 있게 된다.

또한, 도 7a 내지 7c에서 2차권선(5) 양단에 연결한 R5와 C5는 정류다이오드들이 온 상태에서 오프 상태로 변화하는 순간 역회복전류가 흐르면서 차단되게 되는데, 이와 연계하여 발생할 수 있는 고압 스파이크 전압을 줄이면서 동시에 다이오드들의 턴오프 손실을 줄여주기위한 스너버 작용을 담당하는 역할을 한다. 마지막으로 배압정류 회로에 있어서의 캐패시터(C61, C62) 역할은 출력의 직류전압을 두배로 한다는 점이 상이하지만, 나머지의 역할은 C6의 그것과 동일하다. 이와 같은 배압정류회로를 채택한다면 2차권선(5)의 수를 최소화 할 수 있다는 장점이 있다.

도 7a 내지 7c에서 마지막으로 언급할 사안은 인덕터(L2)의 구조에 대한 것이다. 즉, 인덕터(L2)의 인덕턴스는 필터의 역할을 수행해야 하기 때문에 상당히 큰 값의 인덕턴스가 요구된다. 그러나 이 인덕터(L2)에는 충전전류가 흘러야 하기 때문에 큰 충전전류가 흐르는 상황에서도 포화상태에 빠져서는 안 된다. 충전회로를 구현함에 있어서 이러한 조건을 만족하는 인덕터(L2)를 별도로 개별소자를 사용하여 구현하고자 한다면 크기가 커지는 문제로 인하여 휴대기기의 경박단소화를 추구함에 있어서 큰 장애요소가 된다. 따라서, 본 발명에서는 도 1b에 예시한 바와 같이, 인덕터(L2)를 분리형변압기의 2차권선(5)과 동일한 평면상에서 일정한 거리를 두고 분리시킨 형태로 평면형으로 구현함으로써 상기 문제를 해결하였다. 이와 같은 방식으로 구현함으로써 충전을 위한 큰 직류전류가 흐르는 상황에서도 인덕터(L2)가 포화되지 않으므로 상당한 크기의 인덕턴스를 유지하는 것이 가능하게 되며 필터로서의 역할을 훌륭하게 수행할 수 있게 된다.

도 8은 충전제어회로(17)를 상세히 도시한 것으로서, 기존의 축전지를 충전하는 회로에서 일반적으로 사용되는 개념을 구현한 것이라고 할 수 있다.

즉, 축전지의 전압(Vbb)이 기준전압(Vr) 보다 낮은 상태라면 전압비교기(31)의 출력은 'high' 상태에 있게 되며, 따라서 게이트(33)의 출력신호(Vf)는 전류비교기(32)의 출력을 그대로 따라가게 된다. 이런 경우에는 전류비교기(32)의 역할에 의하여 정전류원 형태로 충전되며, 충전전류(Ibb)는 기준전류원(Ir)의 값으로 일정하게 제어된다.

한편, 축전지의 전압(Vbb)이 상승하여 기준전압(Vr) 보다 높아지려고 하면 전압비교기(31)의 역할이 나타나면서 정전압원의 형태로 충전모드가 바뀌게 된다. 이 때에는 충전전류(Ibb)의 크기가 기준전류원(Ir)의 값보다 작아지게 되며 전류비교기(32)의 출력이 'high' 상태에 머물러 있게 되므로, 이 경우의 게이트(33) 출력신호(Vf)는 전압비교기(31)의 출력을 그대로 따라가게 된다.

도 9는 RF 변조 및 송신회로(18)를 예시한 것으로서, 충전제어회로(17)의 출력신호(Vf)에 따라서 RF발생기(36)의 고주파신호를 변조하여 버퍼(35)에 보내주기위한 게이트(34)가 연결되어 있다. 버퍼(35)의 출력은 휴대형 장치(2)의 페라이트 시트(8) 상에 설치된 3차권선(7)에 인가된다.

도 10은 RF 수신 및 복조회로부(20)를 예시한 것으로서, 충전 모체(1)의 PCB기판(9) 상에 설치되어 있는 4차권선(6)을 통하여 RF신호를 수신하고 복조하여, 최종출력신호(Vp)는 충전제어회로(17)에서 보내준 제어신호(Vf)를 복원한

것이 되도록 한다. 여기에서 신호처리를 위한 회로는 고역필터(HPF)와 피크검출기(PD) 및 비교기(36)로 구성되며 각각의 동작은 다음과 같다. 먼저 고역필터(HPF)가 필요한 이유는 4차권선(6)을 통하여 수신한 RF 신호에는 저주파 대역의 잡음이 포함되어 있는데, 특히 고주파 병렬공진형 인버터(13)로부터 스위칭 주파수가 큰 값으로 수신되게 되므로 이 성분을 제거하기 위해서 필요하게 된다. 즉, 인버터(13)가 고주파로 동작한다고 하더라도 RF 신호에 비해서는 저주파에 해당되므로, RF 신호를 분리수신하기 위해서는 고역필터가 필요한 것이다. 이렇게 한 다음에 피크검출기(PD)와 비교기(36)를 거치면 출력(Vp)에서는 충전제어회로(17)의 제어신호(Vf)를 복원할 수 있게 된다.

도 11a 및 11b는 각각 PWM(Pulse Width Modulation) 제어회로(21)의 블록도와 회로도들 예시한 것이며, 상기 RF 수신 및 복조회로(20)로부터 복조된 신호(Vp)를 받아서 프리볼트 DC/DC 컨버터(12)를 제어하기 위한 펄스폭 변조(PWM)된 신호를 만들어 낸다. 이 회로는 적분기(41), 삼각파발생기(42), 비교기(43)로 이루어져 있다. 적분기(41)에서는 복조신호(Vp)를 받아서 적분하는 역할을 하며 적분기(41)의 출력은 비교기(43)에서 삼각파발생기(42)의 출력과 비교되어 PWM 신호를 발생시킨다. 이렇게 하여 발생된 PWM 신호는 프리볼트 DC/DC 컨버터(12)의 MOSFET(M1) 게이트에 인가되어 직류출력전압(Vs)을 제어하게 된다.

발명의 효과

본 발명에 따른 비접촉식 충전 시스템은, 충전 장치의 소형경량화를 위하여 유도결합을 이루는 분리형 변압기의 2차측을 평면상에 구성하여 휴대형 장치의 축전지에 장착하기 쉽게 하였고, 축전지의 충전상태를 무선으로 충전 모체에 전달하여 제어될 수 있도록 하였다. 따라서, 본 발명에 따른 충전 시스템은 앞으로 더욱 더 소형화, 경량화될 휴대폰, MP3 플레이어 등과 같은 휴대형 장치에 대하여 편리성과, 안전성 그리고 미관의 수려함을 위한 디자인의 다양성을 제공하는 효과가 크다고 할 수 있다.

(57) 청구의 범위

청구항 1.

유도 결합 방식을 사용하여 충전 모체로부터 휴대형 장치에 장착된 축전지를 충전하는 비접촉식 충전 시스템에 있어서,

상기 충전 모체는, 저주파 교류전압을 입력 받아 직류전압으로 변환하여 출력하는 저주파 AC/DC 정류기;

상기 직류전압의 크기에 관계없이 일정한 직류전압을 만들어 출력하는 프리볼트 DC/DC 컨버터;

상기 일정한 직류전압을 받아 고주파 교류전력으로 변환하여 출력하는 고주파 병렬공진형 인버터;

상기 고주파 병렬공진형 인버터에 연결되는 페라이트 코어; 및

상기 페라이트 코어의 중앙돌출부와 외곽돌출부 사이에 설치되고, 상기 고주파 교류전력을 받아 유도 결합을 통해 상기 휴대형 장치 측으로 전달하는 1차권선;을 구비하고,

상기 휴대형 장치는, 얇은 페라이트 시트;

상기 1차권선으로부터 상기 교류전력을 수수하기 위하여 상기 1차권선에 대향하도록 상기 페라이트 시트 상에 설치되는 얇은 박막형의 2차권선; 및

상기 2차권선이 수수한 교류전력을 직류전력으로 변환하여 축전지에 제공하는 고주파 AC/DC 정류기;를 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 2.

제 1 항에 있어서,

상기 휴대형 장치는, 상기 축전지의 충전상태를 검사하여 제어신호를 생성하고 출력하는 충전제어회로; 및

상기 제어신호를 받아 RF 신호로 변조하여 무선 송출하는 RF 변조 및 송신회로;를 더 구비하고,

상기 충전 모체는, 상기 RF 신호를 수신하고 복조하여 상기 제어신호를 검출하고 출력하는 RF 수신 및 복조회로; 및

상기 제어신호를 받아 펄스폭 변조 신호를 만들어 상기 프리볼트 DC/DC 컨버터에 인가함으로써 직류전압을 조정하도록 하는 PWM 제어회로;를 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 3.

제 2 항에 있어서,

상기 휴대형 장치는, 상기 페라이트 시트 상에 상기 2차권선과 일정한 거리를 두고 설치되고 상기 RF 변조 및 송신회로에 연결되어 상기 RF 신호에 의해 고주파 자계를 형성하는 3차권선;을 더 구비하고,

상기 충전 모체는, 상기 3차권선에 대향하는 위치에 설치되고 상기 RF 수신 및 복조회로에 연결되어 상기 고주파 자계를 무선으로 수신하여 상기 RF 수신 및 복조회로에 전달하는 4차권선;을 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 4.

제 2 항에 있어서,

상기 충전 모체는 상기 프리볼트 DC/DC 컨버터의 출력전압으로부터 리플성분을 검출하여 상기 PWM 제어회로에 귀환시키는 보상회로;를 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 5.

제 2 항에 있어서,

상기 RF 수신 및 복조회로는, 상기 RF 신호에서 제어신호를 복조하기 전에 상기 RF 신호와 함께 입력된 상기 고주파

병렬공진형 인버터의 구동 주파수 성분을 제거하는 고역필터를 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 6.

제 1 항 또는 제 2 항에 있어서,
상기 고주파 병렬공진형 인버터는 인덕터(L1); 캐패시터(C3); 두 개의 MOS 트랜지스터(M2, M3); 및 두 개의 게이트 증폭기(A1, A2);를 구비하고,
상기 1차권선의 세 단자 중 중간단자에는 상기 인덕터를 통하여 직류전원(Vs)이 연결되고, 상기 1차권선의 양끝단자에는 공진을 형성하기 위한 상기 캐패시터와 상기 두 MOS 트랜지스터의 드레인(Drain)이 연결되며,
상기 두 MOS 트랜지스터의 소스는 모두 접지되고,
상기 두 게이트증폭기는 각각 상기 1차권선의 주권선과 보조권선으로부터 수신된 신호를 증폭하여 인가하도록, 상기 두 MOS 트랜지스터의 게이트에 각각 연결되는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 7.

제 6 항에 있어서,
상기 게이트증폭기는 상기 보조권선에서 발생하는 정현파 형태의 전압파형을 구형파 형태로 바꾸어 주는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 8.

제 1 항에 있어서,
상기 2차권선은 중앙점이 있으며, 상기 고주파 AC/DC 정류기는 상기 중앙점을 이용함으로써 두 개의 다이오드(D8, D9)를 사용하여 전파정류하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 9.

제 1 항에 있어서,
상기 2차권선은 중앙점이 없으며, 상기 고주파 AC/DC 정류기는 네 개의 다이오드(D81, D82, D91, D92)를 사용하여 전파정류하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 10.

제 8 항 또는 제 9 항에 있어서,
상기 고주파 AC/DC 정류기는 상기 다이오드의 정류부 뒤에 연결되는 캐패시터(C6)와 상기 캐패시터 뒤에 연결되는 인덕터(L2)로 구성된 필터를 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 11.

제 10 항에 있어서,
상기 인덕터(L2)는 상기 2차권선과 동일한 평면상에서 일정한 거리를 두고 분리시킨 형태의 평면형 구조인 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 12.

제 8 항 또는 제 9 항에 있어서,
상기 고주파 AC/DC 정류기는 직렬로 연결된 저항(R5)과 캐패시터(C5)를 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 13.

제 1 항에 있어서,
상기 고주파 AC/DC 정류기는 두 개의 다이오드(D81, D91)와 두 개의 캐패시터(C61, C62)를 구비하여, 출력전압파형을 전파정류한 형태를 얻음과 동시에 2배로 상승시켜 배압정류하는 것을 특징으로 하는 비접촉식 충전 시스템.

청구항 14.

제 13 항에 있어서,
상기 고주파 AC/DC 정류기는 상기 다이오드의 정류부 뒤에 연결되는 두 개의 캐패시터(C61, C62)와 상기 캐패시터 뒤에 연결되는 인덕터(L2)로 구성된 필터를 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

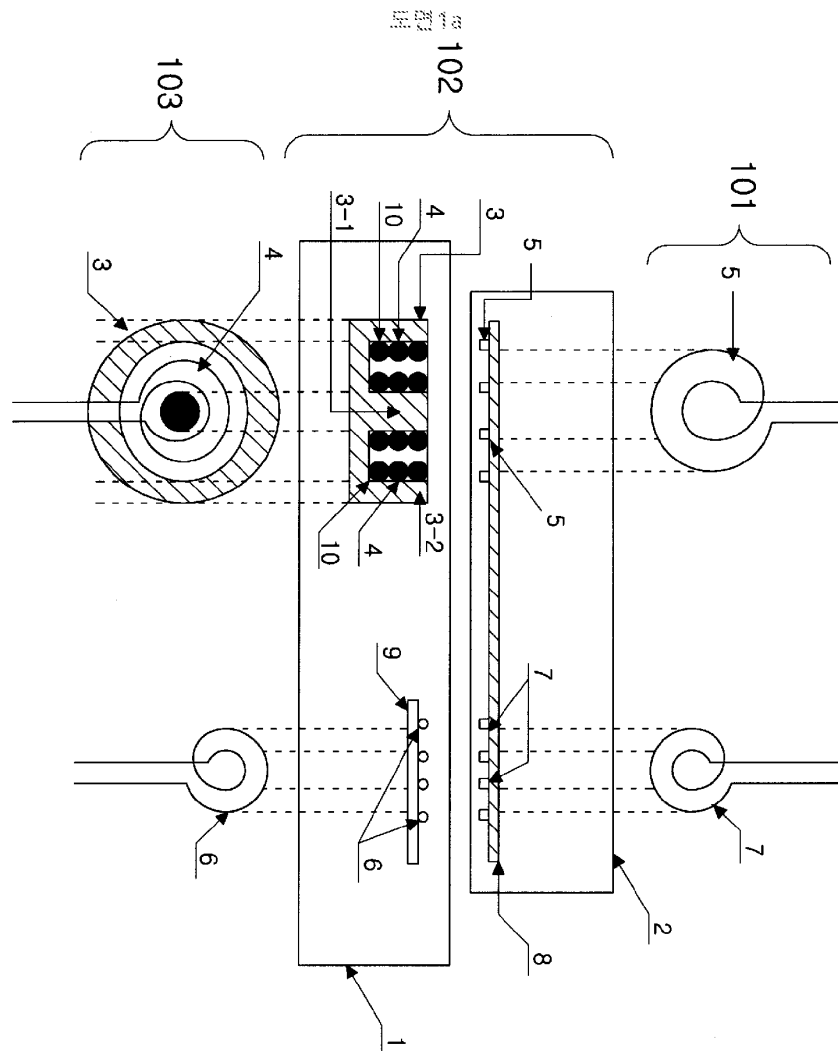
청구항 15.

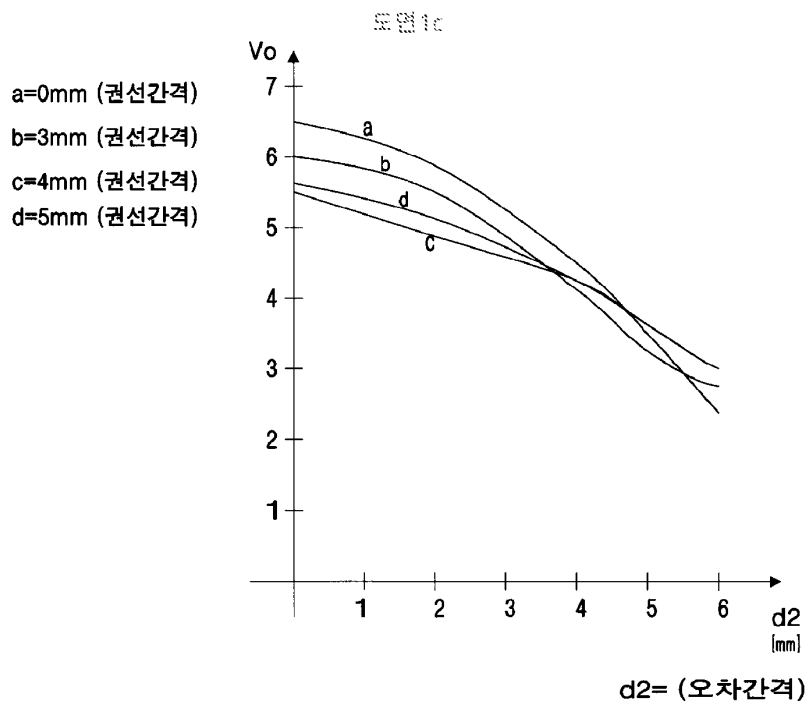
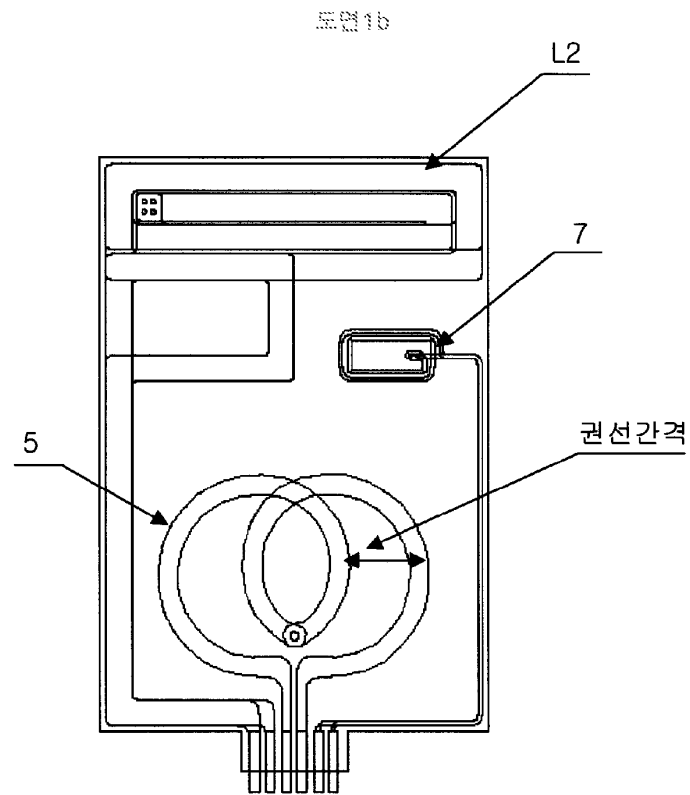
제 14 항에 있어서,
상기 인덕터(L2)는 상기 2차권선과 동일한 평면상에서 일정한 거리를 두고 분리시킨 형태의 평면형 구조인 것을 특징으로 하는 비접촉식 충전 시스템.

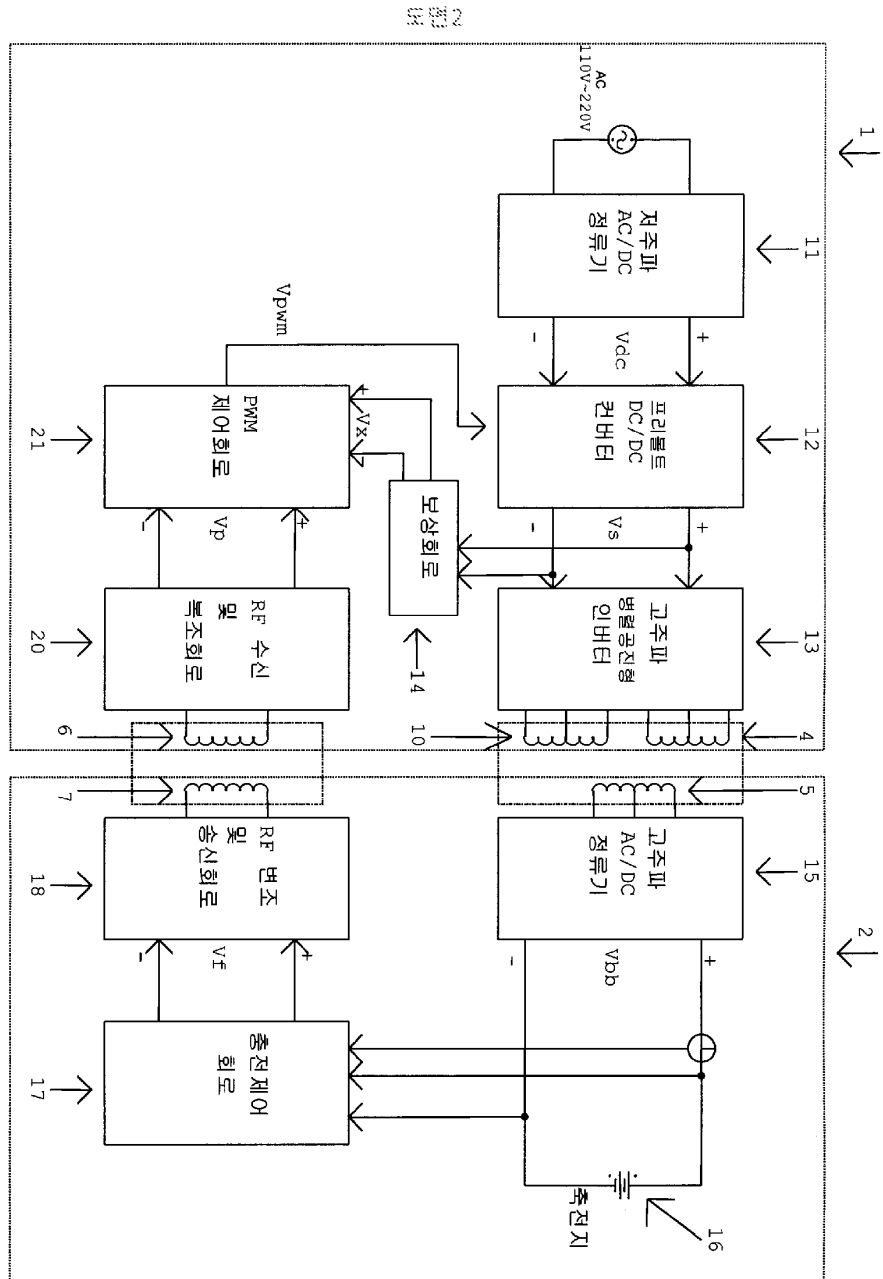
청구항 16.

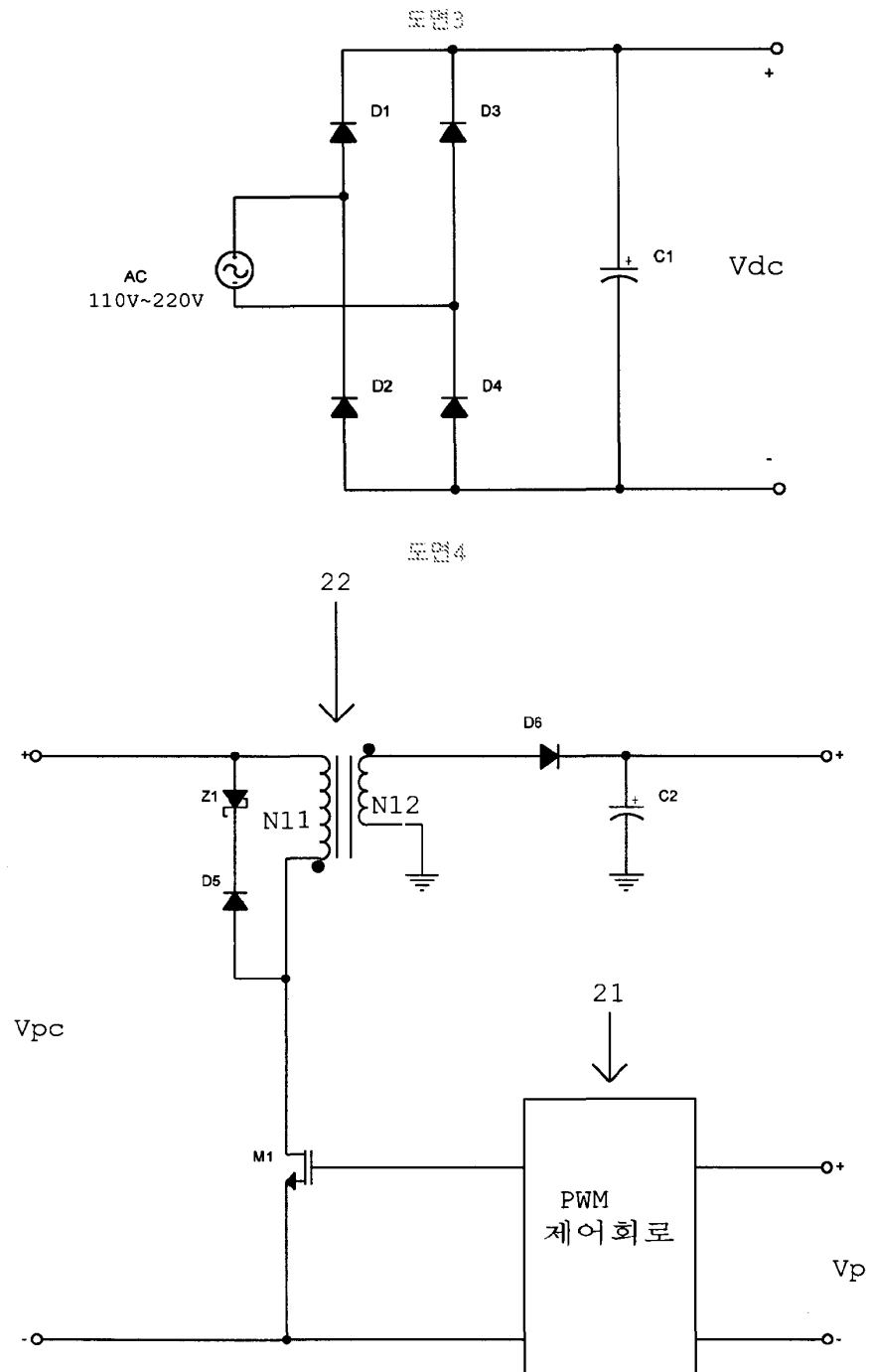
제 15 항에 있어서,
상기 고주파 AC/DC 정류기는 직렬로 연결된 저항(R5)과 캐패시터(C5)를 더 구비하는 것을 특징으로 하는 비접촉식 충전 시스템.

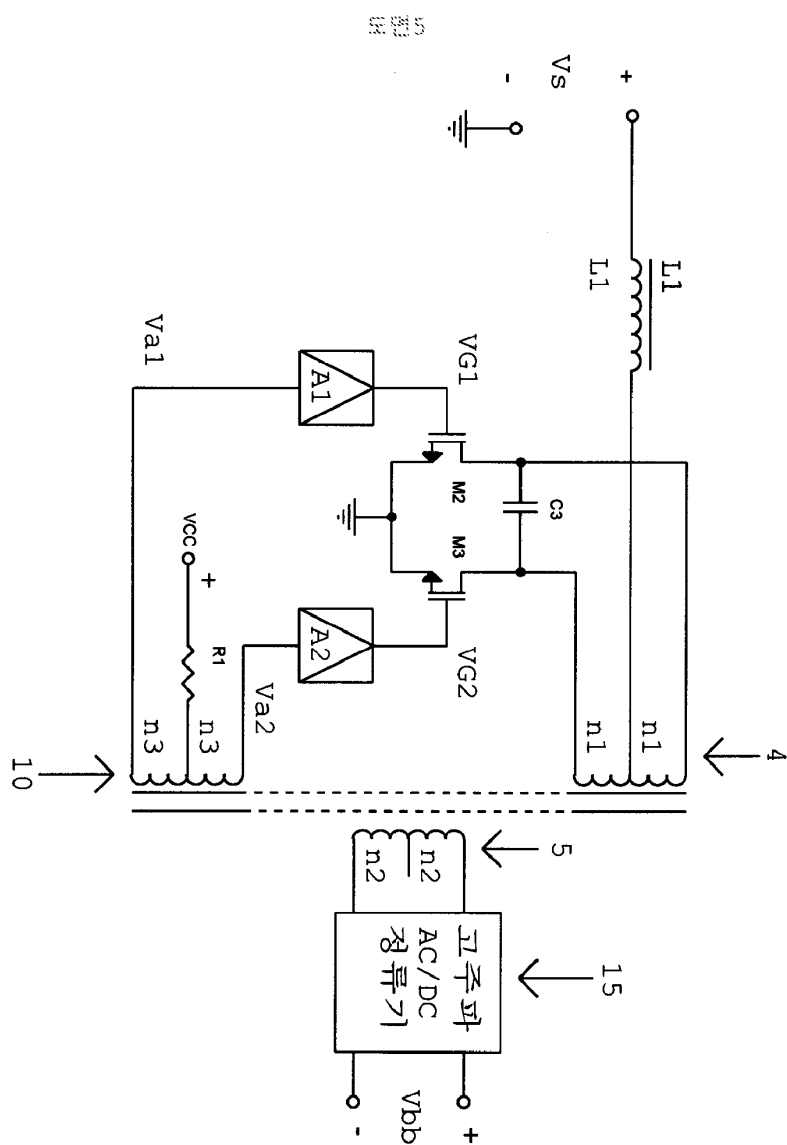
도면

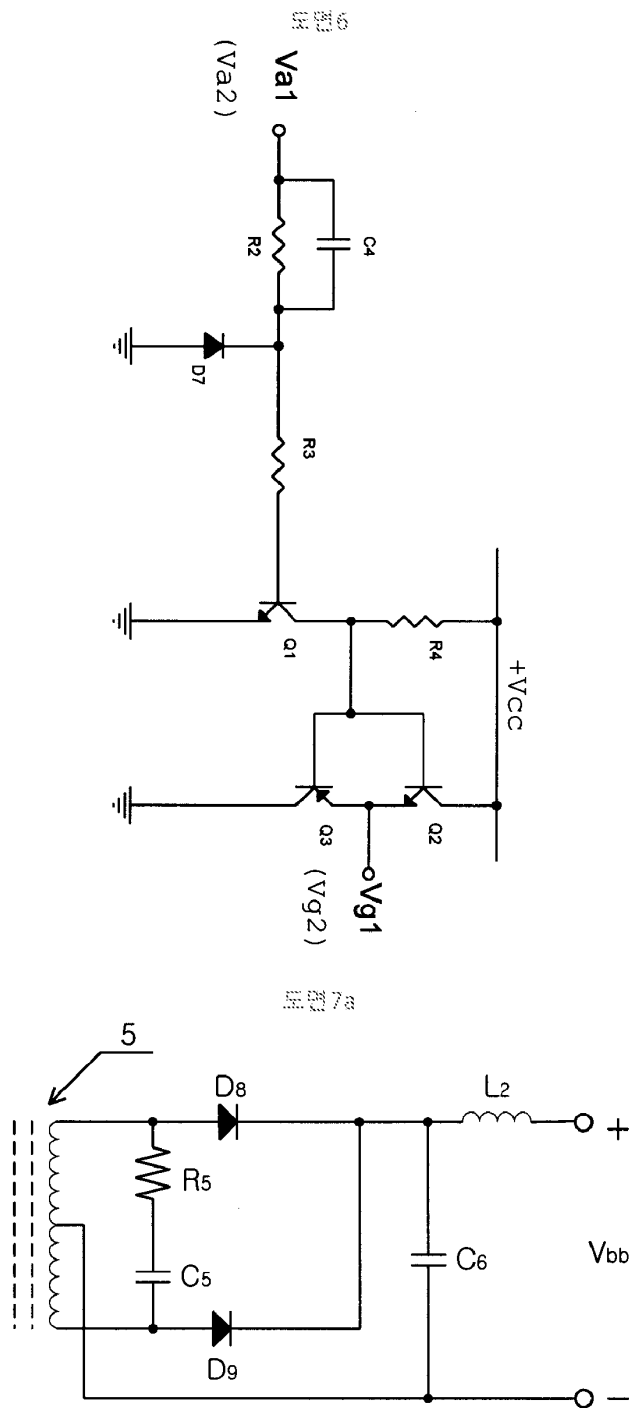




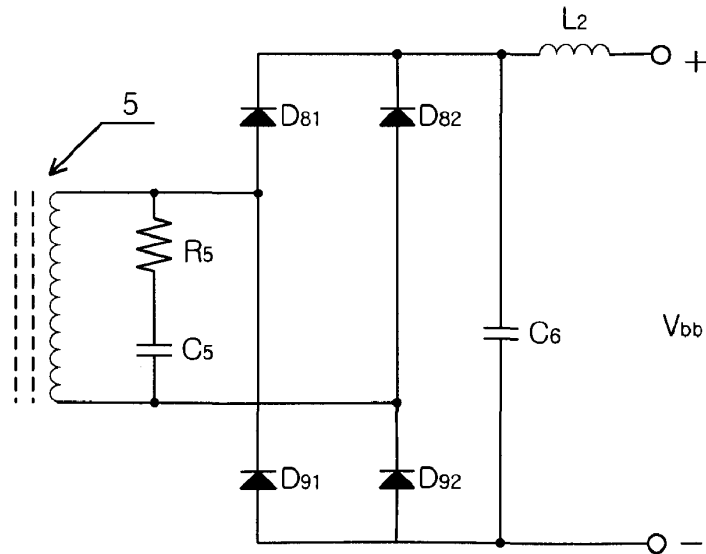




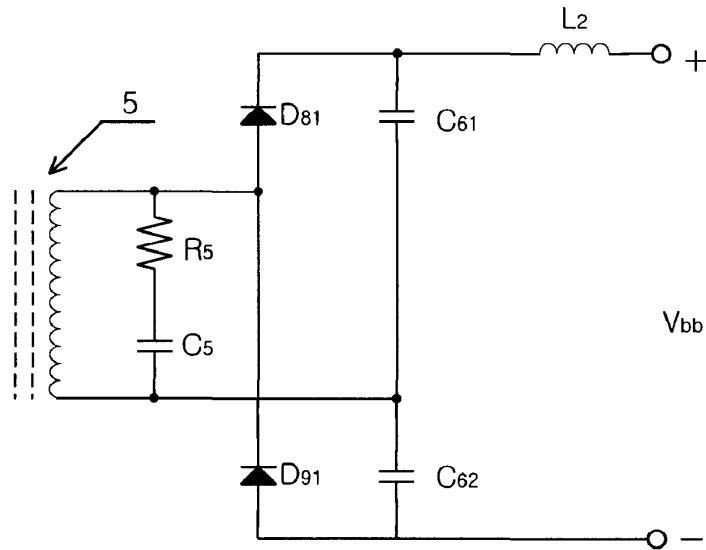




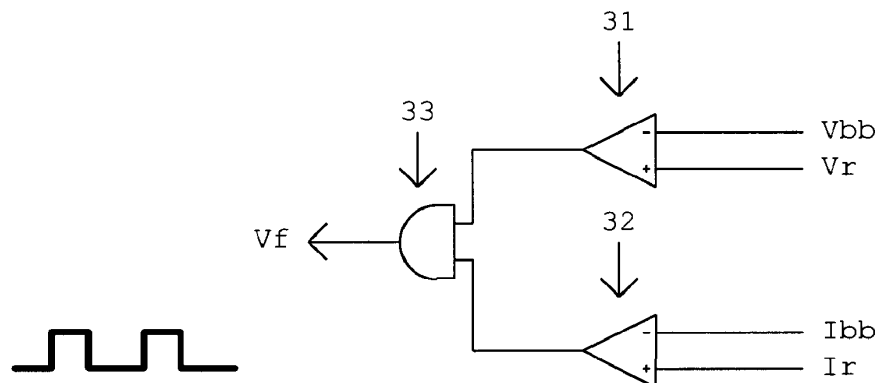
도면 7b

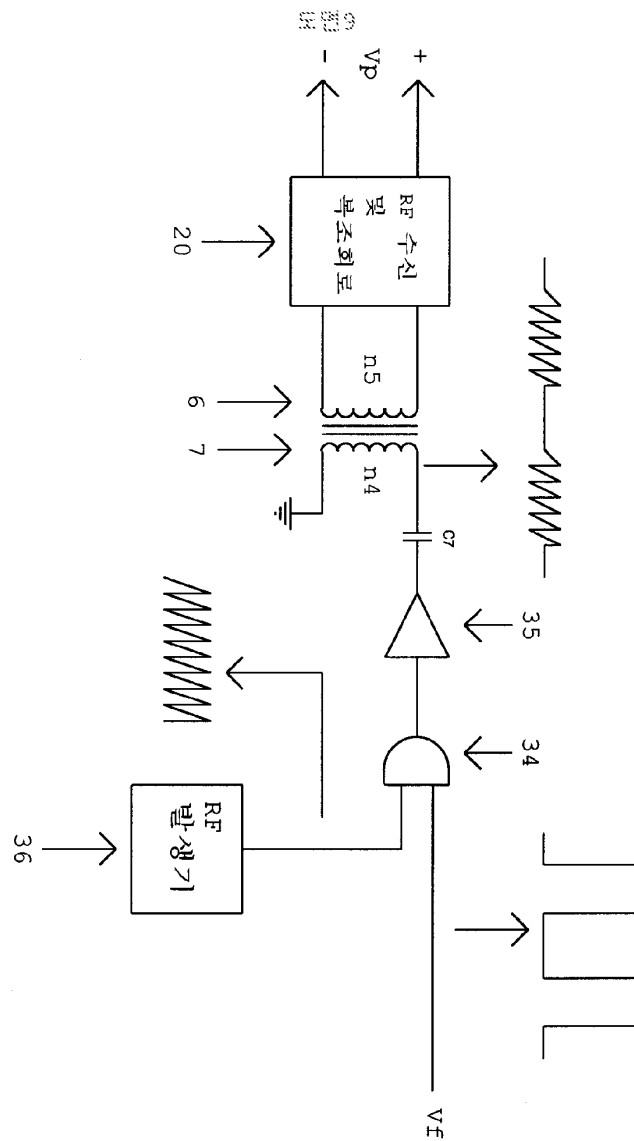


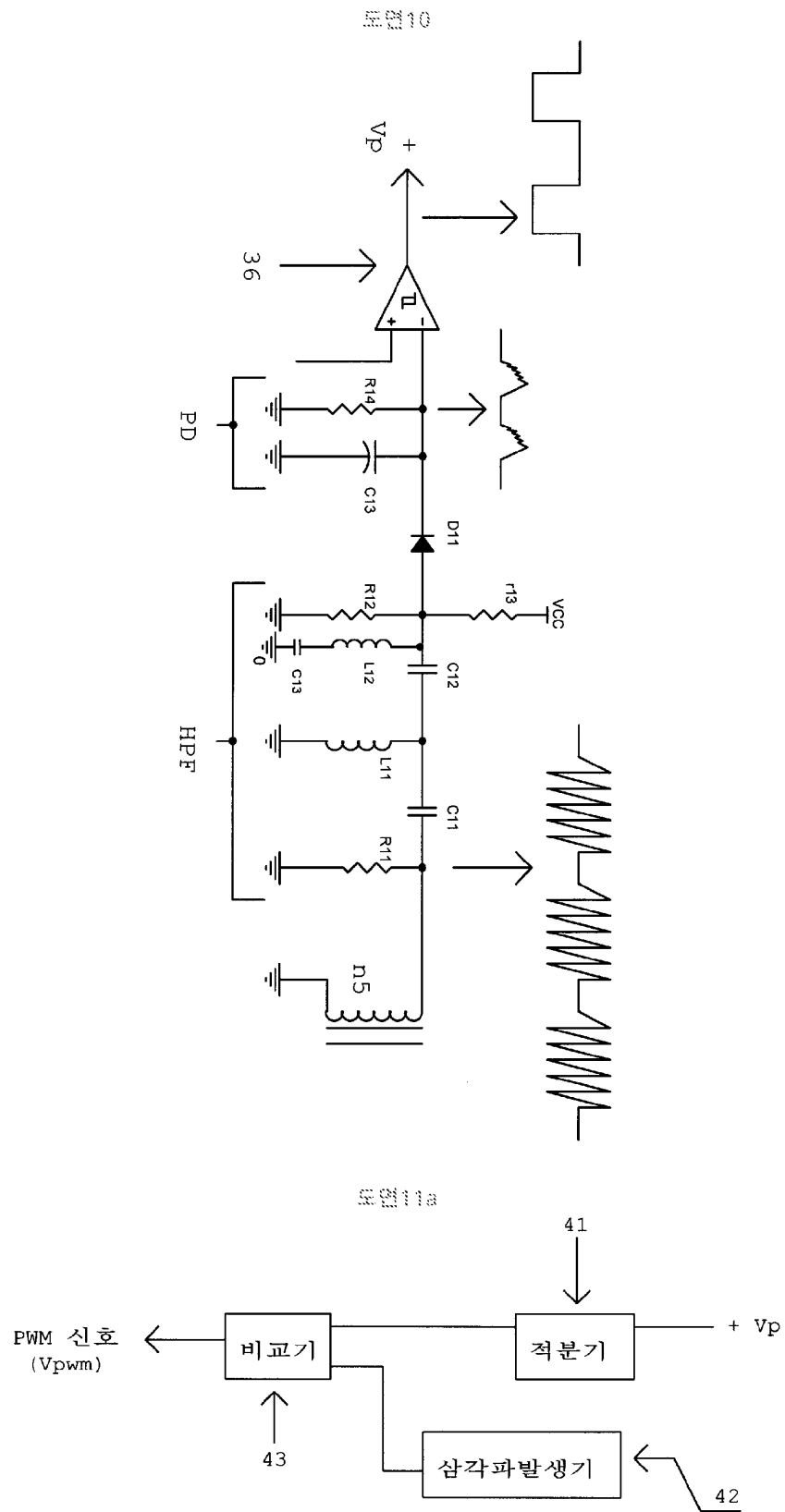
도면 7c

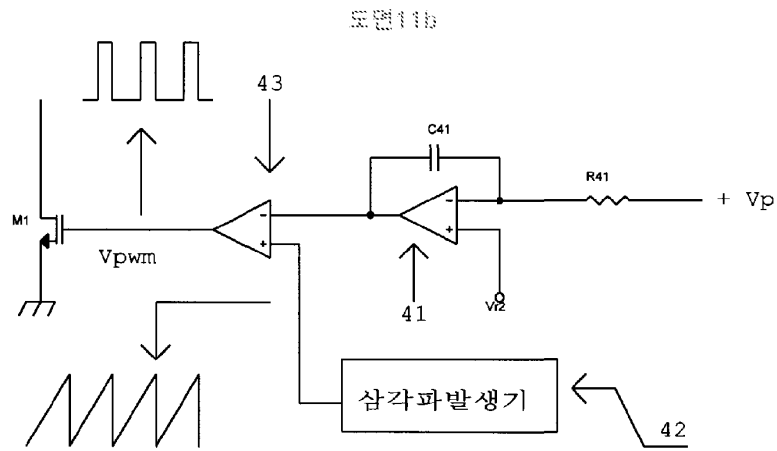


도면 7d









<i>Search Notes</i> 	Application/Control No. 96/000,355	Applicant(s)/Patent Under Reexamination 8013568
	Examiner ANJAN K DEB	Art Unit 3992

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Searched IDS	06/24/2021	AD
Searched Prosecution History	06/24/2021	AD
PE2E search attached	06/24/2021	AD

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Reexamination 	Application/Control No. 96/000,355	Applicant(s)/Patent Under Reexamination 8013568
	Certificate Date	Certificate Number

Requester Correspondence Address: ☒ Patent Owner ☐ Third Party
K&L Gates LLP-Chicago P.O. Box 1135 Chicago, IL 60690

LITIGATION REVIEW ☒	AD (examiner initials)	22 June 2021 (date)
Case Name		Director Initials

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER

<i>Notice of References Cited</i>	Application/Control No. 96/000,355		Applicant(s)/Patent Under Reexamination 8013568	
	Examiner ANJAN K DEB		Art Unit 3992	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6184651-B1	02-2001	Fernandez; Jose M.	H02J50/12	320/108
*	B	US-7208915-B2	04-2007	Kubota; Atsumasa	H02J7/0072	320/134
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	KR-100451606-B1	10-2004	KR	Cho et al	H02J50/10
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20210609



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,355	03/12/2021	8013568	0313071.00020	1538
24573	7590	06/30/2021	EXAMINER	
K&L Gates LLP-Chicago P.O. Box 1135 Chicago, IL 60690			DEB, ANJAN K	
			ART UNIT	PAPER NUMBER
			3992	
			MAIL DATE	DELIVERY MODE
			06/30/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



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(THIRD PARTY REQUESTER'S CORRESPONDENCE ADDRESS)

***EX PARTE* REEXAMINATION COMMUNICATION TRANSMITTAL FORM**

REEXAMINATION CONTROL NO. 96/000,355 .

PATENT UNDER REEXAMINATION 8013568 .

ART UNIT 3992 .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

Office Action in Ex Parte Reexamination	Control No. 96/000,355	Patent Under Reexamination 8013568	
	Examiner ANJAN K DEB	Art Unit 3992	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

- a. ☒ Responsive to the communication(s) filed on 12 March 2021.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☐ This action is made FINAL.

c. ☐ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire _____ month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c)**. If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☒ Notice of References Cited by Examiner, PTO-892.	3. ☐ Interview Summary, PTO-474.
2. ☐ Information Disclosure Statement, PTO/SB/08.	4. ☐ _____.

Part II SUMMARY OF ACTION

- 1a. ☒ Claims 1-24 are subject to reexamination.
- 1b. ☐ Claims _____ are not subject to reexamination.
2. ☐ Claims _____ have been canceled in the present reexamination proceeding.
3. ☐ Claims _____ are patentable and/or confirmed.
4. ☒ Claims 1-24 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ The drawings, filed on _____ are acceptable.
7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.
8. ☒ Acknowledgment is made of the priority claim under 35 U.S.C. 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the certified copies have
 - 1 ☐ been received.
 - 2 ☐ not been received.
 - 3 ☒ been filed in Application No. 11/997,272.
 - 4 ☐ been filed in reexamination Control No. _____.
 - 5 ☐ been received by the International Bureau in PCT application No. _____.
- * See the attached detailed Office action for a list of the certified copies not received.
9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.
10. ☐ Other: _____

cc: Requester (if third party requester)

U.S. Patent and Trademark Office

PTOL-466 (Rev. 08-13)

Office Action in Ex Parte Reexamination

Part of Paper No. 20210609

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DETAILED ACTION

1.0 SUMMARY

This Office action addresses claims 1-24 of United States Patent Number US 8,013,568 (hereinafter "the '568 patent"), issued September 6, 2011 to Park et al., wherein it has been determined in the 96/000,355 reexamination, regarding the Order mailed 04/21/2021 granting *ex parte* reexamination, that a substantial new question of patentability was raised in the request for *ex parte* reexamination, filed on 03/12/2021 (hereafter "the Request").

1.1 Priority

As noted on its front page, the '568 patent claims priority from:

KR 10-2005-0069871 filed July 29, 2005

KR 10-2006-0038960 filed April 28, 2006

1.2 Status of Claims

Claims 1-24 are rejected.

2.0 REFERENCES CITED IN REQUEST

The examiner has considered a substantial new question of patentability has been raised by at least the following prior art reference submitted by Third Party Requester:

1. Korean Patent No. KR950005819B1 to Hong Chung-Sik, English Language Translation ("Chung-Sik")

3.0 ISSUES RAISED IN THE REQUEST

Issue 1: Primary reference: Chung-Sik (KR950005819BI)

Requester states that the teaching of Chung-Sik references raises a substantial new question of patentability with respect to claims 1-24 of the '568 Patent (Request pages, 4-26).

4.0 REJECTIONS PROPOSED IN THE REQUEST

The following rejection is proposed in the request:

- 1) Claims 1-24 of the '568 Patent are obvious under 35 U.S.C. § 103(a) over Chung-Sik taken alone (request pages 4-26).

5.0 CLAIM REJECTION - 35 USC § 102

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5.1 Chung-Sik (cl. 1-3, 5-9, 11-15, 20)

Claim(s) 1-3, 5-9, 11-15 and 20 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Chung-Sik (KR 950005819BI).

- 1. A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:**

Chung-Sik discloses system for charging a battery 32 in a portable device by inductively coupling a voltage from a charger 12 (base unit) to a portable device 18. Inductively coupling a voltage from a charger to a portable device 18 is considered the same as contact-less chargeable battery (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

Chung-Sik disclosed high frequency AC current inducing unit 38 (CONTACTLESS CHARGING UNIT) to which a high frequency AC current (10 KHZ) is induced by means of a magnetic field generated from an external contact-less charging device (induced voltage generating unit) (page 8-2, lines 17-18, and page 8-4, lines 47-51).

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19) (Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

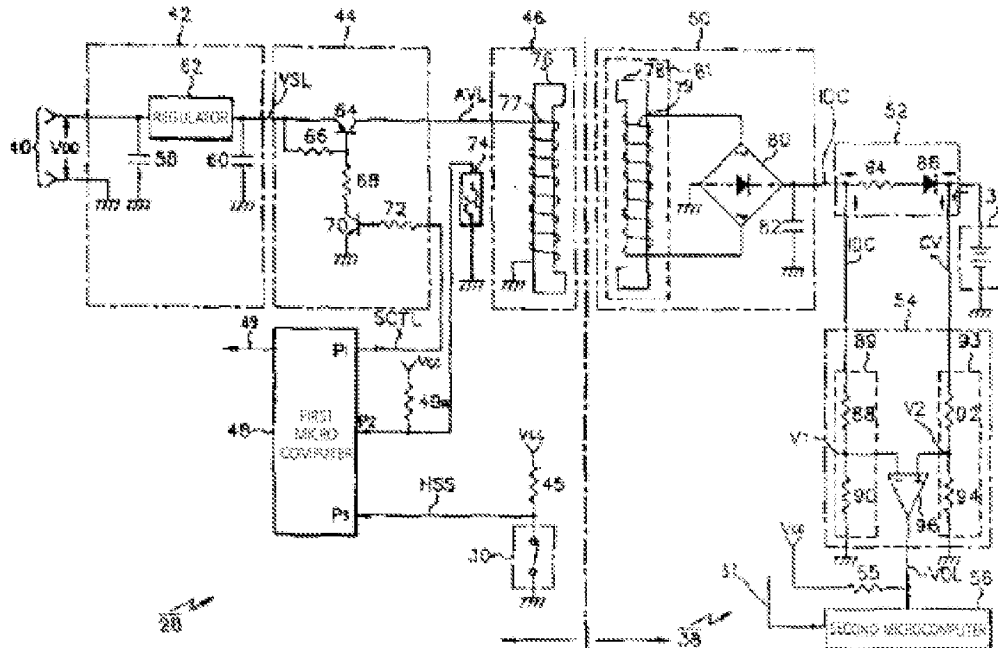
Chung-Sik discloses constant voltage/current supplier for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage) (See “voltage V1 is constant”, page 8-5 line 5). Since voltage V1 is constant it is supplying a charging power to the battery cell in a constant voltage/constant current mode.

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 1, 2) (page 8-2, lines 31-34, 40-55; page 8-3,

lines 36-40; page 8-5, lines 35-43) (Fig. 2).

FIG. 2



Chung-Sik. Fig. 2

2. The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Chung-Sik discloses wherein the high frequency AC current inducing unit is a coil 79 to which a magnetic flux of a magnetic field generated from the external (coil 77) contact-less charging device is linked. (Fig. 2).

3. The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

Chung-Sik discloses over voltage monitoring unit 54 for monitoring voltages (V1, V2) at front and rear ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field (page 8-2, paragraphs 7-8) of the induced voltage generating unit 46 (Fig. 2) (page 8-3, lines 31-34; page 8-5, lines 31-34) (Fig. 2).

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.

Chung-Sik discloses voltage comparator 96 for comparing first and second voltages (V1, V2) detected by the first and second voltage detectors and outputs a voltage comparison result (charge state VDL).

Chung-Sik further disclosed microprocessor 56 for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit (Fig. 2, page 8-4, 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

5. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

Chung-Sik discloses outputting a charge state signal (VDL) which is input to second microcomputer 56 for controlling the portable device 18 (battery) (Fig. 2, page 8-3).

6. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

7. A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:

Chung-Sik disclosed contact-less charging circuit module electrically connected to a battery cell 32 of portable device 18 and used for charging an electric energy to the battery cell 32 in a contact-less method (Fig. 1, page 8-1).

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

Chung-Sik disclosed high frequency AC current inducing unit 38 (CONTACTLESS CHARGING UNIT) to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device (induced voltage generating unit) (page 8-2, lines 17-18).

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19).(Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 28-33). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See “voltage V1 is constant”, page 8-5 line 5).

5 terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2
6 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external

contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (page 8-2, lines 31-34, 49-55; page 8-3, lines 36-40; page 8-5, lines 1-8) (Fig. 2).

8. The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Chung-Sik discloses contact-less chargeable battery according to claim 7 as set forth above.

Chung-Sik discloses wherein the high frequency AC current inducing unit is a coil 79 to which a magnetic flux of a magnetic field generated from the external (coil 77) contact-less charging device is linked. (Fig. 2).

9. The contact-less charging circuit module according to claim 7,

Chung-Sik discloses contact-less chargeable battery according to claim 7 as set forth above.

wherein the overvoltage monitoring unit includes:

a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna;

Chung-Sik disclosed wireless transmitting unit (antenna connected to radio unit 34) for wirelessly propagating the monitoring result through an antenna connected to radio unit 34 (Fig. 1, and Fig. 2, page 8-5).

In this case, the data input to the line 49 is input as data that is wirelessly transmitted from the portable device 18 when the battery 32 is completely charged. If analysis of input data in operation 110 indicates the portable device is abnormal (i.e. charge is incomplete), the first microcomputer 48 jumps to the aforementioned step 106 to continuously generate a charge voltage, and when the portable device is normal, the first microcomputer 48 jumps to operation 112 to stop charging.

When a charge level of the battery 32 is increased through the aforementioned operation, the charge level detection voltage V2 of a second voltage splitter 93 increases, and when the detection voltage V2 becomes higher than the reference voltage V1, the output VDL of the comparator 96 is transitioned to logic "high" from logic "low" and is input to the second microcomputer 56.

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

Chung-Sik also discloses first and second voltage detectors (V1, V2) for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier 52 (Fig. 2).

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputs a voltage comparison result; and

Chung-Sik discloses voltage comparator 96 for comparing first and second voltages (V1, V2) detected by the first and second voltage detectors and outputs a voltage comparison result (charge state VDL) (Fig. 2, page 8-4).

a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.

Chung-Sik discloses second microprocessor 56 for outputting a monitoring result according to the voltage comparison result through line 37 to the wireless transmitting unit (antenna connected to radio unit 34). (Fig. 1, 2 and page 8-5).

11. The contact-less charging circuit module according to claim 1¹,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the monitoring result is a charging power adjustment request signal.

Chung-Sik discloses outputting a charge state signal (VDL) which is input to second microcomputer 56 for controlling the portable device 18 (battery) (Fig. 2, page 8-3).

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit

¹ It appears that Claim 11 should depend from claim 7 that recites a contact-less charging circuit module

52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

12. The contact-less charging circuit module according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an

operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2).

Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

13. A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and,

Chung-Sik discloses contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery 32 that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

Chung-Sik discloses constant voltage/current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See “voltage V1 is constant”, page 8-5 line 5).

wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:

Chung-Sik discloses wirelessly transmitting a monitoring result for voltages at both ends of the constant voltage/constant current supplier (Chung-Sik, English Translation, pages 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 57 in operation 122. The charge completion alarm signal through line 57 is transmitted to the base unit 12 through the audio and logic unit 56 and the radio unit 54, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

Chung-Sik discloses magnetic field generating unit 46 (induced voltage generating unit) for receiving an AC current and forming a magnetic field in an outer space (space around coil 77). (Chung-Sik, English Translation, page 8-4 lines 47-51; and Fig. 2).

10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and

Chung-Sik discloses a high frequency power driving unit (transistor 64) for applying a high frequency AC current to the magnetic field generating unit 46 (Fig. 2, page 8-4).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication by antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

14. The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.

Chung-Sik discloses contact-less chargeable battery according to claim 13 as set forth above.

Chung-Sik discloses wherein the magnetic field generating unit is a coil (77, 78) to both sides of which a high frequency AC current is applied. (Fig. 2, page 8-3).

15. The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the charging power adjusting unit includes:

a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and

Chung-Sik discloses wireless receiving unit (radio unit 26 connected to antenna) for wirelessly receiving the monitoring result through the antenna (Fig. 1).

a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.

Chung-Sik discloses first microprocessor 48 for receiving the monitoring result from the wireless receiving unit (radio unit 26) and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit (Fig. 1, 2 & 3A, pages 8-4, 8-5).

48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

20. The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

6.0 CLAIM REJECTIONS - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6.1 Chung-Sik (cl. 4, 10, 19, 21-24)

Claims 4, 10, 19, and 21-24 are rejected under 35 U.S.C. 103(a) as being obvious over Chung-Sik (KR 950005819B1).

4. The contact-less chargeable battery according to claim 3,

Chung-Sik discloses contact-less chargeable battery according to claim 3 as set forth above.

wherein a magnetic field generated by the contact-less charging device is generated intermittently,

Chung-Sik discloses magnetic field generated by the contact-less charging device is generated intermittently (switches on/off transistor 70) (Fig. 2, page 8-4).

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and

Chung-Sik discloses a control signal (SCTL) output from the output port P1 of FIRST MICRO COMPUTER 48 is applied to a base of the transistor 70 through a resistor 72 and switches "on/off" the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between "low" and "high" depending on a period of the control signal (SCT) and the signal is applied to a base of the transistor 64." (Chung-Sik, English Translation, page 8-4 and Fig. 2).

Regarding charge pause detection unit and detecting a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, Chung-Sik discloses that the charging of battery continues until the detection voltage V2 in the overvoltage detection unit 54 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). The transition to logic "high" from logic "low" is considered a time point when the induction of high frequency AC current ends, and then outputting the end time point (charge completion) to the microprocessor. The microcomputer 56 is broadly considered the same as charging pause detecting unit that produces charging completion alarm when the voltage of battery is determined to be normal and completely charged.

Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

~~Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 13 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.~~

To the extent that Chung-Sik may not specifically disclose charging pause detecting unit it would have been obvious to modify the overvoltage monitoring unit disclosed by Chung-Sik by adding a charging pause detecting unit because Chung-Sik specifically disclosed battery begins to be charged from a "time point" and the charge operation may be automatically stopped by communication between devices.

wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Chung-Sik discloses wherein the monitoring result is transmitted to the external contact-less charging device 12 by means of wireless communication by RADIO UNIT 34. (Chung-Sik, page 8-5, lines 35-43, Fig. 1, 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 36 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

Although Chung-Sik did not specifically disclose communication while a high frequency AC current is not induced in the secondary coil after the end time point is input it would have been obvious for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious to modify overvoltage monitoring unit disclosed by Chung-Sik by transmitting monitoring result to the external charging device by means of wireless communication while a high frequency AC current is not

induced in the secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

10. The contact-less charging circuit module according to claim 9,

Chung-Sik discloses contact-less charging circuit module according to claim 9 as set forth above.

wherein a magnetic field generated by the contact-less charging device is generated intermittently,

Chung-Sik discloses magnetic field generated by the contact-less charging device is generated intermittently (switches on/off transistor 70) (Fig. 2, page 8-4).

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and

Chung-Sik discloses a control signal (SCTL) output from the output port P1 of FIRST MICRO COMPUTER 48 is applied to a base of the transistor 70 through a resistor 72 and switches "on/off" the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between "low" and "high" depending on a period of the control signal (SCTL) and the signal is applied to a base of the transistor 64." (Chung-Sik, page 8-4, Fig. 2).

Regarding detecting a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, Chung-Sik discloses that the charging of battery continues until the detection voltage V2 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). The transition to logic "high" from logic "low" is considered a time point when the induction of high frequency AC current ends, and then outputting the end time point (charge completion) to the microprocessor 56. The microcomputer 56 is broadly considered the same as charging pause detecting unit that produces charging completion alarm when the voltage of battery is determined to be normal and completely charged.

Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

To the extent that Chung-Sik may not specifically disclose a charging pause detecting unit it would have been obvious to modify the overvoltage monitoring unit disclosed by Chung-Sik by adding a charging pause detecting unit because Chung-Sik specifically disclosed battery begins to be charged from a "time point" and the charge operation may be automatically stopped by communication between devices.

wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Chung-Sik discloses wherein the monitoring result (VDL) output to second microprocessor 56 is transmitted to the external contact-less charging device by means of wireless communication by an antenna connected to radio unit 34. (Fig. 2, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

Although Chung-Sik did not specifically disclose communication while a high frequency AC current is not induced in the secondary coil after the end time point is input it would have been obvious for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to transmit a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the

secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

19. The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and

Chung-Sik discloses a high frequency power driving unit 44 (voltage switching unit) for intermittently applying a high frequency AC current by switching on/off transistor 70 to the magnetic field generating unit 46 (induce voltage generating unit) (Fig. 2, page 8-3).

wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.

Chung-Sik discloses wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication. (Chung-Sik, page 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Although Chung-Sik did not specifically disclose charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field

generating unit it would have been obvious for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to transmit a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

21. A battery charging set including a contact-less chargeable battery and a contact-less charging device, wherein the battery includes:

Chung-Sik discloses battery charging set including a contact-less chargeable battery and a contact-less charging device. (page 8-2, lines 6-7) (Fig. 1).

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;

Chung-Sik discloses high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external

contact-less charging device. (Fig. 2, page 8-4).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19) (Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See "constant voltage unit", page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See "voltage V1 is constant", page 8-5 line 5).

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced, wherein the charging device includes:

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field (page 8-2, lines 49-55) of the induced voltage generating unit 46 (Fig. 2) (page 8-3, lines 29-34; page 8-5, lines 35-43) (Fig. 2).

Chung-Sik further discloses wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication. (Chung-Sik, pages 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Although Chung-Sik did not specifically disclose transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced it would have been obvious for charging the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious to modify the overvoltage monitoring unit disclosed by Chung-Sik to transmit the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit for starting charging of the battery when voltage of the battery is determined to be less than normal.

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

Chung-Sik discloses magnetic field generating unit 46 (induced voltage generating unit) for receiving an AC current and forming a magnetic field in an outer space (space around coil 77). (Fig. 2, page 8-4).

a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and

Chung-Sik discloses a high frequency power driving unit 44 (voltage switching unit) for intermittently applying a high frequency AC current by switching on/off transistor 70 to the magnetic field generating unit 46 (induced voltage generating unit) (Fig. 2, page 8-3).

a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik discloses Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by wireless communication through antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the

battery 32 is adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Although Chung-Sik did not specifically disclose charging power adjusting unit 48 (first microcomputer) receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit 46 (induced voltage generating unit) it would have been obvious to do for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit for starting charging of the battery when voltage of the battery is determined to be less than normal.

22. The battery charging set according to claim 21,

Chung-Sik discloses battery charging set according to claim 21 as set forth above.

wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

23. A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:

Chung-Sik discloses method for controlling charging of a contact-less chargeable battery 32 in a portable device by means of electromagnetic induction phenomenon by inductively coupling a voltage from a charger 12 (base unit) to a portable device 18 comprising contactless charging unit 38 for charging chargeable battery 32 (page 8-2, lines 6-7) (Fig. 1).

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;

Chung-Sik discloses intermittently applying a high frequency AC current to a primary coil 77 provided to the charging device by a voltage switching unit 44 by turning on/off transistor 64 so as to intermittently generate a magnetic field in an outer region around coil 77 (Fig. 2).

(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;

Chung-Sik discloses linking a magnetic flux of the generated magnetic field of coil 77 to a secondary coil 79 provided to the battery 32 so as to intermittently output an electromagnetically-induced high frequency AC current (Fig. 2).

(c) rectifying the output high frequency AC current to be converted into a DC current;

Chung-Sik discloses rectifying the high frequency AC current output from coil 79 and converted into a DC current (Fig. 2, page 8-3).

The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting unit 81 that is inductively coupled to the induced voltage generating unit 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81.

(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;

Chung-Sik discloses applying the DC current to a battery cell 32 through a constant voltage/constant current supplier (80, 52) (see "constant voltage V1") so as to charge the battery cell in a constant voltage/constant current mode (Fig. 2, page 8-4, lines 59-62; page 8-5, line 5).

In this case, the rectified voltage IDC is input to a first voltage splitter 89, simultaneously limited to a predetermined level through the resistor 84 and the diode 86, then applied to the battery 32. That is, the battery 32 is charged. In the above case, the resistor 84 is a current limiter resistor, and the diode 86 is a diode for preventing countercurrent when the voltage IDC is lower than a voltage of the battery 32.

terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2

(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and

Chung-Sik discloses contactless charge device for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (Chung-Sik , English Translation, page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 2)(Chung-Sik , English Translation, page 8-2, lines 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

Although Chung-Sik did not specifically disclose communication while a high frequency AC current is not induced in the secondary coil it would have been obvious to do so for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to transmit a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.

Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication by antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

24. The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses method according to claim 23 as set forth above.

Chung-Sik discloses battery voltage detector circuit 54 includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

6.2 Chung-Sik, Cho (cl. 16-18)

Claims 16-18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Chung-Sik as applied to claim 15 above, and further in view of Cho Gyu Hyeong et al. (KR 100451606 B1)(Hereafter Cho et al).

16. The contact-less chargeable battery according to claim 15,

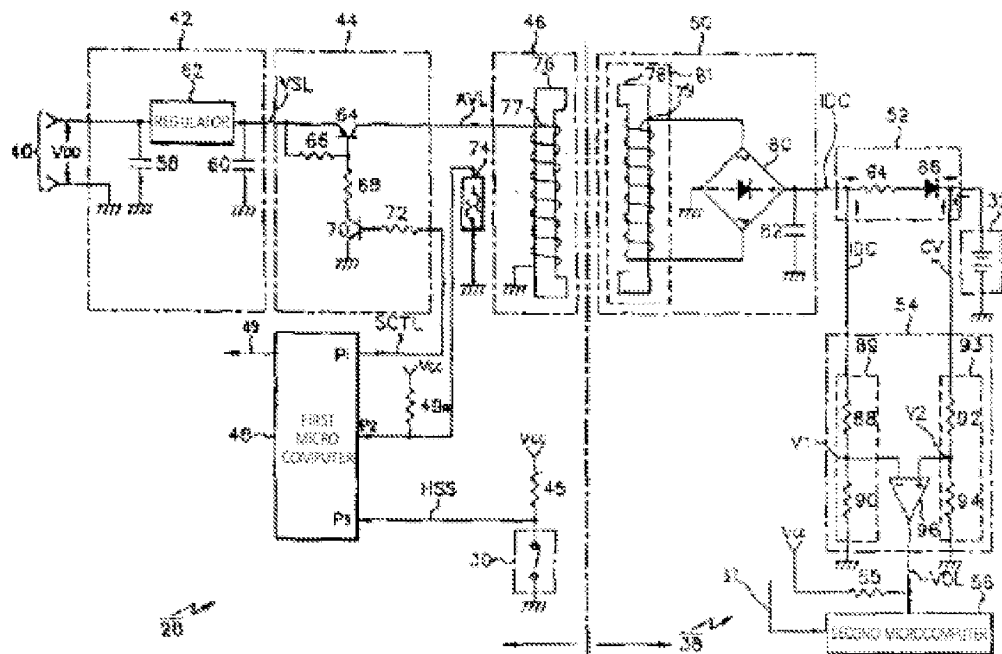
Chung-Sik discloses contact-less chargeable battery according to claim 15 as set forth above.

further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit,

Chung-Sik discloses constant voltage supplier 42 (constant voltage unit) that regulates the voltage input to power line 40 and outputting the voltage as a constant voltage, and then supplying a constant-voltage current to the high frequency power driving unit 44. Specifically, Chung-Sik discloses AC power having a period of about 10 KHZ is generated from a collector of the transistor 64 in the high frequency power driving unit 44. (Fig. 2, page 8-3, lines 24-27, page 8-4, lines 40-51).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

FIG. 2



Chung-Sik. Fig. 2

Chung-Sik did not disclose constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, because Chung-Sik receives 12 VDC directly from the power line 40 (Fig. 1, page 8-4, lines 4-5). However, if a DC power supply is not available it would have been obvious to one of ordinary skill in the art to add a rectifier for the conversion of power line AC voltage to DC.

In analogous art Cho et al. (KR 100451606 B1) disclosed AC / DC rectifier 11 receives a low frequency AC input voltage, such as 110V or 220V, and converts it into direct current Vdc (Fig. 1). Cho et al. (KR 100451606 B1) further discloses a constant voltage supplying part (DC/DC converter 12) for receiving the converted DC current Vdc and outputs a constant voltage current (Vdc). (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the contact-less charging device disclosed by Chung-Sik by adding a rectifier for rectifying the AC current received from AC power line to convert the AC current into a DC current disclosed by Cho et al. (KR 100451606 B1) and adding a constant voltage supplying part for receiving the converted DC current disclosed by Cho et al. (KR 100451606 B1) to output a constant voltage current.

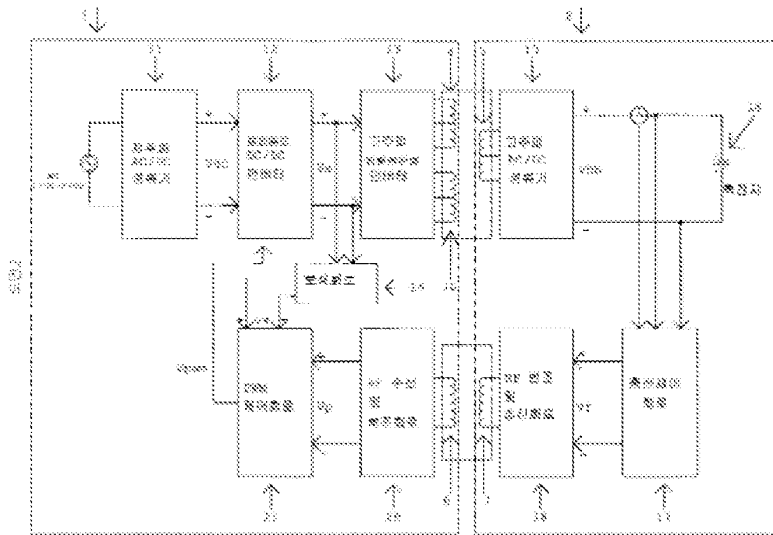


Fig. 2. Cho et al. (KR 100451606 B1)

wherein the high frequency power driving unit includes:

a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and

Chung-Sik discloses high frequency power driving unit (voltage switching unit 44) receives driving signal SCTL (control signal) of predetermined period is output from first microprocessor 48 and applied to voltage switching unit 44 (charge voltage generating unit 28 shown in Fig. 1) comprising transistors 72 and 64 (Fig. 2, page 8-3, lines 28-35. Chung-Sik specifically disclosed the charge voltage generating device includes a charge control pulse generator which generates a pulse sequence with a predetermined period. (Fig. 2, page 8-6, lines

21-24).

a charge voltage generating device including a charge control pulse generator which generates a pulse sequence with a predetermined period in response to input of a charge initiation signal, a voltage switch which converts and outputs a DC voltage at a predetermined level into an AC voltage in response to input of the generated pulse sequence, and a voltage

In an analogous art, Cho et al. disclosed contact-less chargeable battery comprising control circuit (PWM 21) configured to receive a control signal and generate a pulse width modulated signal (Vpwm) to be applied to the DC / DC converter to adjust the DC voltage (Fig. 2, Cho et al. English Translation, page 3, 2nd paragraph).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify Chung-Sik by adding pulse signal generator for generating a pulse width modulated signal (PWM) disclosed by Cho et al. for adjusting charging power for charging a contact-less chargeable battery.

a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.

Chung-Sik discloses power driving part (voltage switching unit 44) for receiving the pulse signal (SCTL) from the first microprocessor 48 to rapidly switch the constant-voltage current input from the constant voltage supplier 42, thereby generating a high frequency AC current in a pulse pattern (Fig. 2). Chung-Sik specifically discloses charge control pulse generator which generates a pulse sequence (pulse pattern) with a predetermined period. (Fig. 2, page 8-6, lines 21-24).

a charge voltage generating device including a charge control pulse generator which generates a pulse sequence with a predetermined period in response to input of a charge initiation signal, a voltage switch which converts and outputs a DC voltage at a predetermined level into an AC voltage in response to input of the generated pulse sequence, and a voltage

Additionally, Cho et al. disclosed power driving part (DC / DC converter 12) for receiving the pulse signal (Vpwm) to rapidly switch the constant-voltage current input from the constant voltage supplier Vdc, thereby generating a high frequency AC current in a pulse pattern input to winding 4 of transformer (Fig. 2).

17. The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.

Chung-Sik discloses contact-less charging device according to claim 16 as set forth above.

Chung-Sik discloses voltage switching unit 44 for switching a power voltage at a predetermined level in response to an input of a control signal SCTL with a predetermined period and converting and outputting an AC voltage. When the control signal (SCTL) is blocked, both the transistors 64 and 70 with respect to the voltage switching unit 44 are switched "off" to block a voltage of the AC line (AVL). Thus voltage switching unit 44 adjusts the charging power by switching on transistor 64 in response to the control signal SCTL with a predetermined period (Fig. 2, page 8-3, lines 28-33). Chung-Sik further discloses that the charging of battery continues until the detection voltage V2 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). Thus Chung-Sik discloses adjusting the charging power by providing a number of pulses until charge completion.

Additionally, Cho et al. disclosed control circuit (PWM 21) configured to receive a control signal and generates a pulse width modulated signal (V_{pwm}) to be applied to the DC / DC converter to adjust the DC voltage (Fig. 2, Cho et al. English Translation, page 3, 2nd paragraph).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify Chung-Sik by adding PWM that receives a control signal to generate a pulse width modulated signal (V_{pwm}) disclosed by Cho et al. for adjusting charging power for charging a battery.

18. The contact-less charging device according to claim 16,

Chung-Sik discloses contact-less charging device according to claim 16 as set forth above.

wherein the constant voltage supplier includes:

an overvoltage filter for receiving a common AC current and intercepting an overvoltage current.

Chung-Sik discloses an overvoltage filter by capacitor 58 for receiving the power supply 20 current and intercepting an overvoltage current (Fig. 2, page 8-4, lines 6-7).

power transmitter 28 inputs a power voltage through the line 40. The power of the line 40 may be filtered by a capacitor 58 in the constant voltage unit 42 and is input to the regulator 62. The regulator 62 (which is a model No. 78×8 regulator series according to the present invention) regulates the input voltage of 12 VDC and outputs the voltage to the power supplying line (VSL).

a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.

Chung-Sik discloses current passing through the filter is input to regulator 62 that provides regulated 12 VDC. (Fig. 2).

Chung-Sik did not disclose rectifying an AC current because Chung-Sik receives 12 VDC directly from the power line 40 (Fig. 1, page 8-4, lines 4-5). However, if a DC power supply is not available it would have been obvious to one of ordinary skill in the art to add a rectifier for the conversion of power line AC voltage to DC.

In analogous art Cho et al. (KR 100451606 B1) disclosed AC/DC rectifier 11 receives a low frequency AC input voltage, such as 110V or 220V, and converts it into direct current Vdc (Fig. 1). Cho et al. (KR 100451606 B1) further discloses a constant voltage supplying part (DC/DC converter 12) for receiving the converted DC current Vdc and outputs a constant voltage current (Vdc).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the contact-less charging device disclosed by Chung-Sik by adding a rectifier for rectifying the AC current received from AC power line to convert the AC current into a DC current disclosed by Cho et al. (KR 100451606 B1) and adding a constant voltage supplying part for receiving the converted DC current disclosed by Cho et al. (KR 100451606 B1) to output a constant voltage current.

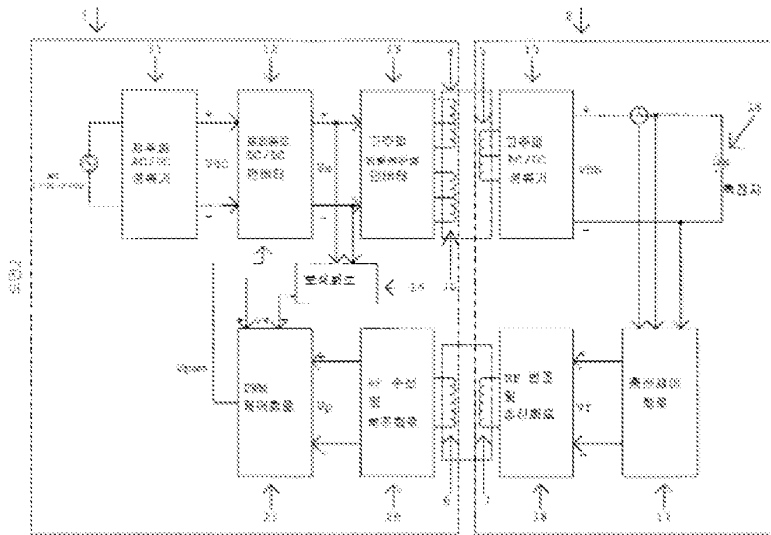


Fig. 2. Cho et al. (KR 100451606 B1)

7.0 CONCLUSION

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Fernandez et al (US 6,184,651 B1) published 2001-02-06, disclosed contactless charging system, charging energy is transferred across an inductive coupler to charge a battery (21) of a portable device, such as a two-way radio, cellular phone, paging device, or wireless communicator (Abstract, Fig. 1). The secondary charging device 19 is electrically coupled to a sensing device 38 which provides to a radio transceiver 35 a feedback signal indicative of a charging parameter of the secondary charging device 19, such as indicative of a charging voltage. The radio transceiver 35 preferably comprises an encoder/decoder to encode a signal for radio transmission through antenna 37 of radio transceiver 35. The radio signal from antenna 37

is received wirelessly by antenna 52 of transceiver 39 providing feedback to primary controller 11. The primary controller 11 then uses the feedback control signal, such as to regulate a parameter of the charging process, a charging signal voltage, and/or a cycling rate, and thereby improving the efficiency of the overall charging process and the energy transfer to the battery 21 (Fig. 3).

Kubota et al. (US 7208915) published 2007-04-24, foreign priority date 2004-09-30 disclosed constant current battery charger includes voltage monitor (Fig. 1).

Extensions of Time

Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that *ex parte* reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extensions of time in *ex parte* reexamination proceedings are provided for in 37 CFR 1.550(c).

Waiver of Right to File Patent Owner Statement

In a reexamination proceeding, Patent Owner may waive the right under 37 C.F.R. 1.530 to file a Patent Owner Statement. The document needs to contain a statement that Patent Owner waives the right under 37 C.F.R. 1.530 to file a Patent Owner Statement and proof of service in the manner provided by 37 C.F.R. 1.248, if the request for reexamination was made by a third party requester, see 37 C.F.R. 1.550(f). The Patent Owner may consider using the following statement in a document waiving the right to file a Patent Owner Statement:

Patent Owner waives the right under 37 C.F.R. 1.530 to file a Patent Owner Statement.

Amendment in Reexamination Proceedings

Patent owner is notified that any proposed amendment to the specification and/or claims in this reexamination proceeding must comply with 37 CFR 1.530(d)-(j), must be formally presented pursuant to 37 CFR § 1.52(a) and (b), and must contain any fees required by 37 CFR § 1.20(c). See MPEP § 2250(IV) for examples to assist in the preparation of proper proposed amendments in reexamination proceedings.

Submissions

If the patent owner fails to file a timely and appropriate response to any Office action or any written statement of an interview required under 37 CFR § 1.560(b), the *ex parte* reexamination proceeding will be terminated, and the Director will proceed to issue a certificate under 37 CFR § 1.570 in accordance with the last Office action.

Service of Papers

After the filing of a request for reexamination by a third party requester, any document filed by either the patent owner or the third party requester must be served on the other party (or parties where two or more third party requester proceedings are merged) in the reexamination proceeding in the manner provided in 37 CFR 1.248. See 37 CFR 1.550(f).

Notification of Concurrent Proceedings

The patent owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving Patent No. US 8,013,568B2 throughout the course of this reexamination proceeding. The third

party requester is also reminded of the ability to similarly apprise the Office of any such activity or proceeding throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282 and 2286.

All correspondence relating to this ex parte reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
 Central Reexamination Unit
 Commissioner for Patents
 United States Patent & Trademark Office
 P.O. Box 1450
 Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
 Central Reexamination Unit

By hand: Customer Service Window
 Randolph Building
 401 Dulany Street
 Alexandria, VA 22314

Any inquiry concerning this communication should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

/ANJAN K DEB/
Primary Examiner, Art Unit 3992

Conferees:

/FRED O FERRIS III/
Reexamination Specialist, Art Unit 3992

/M.F/
Supervisory Patent Examiner, Art Unit 3992



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,355	03/12/2021	8013568	0313071.00020	1538
24573	7590	07/09/2021	EXAMINER	
K&L Gates LLP-Chicago			DEB, ANJAN K	
P.O. Box 1135				
Chicago, IL 60690				
			ART UNIT	PAPER NUMBER
			3992	
			MAIL DATE	DELIVERY MODE
			07/09/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<i>Ex Parte Reexamination Interview Summary</i>	Control No. 96/000,355	Patent Under Reexamination 8013568	
	Examiner ANJAN K DEB	Art Unit 3992	AIA (FITF) Status No
	All participants (USPTO personnel, patent owner, patent owner's representative):		
(1) <u>ANJAN DEB</u>	(3) _____		
(2) <u>Matthew S. Dicke</u>	(4) _____		
Date of Interview: <u>08 July 2021</u> Type: a) ☒ Telephonic b) ☐ Video Conference c) ☐ Personal (copy given to: 1) ☐ patent owner 2) ☐ patent owners representative) Exhibit shown or demonstration conducted: d) ☐ Yes e) ☒ No. If Yes, brief description: _____ Agreement with respect to the claims f) ☐ was reached. g) ☐ was not reached. h) ☒ N/A. Any other agreement(s) are set forth below under "Description of the general nature of what was agreed to..." Claim(s) discussed: <u>N/A</u> . Identification of prior art discussed: <u>N/A</u> . Description of the general nature of what was agreed to if an agreement was reached, or any other comments: <u>See Continuation Sheet</u> . (A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims patentable, if available, must be attached. Also, where no copy of the amendments that would render the claims patentable is available, a summary thereof must be attached.) A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION MUST INCLUDE PATENT OWNER'S STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. (See MPEP § 2281). IF A RESPONSE TO THE LAST OFFICE ACTION HAS ALREADY BEEN FILED, THEN PATENT OWNER IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO PROVIDE THE MANDATORY STATEMENT OF THE SUBSTANCE OF THE INTERVIEW (37 CFR 1.560(b)). THE REQUIREMENT FOR PATENT OWNERS STATEMENT CAN NOT BE WAIVED. EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).			
/ANJAN K DEB/ Primary Examiner, Art Unit 3992			
cc: Requester (if third party requester)			

Continuation of Description of the general nature of what was agreed to if an agreement was reached, or any other comments: Examiner called Attorney Matthew S. Dicke regarding the Office Action (Non-Final Rejection) mailed on 6/30/2021 concerning application # 96/000,355 and left voice message to inform him that the time period to respond to the Office Action is two months from the mailing date of the Office Action. The time period in PTOL-466 Form item (c) was blank due to a clerical error.

Electronic Acknowledgement Receipt	
EFS ID:	43391636
Application Number:	96000355
International Application Number:	
Confirmation Number:	1538
Title of Invention:	CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF
First Named Inventor/Applicant Name:	8013568
Customer Number:	24573
Filer:	Matthew S. Dicke/Meg Boinski
Filer Authorized By:	Matthew S. Dicke
Attorney Docket Number:	0313071.00020
Receipt Date:	30-JUL-2021
Filing Date:	12-MAR-2021
Time Stamp:	15:17:44
Application Type:	Supplemental Examination
Patent Number:	

Payment information:

Submitted with Payment	no				
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Misc Item of Information	0313071-00020_InformalWrittenStatement.pdf	199105 928c57b40f8d829d56cd96c5931a02088775dd1a	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			199105		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner: LS CABLE & SYSTEM LTD.
Reexam. Proc. No.: 96/000,355
Conf. No.: 1538
Filed: March 12, 2021
Title: CONTACT-LESS CHARGEABLE BATTERY AND CHARGING
DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL
METHOD THEREOF
Art Unit: 3992
Examiner: Anjan K Deb
Docket No.: 0313071.00020

STATEMENT OF ISSUES TO BE DISCUSSED IN TELEPHONE INTERVIEW

Dear Examiner Anjan K Deb:

For the telephone interview scheduled on Tuesday, August 10, 2021 at 11AM (EST), the undersigned representative of the patent owner would like to discuss the Non-Final Office Action mailed June 30, 2020 for *Ex Parte* Reexamination proceeding no. 96/000,355. In particular, the undersigned would like to discuss:

1. The rejection of claims 1-3, 5-9, 11-15, and 20 under 35 U.S.C. 102 as allegedly being anticipated by Korean Patent No. KR 950005819 (“Chung-Sik”);
2. The rejection of claims 4, 10, 19, and 21-24 under 35 U.S.C. 103 as allegedly being obvious over Chung-Sik;
3. The rejection of claims 16-18 under 35 U.S.C. 103 as allegedly being unpatentable over Chung-Sik in view of Korean Patent No. KR 100451606 (“Cho”);
4. Chung-Sik’s failure to teach or suggest the claimed “constant voltage/constant current supplier” recited in independent claim 1 and similar features recited in independent claims 7, 13, 21, and 23;
5. Chung-Sik’s failure to teach or suggest the claimed “overvoltage monitoring unit” recited in independent claim 1, and similar features recited in independent claims 7, 13, 21, and 23; and
6. Chung-Sik’s principle of operation, intended purpose, and other disclosures in Chung-Sik that indicate non-obviousness of the claimed invention over Chung-Sik or that teach away

from modifying Chung-Sik when attempting to establish a *prima facie* case of obviousness against the claims.

The undersigned thanks the Examiner for their time and attention in this matter. The Examiner is invited to call the undersigned should the Examiner wish to re-schedule the telephone interview or should the Examiner have any questions in advance of the telephone interview.

Respectfully submitted,

K&L GATES LLP

BY: /Matthew S. Dicke/

Matthew S. Dicke

Reg. No. 58,819

Customer No. 24573

Phone: (312) 578-5415

Dated: July 30, 2021



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,355	03/12/2021	8013568	0313071.00020	1538
24573	7590	08/12/2021	EXAMINER	
K&L Gates LLP-Chicago			DEB, ANJAN K	
P.O. Box 1135				
Chicago, IL 60690				
			ART UNIT	PAPER NUMBER
			3992	
			MAIL DATE	DELIVERY MODE
			08/12/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<i>Ex Parte Reexamination Interview Summary</i>	Control No. 96/000,355	Patent Under Reexamination 8013568	
	Examiner ANJAN K DEB	Art Unit 3992	AIA (FITF) Status No
All participants (USPTO personnel, patent owner, patent owner's representative):			
(1) <u>ANJAN DEB</u>	(3) <u>Fred Ferris</u>		
(2) <u>Hetul Patel</u>	(4) <u>Matthew S. Dicke & Sherif Mahmoud</u>		
Date of Interview: <u>10 August 2021</u> Type: a) ☒ Telephonic b) ☐ Video Conference c) ☐ Personal (copy given to: 1) ☐ patent owner 2) ☐ patent owners representative) Exhibit shown or demonstration conducted: d) ☐ Yes e) ☒ No. If Yes, brief description: _____ Agreement with respect to the claims f) ☐ was reached. g) ☒ was not reached. h) ☐ N/A. Any other agreement(s) are set forth below under "Description of the general nature of what was agreed to..." Claim(s) discussed: <u>1</u> . Identification of prior art discussed: <u>Chung-Sik(KR950005819BI)</u> . Description of the general nature of what was agreed to if an agreement was reached, or any other comments: <u>See Continuation Sheet</u> . (A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims patentable, if available, must be attached. Also, where no copy of the amendments that would render the claims patentable is available, a summary thereof must be attached.) A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION MUST INCLUDE PATENT OWNER'S STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. (See MPEP § 2281). IF A RESPONSE TO THE LAST OFFICE ACTION HAS ALREADY BEEN FILED, THEN PATENT OWNER IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO PROVIDE THE MANDATORY STATEMENT OF THE SUBSTANCE OF THE INTERVIEW (37 CFR 1.560(b)). THE REQUIREMENT FOR PATENT OWNERS STATEMENT CAN NOT BE WAIVED. EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).			
/ANJAN K DEB/ Primary Examiner, Art Unit 3992	/F.O.F/ Reexamination Specialist, Art Unit 399	/HBP/	
cc: Requester (if third party requester)			

Continuation of Description of the general nature of what was agreed to if an agreement was reached, or any other comments: Applicant's representative mainly discussed Items # 4 and # 5 of the Agenda filed on 7/30/2021, and described how claim 1 of the '568 patent distinguished over the prior art (Chung-Sik). Examiner explained how Chung-Sik disclosed the "constant voltage/constant current supplier" (Agenda item #4) and the "overvoltage monitoring unit" (Agenda item #5) according to broadest reasonable interpretation of the terms. Examiners further explained that claim 1 and similarly some other claims are subject to interpretation under 112 6th paragraph and suggested to Applicants to provide support in the specification for the functional language recited in apparatus claims in the next response. No agreement was reached regarding patentability of the claims.

REMARKS

Claims 1-24 of U.S. Patent No. 8,013,568 (hereinafter “the ‘568 patent”) were subject to reexamination, of which claims 1, 7, 13, 21, and 23 are independent. In the Non-Final Office Action mailed June 30, 2021, claims 1-24 stand rejected. Claims 1-3, 5-9, 11-15, and 20 were rejected under 35 U.S.C. 102 as allegedly being anticipated by Korean Patent No. KR950005819B1 (hereinafter “Chung-Sik”). Claims 4, 10, 19, and 21-24 were rejected under 35 U.S.C. 103 as allegedly being unpatentable over Chung-Sik. Claims 16-18 were rejected under 35 U.S.C. 103 as allegedly being unpatentable over Chung-Sik in view of Korean Patent No. KR100451606B1 (hereinafter “Cho”).

With the present response, claims 3, 9, 11-12, and 16 are amended and new claims 25-48 are added. No new matter was added with these amendments. These amendments do not enlarge the scope of the original patent claims. Favorable reconsideration of the pending claims and allowance of the new claims is respectfully requested in light of the following remarks.

1. Statement of Issues Discussed During Telephone Interview

The Patent Owner thanks the Examiners for the telephone interview conducted on August 10, 2021 between the Examiners and the Patent Owner’s Representatives, Matthew S. Dicke (USPTO Reg. No. 58,819) and Sherif N. A. Mahmoud (USPTO Reg. No. 71,860).

During the interview, the parties discussed the claimed invention, technical problems solved by the claimed invention, and the pending claim rejections.

The parties also discussed Chung-Sik’s system, Chung-Sik’s principle of operation, and other disclosures in Chung-Sik.

The parties also discussed Patent Owner’s proposed arguments regarding how the pending claims are patentably distinguished over Chung-Sik.

The parties also discussed Patent Owner’s proposed arguments regarding the claimed “constant voltage/constant current supplier” (listed as item #4 in the interview agenda submitted on July 30, 2021) and the claimed “overvoltage monitoring unit” (listed as item #5 in the interview agenda). The Examiners explained their interpretation of the claim limitations recited in claim 1 in view of the pending claim rejections.

The Examiners also suggested that some of the limitations recited in claim 1 may be subject to interpretation under 35 U.S.C. 112, sixth paragraph. The Examiners suggested that the Patent

Owner consider pointing to support in the specification (with the present response) for various claim limitations recited in claim 1.

No agreement was reached regarding patentability of the claims. The Patent Owner thanks the Examiners for their time and consideration.

2. Treatment under 35 U.S.C. 112, Sixth Paragraph

As noted above, during the telephone interview, the Examiners suggested that some of the limitations in claim 1 may be subject to an interpretation under 35 U.S.C. 112, sixth paragraph. Patent Owner first respectfully notes that an interpretation under 35 U.S.C. 112, sixth paragraph was not formally invoked in the Office Action and is not an active part of the present formal record. To the extent such an interpretation were to be formally invoked or in the event of any new ground of rejection, Patent Owner respectfully submits a non-final office action would be required.

With this said and out of an abundance of caution, Patent Owner expressly asserts that the pending claims were not intended to be and should not be interpreted as means-plus-function claims under 35 U.S.C. 112, sixth paragraph. If persons of ordinary skill in the art reading the specification understand a term to have a sufficiently definite meaning as the name for the structure that performs the function, even when the term covers a broad class of structures or identifies the structures by their function (e.g., “filters,” “brakes,” “clamp,” “screwdriver,” and “locks”), 35 U.S.C. 112 sixth paragraph will not apply. *See* MPEP 2181(I)(A); *Apex Inc. v. Raritan Computer, Inc.*, 325 F.3d 1364, 1372-73, 66 USPQ2d 1444, 1451-52 (Fed. Cir. 2003); *CCS Fitness*, 288 F.3d at 1369, 62 USPQ2d at 1664; *Watts v. XL Sys. Inc.*, 232 F.3d 877, 880-81, 56 USPQ2d 1836, 1839 (Fed. Cir. 2000); *Personalized Media*, 161 F.3d at 704, 48 USPQ2d at 1888; *Greenberg v. Ethicon Endo-Surgery, Inc.*, 91 F.3d 1580, 1583, 39 USPQ2d 1783, 1786 (Fed. Cir. 1996) (“Many devices take their names from the functions they perform.”). A term is not required to denote a specific structure or a precise physical structure to avoid the application of 35 U.S.C. 112, sixth paragraph. *See* MPEP 2181(I)(A); *Watts*, 232 F.3d at 880, 56 USPQ2d at 1838; *Inventio AG v. Thyssenkrupp Elevator Americas Corp.*, 649 F.3d 1350, 99 USPQ2d 1112 (Fed. Cir. 2011) (holding that the claim terms “modernizing device” and “computing unit” when read in light of the specification connoted sufficient, definite structure to one of skill in the art to preclude application of 35 U.S.C. 112, sixth paragraph); *Mass. Inst. of Tech.*, 462 F.3d at 1355-1356, 80 USPQ2d at 1332 (the court found the recitation of “aesthetic correction circuitry” sufficient to avoid pre-AIA 35 U.S.C. 112,

sixth paragraph, treatment because the term circuit, combined with a description of the function of the circuit, connoted sufficient structure to one of ordinary skill in the art.).

Persons of ordinary skill in the art reading the specification of the '568 patent would recognize that recited claim terms have a sufficient definite meaning as the name for structure. The recited claim terms are also modified by sufficient structure, material, and/or acts for a person skilled in the art reading the specification to recognize that the recited claim terms, together with the functions, structures, materials, and/or acts recited in the claims, connote sufficient definite structure.

The specific claim features discussed during the telephone interview (*e.g.*, constant voltage/constant current supplier and overvoltage monitoring unit) are well supported by the specification, connote sufficient definite structure to persons skilled in the art reading the specification, and each and every word of the claims should be given patentable weight. For the Examiners' convenience, while such support is not being offered for an interpretation under 35 U.S.C. 112, sixth paragraph, support for the claimed "constant voltage/constant current supplier" is found at least at column 2, lines 13-20; column 7, lines 33-44; and column 10, lines 39-44 of the specification. Furthermore, support for the claimed "overvoltage monitoring unit" is found at least at column 4, lines 14-45 and column 7, lines 43 to column 8, line 63.

3. Status of the Claims

Claims 1-48 are currently pending, of which claims 1, 7, 13, 21, and 23 are independent.

Claims 3 and 9 are amended to correct typographical errors. Support for these amendments is found at least at column 8, lines 56 to 63; column 10, lines 10-13; column 11 lines 15-18; and Figs. 3 and 5.

Claims 11 and 12 are amended to correct typographical errors in their dependency. Support for these amendments is found at least at column 4, lines 18-22 and column 11, lines 58-61.

Claim 16 is amended to correct a typographical error. Support for this amendment is found at least at column 8, lines 20-28.

Claims 25-48 are newly added claims.

Support for new claims 25, 30, 35, and 40 is found at least at column 2, lines 13-20 (example specifying that the constant voltage/constant current supplier is a circuit element); column 4, lines 28-37 (example illustrating circuitry of the overvoltage monitoring unit and the role of the microprocessor); column 7, lines 33-63 (example illustrating control of the constant

voltage/constant current supplier by the microprocessor); column 8, lines 32-53; column 9, lines 13-21; column 10, lines 1-5; column 10, lines 39-44; column 10, line 49 to column 11, line 15; column 11, lines 32-45; column 11, lines 53-61; and column 11, line 66 to column 12, line 17. Support is also found in Figs. 3 and 5.

Support for new claims 26, 31, 36, 41, and 48 is found at least at column 8, lines 5-9; column 9, lines 22-34; and column 11, lines 35-51.

Support for new claims 27, 32, 37, 42, and 45 is found at least at Figs. 3 and 5; column 7, lines 50-55; column 8, lines 32-41; and column 10, lines 59-67.

Support for new claims 28, 33, 38, 43, and 46 is found at least at column 2, lines 15-20; column 7, lines 36-42; and column 10, lines 39-44.

Support for new claims 29, 34, 39, 44, and 47 is found at least at column 2, lines 15-20; and column 10, lines 39-44.

4. Response to Claim Rejections

As noted above, claims 1-3, 5-9, 11-15, and 20 were rejected under 35 U.S.C. 102 as allegedly being anticipated by Chung-Sik. Claims 4, 10, 19, and 21-24 were rejected under 35 U.S.C. 103 as allegedly being unpatentable over Chung-Sik. Claims 16-18 were rejected under 35 U.S.C. 103 as allegedly being unpatentable over Chung-Sik in view of Cho.

The rejections of claims 1-24 are respectfully traversed. Chung-Sik and Cho, alone or in combination, do not teach or suggest all features of any of the independent claims 1, 7, 13, 21, and 23.

a. Claims 1-6 and 25-29

Independent claim 1 recites:

Claim 1: A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

The Office seems to have identified Chung-Sik's portable device 18 (illustrated in Fig. 1 of Chung-Sik) as allegedly corresponding to the claimed "contact-less chargeable battery" recited in claim 1. *See* Office Action, p. 5 ("Chung-Sik discloses system for charging a battery 32 in a portable device by inductively coupling a voltage from a charger 12 (base unit) to a portable device 18. Inductively coupling a voltage from a charger to a portable device 18 is considered the same as contact-less chargeable battery (page 8-2, lines 6-7) (Fig. 1)").

However, neither Chung-Sik's portable device 18 nor Chung-Sik's contactless charging unit 38 (illustrated in Fig. 2 of Chung-Sik) includes all the elements of the contact-less chargeable battery recited in claim 1.

i. Chung-Sik fails to teach or suggest a constant voltage/constant current supplier that receives a DC current from a rectifier and that supplies a charging power to a battery cell in a constant voltage/constant current mode

All words in a claim must be considered in judging the patentability of that claim against the prior art. MPEP 2143.03; *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Moreover, the elements in the prior art must be arranged as required by the claim. *See* MPEP 2131.

Chung-Sik does not include any disclosure that teaches or suggests a constant voltage/constant current supplier that: (1) receives the DC current from the rectifier and (2) supplies a charging power to the battery cell (3) in a constant voltage/constant current mode. The entirety of Chung-Sik does not mention any particular element of the portable device 18 or the contactless charging unit 38 that encompasses all these limitations. In fact, none of the elements described in Chung-Sik is arranged as required by the claim and encompasses all the recited claim limitations of the claimed constant voltage/constant current supplier.

The Office Action has also failed to identify such disclosure. In particular, the Office Action incorrectly alleges that:

Chung-Sik discloses constant voltage/current supplier for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a

constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage) (See “voltage V1 is constant”, page 8-5 line 5). Since voltage V1 is constant it is supplying a charging power to the battery cell in a constant voltage/constant current mode.

(Emphasis added). (Office Action, p. 6).

Patent Owner respectfully disagrees. Chung-Sik’s alleged constant voltage unit (identified by the Office Action above) does not correspond to the claimed constant voltage/constant current supplier. In particular, Chung-Sik’s alleged constant voltage unit 42 does not receive a DC current from a rectifier or supply a charging power to a battery cell.

Chung-Sik states that “[i]n the drawings, 42 is a constant voltage unit for regulating a voltage input to the power line 40 and outputting the voltage as a constant voltage, and includes a regulator 62 for regulating an input power voltage (Vcc) to outputting the same as a predetermined voltage, and noise removing capacitors 58 and 60 which are connected between the input and terminal ends of the regulator 62” (emphasis added). (Page 8-3, lines 24-27). As shown in Fig. 1 of Chung-Sik, the power transmitter 28 of the base unit 12 (not the portable device 18) is the only component that receives the voltage input to the power line 40. Further, as shown in Fig. 2 of Chung-Sik, the constant voltage unit 42 is included in Chung-Sik’s power transmitter 28 of the base unit 12 (not the portable device 18).

Thus, Chung-Sik’s constant voltage unit 42 at best receives the input power voltage (Vcc) from the power supply 20 and outputs a predetermined voltage (VSL) to voltage switching unit 44. Claim 1, on the other hand, specifically recites “a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode” (emphasis added). *See, e.g.*, ‘568 at column 7, lines 33-42 and column 10, lines 39-44.

In fact, Chung-Sik’s constant voltage unit 42 is not even part of Chung-Sik’s portable device 18 or Chung-Sik’s contactless charging unit 38 (where Chung-Sik’s rectifier 80 and Chung-Sik’s battery 32 are disposed). Rather, Chung-Sik’s alleged constant voltage unit 42 is disposed in a different physical device (the base unit 12), which does not include the rectifier 80 or the battery 32, as clearly shown in Fig. 2 of Chung-Sik. Thus, Chung-Sik’s constant voltage unit 42 is clearly not the “constant voltage/constant current supplier for receiving the DC current from the

rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode” (emphasis added) recited in claim 1.

More generally, the Patent Owner has not found any teaching or suggestion in Chung-Sik of a “constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode” as recited in claim 1.

The Office Action also seems to suggest that Chung-Sik’s charging unit 52 may correspond to the claimed “constant voltage/constant current supplier.” (Office Action, p. 6). However, Chung-Sik’s charging unit 52 does not encompass the claimed “constant voltage/constant current supplier” according to all the recited claim limitations.

Chung-Sik teaches that “52 is a charging unit configured in such a way that a resistor 84 and a diode 86 are connected in series to each other between the battery 32 and an output terminal of the rectifier 80, and which outputs a charge voltage of the battery 32 using output of the rectifier 80 in one direction” (emphasis added). (Fig. 2 and page 8-3, lines 53-55). In view of this description in Chung-Sik, it is not clear if or how charging unit 52 would even be capable of charging battery 32 in a constant voltage/constant current mode.

Therefore, at best, Chung-Sik seems to describe a charging unit 52 that “outputs a charge voltage of the battery 32 using output of the rectifier 80 in one direction.” Claim 1, on the other hand, specifically recites a “constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode” (emphasis added).

Notably, the entirety of Chung-Sik does not mention any example in which the charging unit 52 is a constant voltage/constant current supplier (or any other circuit element of the type capable of charging a battery in a constant voltage/constant current mode). For the sake of comparison, the specification of the present patent describes example constant voltage/constant current suppliers at least at column 2, lines 13-20 and column 7, lines 33-44, among other examples in the specification. In contrast, the entirety of Chung-Sik does not even seem to suggest whether a constant voltage/constant current supplier can be incorporated in Chung-Sik’s portable device 18 or contactless charging unit 38 as an alternative or additional component, nor does Chung-Sik seem to disclose any motivation for making such a modification.

The Office Action also seems to suggest that Chung-Sik's Voltage V1 illustrated at Fig. 2 of Chung-Sik may correspond to the claimed constant voltage/constant current supplier. Office Action, p. 6. However, the voltage V1 is only a reference voltage and not a physical component or circuit element in Chung-Sik's portable unit 18 / contactless charging unit 38. See Chung-Sik, page 8-5, line 5. Thus, Chung-Sik's reference voltage V1 cannot correspond to the claimed "constant voltage/constant current supplier." At best, Chung-Sik's reference voltage V1 seems to be a value at a node, and thus clearly not a supplier (or other circuit component) that receives the DC current from the rectifier and supplies the charging power to the battery cell in a constant voltage/constant current mode.

For at least the foregoing reasons, Chung-Sik fails to teach or suggest a "constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode" according to all of the recited claim limitations.

ii. Chung-Sik fails to teach or suggest an overvoltage monitoring unit that transmits a monitoring result so as to induce a change of intensity of the magnetic field

Chung-Sik does not teach or suggest "an overvoltage monitoring unit monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field" (emphasis added), as recited in claim 1.

The Office Action seems to have identified Chung-Sik's battery voltage detector 54 as allegedly corresponding to the claimed "overvoltage monitoring unit." See Office Action, p. 6.

Chung-Sik states that "54 is a battery voltage detector and includes first and second voltage splitters 89 and 93 for comparing a voltage of an input terminal of the charging unit 52 with a voltage of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 and outputting a charge state signal (VDL)" (emphasis added). (Page 8, lines 56-58). In Chung-Sik, "when the detection voltage V2 becomes higher than the reference voltage V1, ... the second microcomputer 56 ... determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122 ... The first microcomputer 48 that receives ... the charge completion

signal ... from the portable device 18 ... performs operation 112.” (Page 8-5, lines 32-43). In particular, Chung-Sik teaches that “the first computer 48 jumps to operation 112 to stop charging.” (Page 8-5, line 31).

Thus, at best, Chung-Sik seems to describe a battery voltage detector 54 that outputs a charge completion alarm signal when the battery 32 is fully charged, which causes a first computer 48 (of the base unit 12) to stop charging or switch off charging the battery 32. In other words, Chung-Sik at best seems to teach switching on or off the charging of the battery (by transmitting a charge state signal (VDL)) when the battery 32 is fully charged or when the portable device 18 is mounted onto the base unit 12.

Claim 1, on the other hand, specifically recites “an overvoltage monitoring unit monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field [generated from the external contact-less charging device]” (emphasis added).

Moreover, Chung-Sik seems to teach away from changing the intensity of the magnetic field while charging the battery 32. In particular, Chung-Sik’s disclosed principle of operation provides no motivation for changing the intensity of the magnetic field while charging the battery 32. Chung-Sik assumes that the battery 32 will only be charged when the portable device 18 and the base unit 12 are in a specific spatial arrangement, namely Chung-Sik’s base unit 12 charges the battery 32 only when the portable device 18 is mounted to the base unit 12. For example, Chung-Sik states that “the battery may be recharged only when the portable device 18 is installed on the base unit 12.” Page 8-2, lines 59-60. Chung-Sik also states that “when a portion of the contactless charging unit 38 of the portable device 18 is mounted (positioned) on the power transmitter 28 of the base unit 12, a charge switch 30 of the base unit 12 is started (turned “on”) by the mounting of the portable device 18. Page 8-2, line 62 to page 8-3, line 2. In Chung-Sik, “when the portable device 18 is separated from the base unit 12, the charge switch 30 is “turned off”. Page 8-3, lines 11-14. Further, in Chung-Sik, “when the two devices are coupled to each other, the core 78 of the induced voltage detecting unit 81 installed on the contactless charging unit 38 in the portable device 18 is positioned on an opposite surface of the core 76 of the induced voltage generating unit 46 in the power transmitter 28 and is space-coupled thereto” (emphasis added). Page 8-4, lines 20-25.

Thus, Chung-Sik seems to suggest that the portable device 18 does not need to induce any changes to the intensity of the magnetic field while charging the battery 32, because Chung-Sik charges the battery 32 only when the base unit 12 and the portable device 18 are at a fixed relative spatial relationship to one another. This is in contrast to the exact technical problem presented in the subject patent, which “solve[s] a restriction for the relative positions between the chargeable battery and the charging device when charging the battery in a contact-less charging method...”). *See* ‘568 at column 3, lines 25-34.

For at least the reasons stated above, Chung-Sik fails to teach or suggest an overvoltage monitoring unit that transmits a monitoring result so as to induce a change of intensity of the magnetic field.

iii. Claims 1-6 and 25-29 are allowable over Chung-Sik and Cho

Cho does not make up for the shortcomings of Chung-Sik set forth above.

For at least the foregoing reasons, independent claim 1 is allowable over Chung-Sik and Cho, taken alone or in combination. Claims 2-6 and 25-29 are allowable for at least the reason that they depend from allowable claim 1.

b. Claims 7-12 and 30-34

Independent claim 7 recites:

Claim 7: A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:
a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;
a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;
a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and
an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Chung-Sik and Cho fail to teach or suggest the claimed “constant voltage/constant current supplier” and the claimed “overvoltage monitoring unit” recited in claim 7 (and similarly recited in claim 1).

Thus, for at least the same reasons stated above in response to the rejection of claim 1, independent claim 7 is also allowable over Chung-Sik and Cho. Dependent claims 6-12 and 30-34 are allowable for at least the reason that they depend from allowable claim 7.

c. Claims 13-20 and 35-39

Independent claim 13 recites:

Claim 13: A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and

a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik and Cho fail to teach or suggest the claimed “constant voltage/constant current supplier” recited in claim 13, for at least the same reasons described above in the response to the rejection of claims 1 and 7. Further, Chung-Sik and Cho fail to teach or suggest the claimed “charging power adjusting unit” recited in claim 13, which adjusts the power applied to the magnetic field based on a monitoring result provided by a contact-less chargeable battery, for at least some of the same reasons described above in connection with the “overvoltage monitoring unit” of claim 1.

For at least the foregoing reasons, independent claim 13 is allowable over Chung-Sik and Cho. Dependent claims 14-20 and 35-39 are also allowable for at least the reason that they depend from allowable claim 13.

d. Claims 21-22 and 40-44

Independent claim 21 recites:

Claim 21: A battery charging set including a contact-less chargeable battery and a contact-less charging device,
wherein the battery includes:

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contactless charging device;

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode; and

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,

wherein the charging device includes:

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and

a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik and Cho fail to teach or suggest the claimed “constant voltage/constant current supplier” and the claimed “overvoltage monitoring unit” recited in claim 21, for at least the same reasons described above in the response to the rejection of claims 1 and 7.

For at least the foregoing reasons, independent claim 21 is allowable over Chung-Sik and Cho. Dependent claims 22 and 40-44 are also allowable for at least the reason that they depend from allowable claim 21.

e. Claims 23-24 and 45-48

Independent claim 23 recites:

Claim 23: A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:

(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;

(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;

(c) rectifying the output high frequency AC current to be converted into a DC current;

(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;

(e) monitoring voltages at both ends of the constant voltage/ constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and

(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.

Chung-Sik and Cho fail to teach or suggest the claimed “constant voltage/constant current supplier” recited in claim 23, for at least some of the reasons described above with respect to the “constant voltage/constant current supplier” in the response to the rejection of claims 1 and 7.

For at least the foregoing reasons, independent claim 23 is allowable over Chung-Sik and Cho. Dependent claims 24 and 45-48 are also allowable for at least the reason that they depend from allowable claim 23.

f. New claims 25, 30, 35, and 40

In addition to the reasons stated above, claims 25, 30, 35, and 40 are also allowable for the following reasons as well.

Claim 25 recites, *inter alia*, “wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.” Claim 25 provides further structural specifics and further distinguishes the claimed overvoltage monitoring unit and the claimed constant voltage/constant current supplier from Chung-Sik and Cho. Claims 30, 35, and 40 recite similar limitations. For the avoidance of doubt, as in the case of the support cited further the interview, this structure is not intended to be limiting in the sense of 35 USC 112 paragraph six.

For at least the foregoing reasons as well, claim 25 (and similarly claims 30, 35, and 40) are allowable over Chung-Sik and Cho.

g. New claims 26, 31, 36, 41, and 48

In addition to the reasons stated above, claims 26, 31, 36, 41, and 48 are also allowable for the following reasons as well.

Claim 26 recites “wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.” Claim

26 further distinguishes the claimed overvoltage monitoring unit and the claimed constant voltage/constant current supplier from Chung-Sik's system, and provides additional structural limitations. Chung-Sik does not teach or suggest controlling (through wireless feedback control) the voltages at both ends of a constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

For at least the foregoing reasons as well, claim 26 (and similarly claims 31, 36, 41, and 48) are allowable over Chung-Sik and Cho.

h. New claims 27, 32, 37, 42, and 45

In addition to the reasons stated above, claims 27, 32, 37, 42, and 45 are also allowable for the following reasons as well.

Claim 27 recites "wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell."

Thus, the claim limitations recited in claim 27 (e.g., front end of supplier where DC current is received from rectifier, and rear end of supplier where charging power is supplied) provide further structural limitations for the constant voltage/constant current supplier to further distinguish the constant voltage/constant current supplier from Chung-Sik's constant voltage unit 42 (which does not receive a DC current from a rectifier at a front end or supply a charging voltage to a battery cell at a rear end).

Thus, for at least the foregoing reasons as well, claim 27 is allowable over Chung-Sik and Cho. For similar reasons as well, claims 32, 36 and 42 are allowable over Chung-Sik and Cho.

i. New claims 28, 33, 38, 43, and 46

In addition to the reasons stated above, claims 28, 33, 38, 43, and 46 are also allowable for the following reasons as well.

Claim 28 recites "wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage." Thus, claim 28 further distinguishes the claimed constant voltage/constant current supplier from Chung-Sik (which does not teach or suggest charging a battery cell in a constant current mode initially and then in a constant voltage mode at a later stage).

For at least the foregoing reasons as well, claim 28 (and similarly claims 33, 38, 43, and 46) are allowable over Chung-Sik and Cho.

j. New claims 29, 34, 39, 44, and 47

In addition to the reasons stated above, claims 29, 34, 39, 44, and 47 are also allowable for the following reasons as well.

Claim 29 recites “wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.” Claim 29 further distinguishes the claimed constant voltage/constant current supplier from Chung-Sik. In particular, Chung-Sik does not teach or suggest charging a battery cell in a constant current mode based on a charging voltage of a battery cell exceeding a predetermined level. At best, Chung-Sik teaches charging a battery only when a contactless charging device is mounted on a base unit.

For at least the foregoing reasons as well, claim 29 (and similarly claims 34, 39, 44, and 47) are allowable over Chung-Sik and Cho.

5. Conclusion

For at least the foregoing reasons, the Patent Owner respectfully submits that the present reexamination proceeding is in condition for allowance and earnestly solicits reconsideration of the same. The Commissioner is hereby authorized to charge Deposit Account No. 02-1818 for any fees which are due and owing. If such a withdrawal is made, please indicate the Attorney Docket No. 0313071.00020 on the account statement.

Respectfully submitted,

K&L GATES LLP

BY /Matthew S. Dicke/
Matthew S. Dicke
Reg. No. 58,819
Customer No. 24573
(312) 578-5415

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AMENDMENTS TO THE CLAIMS

Claim 1 (Original): A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Claim 2 (Original): The contact-less chargeable battery according to claim 1, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Claim 3 (Amended): The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit includes:

a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna;

first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and [outputs] outputting a voltage comparison result; and

a microprocessor for outputting [a] the monitoring result according to the voltage comparison result to the wireless transmitting unit.

Claim 4 (Original): The contact-less chargeable battery according to claim 3, wherein a magnetic field generated by the contact-less charging device is generated intermittently,

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Claim 5 (Original): The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.

Claim 6 (Original): The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Claim 7 (Original): A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Claim 8 (Original): The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Claim 9 (Amended): The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit includes:

a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna;

first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and [outputs] outputting a voltage comparison result; and

a microprocessor for outputting [a] the monitoring result according to the voltage comparison result to the wireless transmitting unit.

Claim 10 (Original): The contact-less charging circuit module according to claim 9, wherein a magnetic field generated by the contact-less charging device is generated intermittently,

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and

wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Claim 11 (Amended): The contact-less charging circuit module according to claim [1] 7, wherein the monitoring result is a charging power adjustment request signal.

Claim 12 (Amended): The contact-less charging circuit module according to claim [1] 7, wherein the monitoring result is a difference of voltages at front and rear ends of the constant

voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Claim 13 (Original): A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:

- a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

- a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and

- a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Claim 14 (Original): The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.

Claim 15 (Original): The contact-less charging device according to claim 13, wherein the charging power adjusting unit includes:

- a wireless receiving unit for wirelessly receiving the monitoring result through an antenna;
- and

- a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.

Claim 16 (Amended): The contact-less [chargeable battery] charging device according to claim 15, further comprising a constant voltage supplier for converting a common AC current,

converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit, wherein the high frequency power driving unit includes:

- a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and

- a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.

Claim 17 (Original): The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.

Claim 18 (Original): The contact-less charging device according to claim 16, wherein the constant voltage supplier includes:

- an overvoltage filter for receiving a common AC current and intercepting an overvoltage current;

- a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and

- a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.

Claim 19 (Original): The contact-less charging device according to claim 13, wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and

wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.

Claim 20 (Original): The contact-less charging device according to claim 13, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current

supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Claim 21 (Original): A battery charging set including a contact-less chargeable battery and a contact-less charging device,

wherein the battery includes:

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contactless charging device;

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode; and

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced,

wherein the charging device includes:

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and

a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Claim 22 (Original): The battery charging set according to claim 21, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current

supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Claim 23 (Original): A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:

(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;

(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;

(c) rectifying the output high frequency AC current to be converted into a DC current;

(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;

(e) monitoring voltages at both ends of the constant voltage/ constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and

(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.

Clam 24 (Original): The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Claim 25 (New): The contact-less chargeable battery according to claim 1, wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Claim 26 (New): The contact-less chargeable battery according to claim 1, wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Claim 27 (New): The contact-less chargeable battery according to claim 1, wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Claim 28 (New): The contact-less chargeable battery according to claim 1, wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Claim 29 (New): The contact-less chargeable battery according to claim 1, wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Claim 30 (New): The contact-less charging circuit module according to claim 7, wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Claim 31 (New): The contact-less charging circuit module according to claim 7, wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Claim 32 (New): The contact-less charging circuit module according to claim 7, wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Claim 33 (New): The contact-less charging circuit module according to claim 7, wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Claim 34 (New): The contact-less charging circuit module according to claim 7, wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Claim 35 (New): The contact-less chargeable battery according to claim 13, wherein the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.

Claim 36 (New): The contact-less charging circuit module according to claim 35, wherein the at least one microprocessor controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Claim 37 (New): The contact-less charging device according to claim 13, wherein the constant voltage/constant current supplier has a front end and a rear end, and wherein the constant voltage/constant current supplier receives a DC current from a rectifier at the front end and supplies a charging power at the rear end.

Claim 38 (New): The contact-less charging device according to claim 13, wherein the constant voltage/constant current supplier charges the battery in a constant current mode at an initial charging stage and then charges the battery in a constant voltage mode at a later charging stage.

Claim 39 (New): The contact-less charging device according to claim 13, wherein the constant voltage/constant current supplier charges the battery in a constant voltage mode based on a charging voltage of the battery exceeding a predetermined level.

Claim 40 (New): The battery charging set according to claim 21, wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Claim 41 (New): The battery charging set according to claim 21, wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing a change of intensity of the magnetic field.

Claim 42 (New): The battery charging set according to claim 21, wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Claim 43 (New): The battery charging set according to claim 21, wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Claim 44 (New): The battery charging set according to claim 21, wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Claim 45 (New): The method of claim 23, further comprising:
receiving, by the constant voltage/constant current supplier, the DC current at a front end
of the constant voltage/constant current supplier; and
supplying, by the constant voltage/constant current supplier, the DC current at a rear end
of the constant voltage/constant current supplier to the battery cell.

Claim 46 (New): The method of claim 23, further comprising:
supplying, by the constant voltage/constant current supplier, the DC current to the battery
cell in a constant current mode during an initial charging stage and then in a constant voltage mode
at a later charging stage.

Claim 47 (New): The method of claim 23, further comprising:
charging, by the constant voltage/constant current supplier, the battery cell in a constant
voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Claim 48 (New): The method of claim 23, further comprising:
controlling, through wireless feedback control of the charging of the battery cell, the
voltages at both ends of the constant voltage/constant current supplier by inducing a change of
intensity of the magnetic field.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Art Unit: 3992
Examiner: Anjan K Deb
Attorney Docket No.: 0313071.00020
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Patent Under Reexam: 8,013,568
Title: CONTACT-LESS CHARGEABLE BATTERY AND
CHARGING DEVICE, BATTERY CHARGING SET, AND
CHARGING CONTROL METHOD THEREOF

Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO NON-FINAL OFFICE ACTION

This Response is submitted in reply to the Non-Final Office Action dated June 30, 2021 and in furtherance of the telephone interview conducted on August 10, 2021. The Patent Owner respectfully requests entry of the following amendments and consideration of the following remarks.

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks begin on page 13 of this paper.

Electronic Acknowledgement Receipt	
EFS ID:	43635498
Application Number:	96000355
International Application Number:	
Confirmation Number:	1538
Title of Invention:	CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF
First Named Inventor/Applicant Name:	8013568
Customer Number:	24573
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1	Miscellaneous Incoming Letter	0313071-00020_ReExamRespN FOA.pdf	196202 8586b2163406ff6cd34695f2f49fdc5a136b 7fc	no	27
Warnings:					
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	3	"8013568".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/18 01:26 PM
L2	5	"100451606".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/18 01:26 PM
L3	5058	320/108.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 11:25 AM
L4	261	L3 AND (constant ADJ current)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 11:27 AM
L5	197	L4 AND (constant ADJ voltage)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 11:30 AM
L6	197	L4 AND L5	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 11:30 AM
L7	94	L6 AND h02j50/10.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD,	OR	ON	ON	2021/09/21 11:34 AM

L8	89	L7 AND ((charger charging) near3 battery)	DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 11:35 AM
L9	25	L8 AND @pd<"20110906"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 11:39 AM
L10	5	L9 AND @pd<"20050729"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 11:41 AM
L11	5	"6,184,651".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/21 09:04 PM
L12	0	L10 AND (wireless wirelessly)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 12:15 PM
L13	215303	battery ADJ (charger charging charged) AND (wireless wirelessly)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 12:17 PM
L14	215303	(battery ADJ (charger charging charged)) AND (wireless	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD,	OR	ON	ON	2021/09/22 12:17 PM

L15	10395	wirelessly) L14 AND @pd<"20050729"	DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 12:18 PM
L16	4392	L15 AND antenna	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 12:19 PM
L17	625	L16 AND feedback	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 12:20 PM
L18	62	L17 AND (contactless (contact ADJ less))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 12:25 PM
L19	0	L18 AND ((constant ADJ current) near3 (constant ADJ voltage))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 06:28 PM
L20	0	L18 AND ((constant ADJ current) AND (constant ADJ voltage))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/22 06:28 PM
L21	22	L17 AND ((constant ADJ current) AND (constant ADJ voltage))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD,	OR	ON	ON	2021/09/22 06:29 PM

L22	12	((KR-100451606-B1 OR EP-1518512-A2 OR JP-H08237941-A OR JP-H09251865-A).did. AND FTDB.dbnm.) OR ((WO-2007013726-A1 OR US-6184651-B1).did. AND DWPI.dbnm.) OR ((US-8013568-B2 OR US-6040680-A OR US-6683438-B2 OR US-6184651-B1 OR US-6016046-A).did. AND USPT.dbnm.) OR ((US-20130293192-A1).did. AND PGPB.dbnm.)	DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/27 11:39 AM
L23	12	((KR-100451606-B1 OR EP-1518512-A2 OR JP-H08237941-A OR JP-H09251865-A).did. AND FTDB.dbnm.) OR ((WO-2007013726-A1 OR US-6184651-B1).did. AND DWPI.dbnm.) OR ((US-8013568-B2 OR US-6040680-A OR US-6683438-B2 OR US-6184651-B1 OR US-6016046-A).did. AND USPT.dbnm.) OR ((US-20130293192-A1).did. AND PGPB.dbnm.)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/27 11:39 AM
L24	620857	battery ADJ (charging charger)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/27 11:45 AM
L25	61525	(battery ADJ (charging charger)).ti.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/27 11:46 AM
L26	6500	H02J7/00308.cpc.	(US-PGPUB; USPAT;	OR	ON	ON	2021/09/27

L27	361	L25 AND L26	USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	11:49 AM
L28	126	L27 AND @pd<"20050729"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/27 11:50 AM
L29	3123	H02J7/16.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/27 11:55 AM
L30	18	L28 AND L29	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/09/27 11:55 AM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

**CHARGER FOR SECONDARY BATTERY APPLIED ELECTRIC EQUIPMENT AND
ADAPTER FOR USE IN CHARGER**

PATENT NUMBER	DOCUMENT ID	DATE PUBLISHED	SOURCE
H09251865	JP-H09251865-A	1997-09-22	FIT

PATENT FAMILY ID
13072971

INVENTOR INFORMATION

NAME	CITY	STATE	ZIP CODE	COUNTRY
SUGINAKA JUNKO	N/A	N/A	N/A	N/A
NISHI KATSUTOSHI	N/A	N/A	N/A	N/A

APPLICANT INFORMATION

NAME	CITY	STATE	ZIP CODE	COUNTRY
SUGINAKA JUNKO	N/A	N/A	N/A	N/A

AUTHORITY	TYPE
N/A	N/A

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CPC ISSUED

TYPE	CPC	DATE
CPOA	Y02E60/10	2013-01-01

CPC CURRENT

TYPE	CPC	DATE
CPCA	Y02E60/10	2013-01-01

Abstract

PROBLEM TO BE SOLVED: To complementarily charge or alternately supply electric power consumed in use or semi-use in addition of natural charge by providing contacts for a secondary battery and secondary battery applied electric equipment connected in parallel to a charger. **SOLUTION:** A power source plug 22 or a connector 23 is disposed on a side of a power source. A secondary battery is provided on one side of a charger body 20 via a battery adapter 30; while a cordless telephone is mounted on the other side thereof via the adapter 30 and a telephone adapter 40. In this manner, the secondary battery and the telephone can

be charged. Subsequently, in a state in which the plug 22 or the connector 23 is detached from the power source, the secondary battery and the telephone are provided in the same manner as described above. If the secondary battery mounted on one side has a sufficient capacity, the telephone can be complementarily charged or alternately supplied with a current consumed in use or semi-use, thereby restraining a decrease in capacity of the secondary battery mounted in the telephone.

Description

Detailed Description of the Invention

[0001]

BACKGROUND OF THE INVENTION 1. Field of the Invention The present invention relates to a secondary battery for a secondary battery application electric device such as a portable radio telephone, and a secondary battery application electric device for charging (that is, mounted on the secondary battery application electric device). The present invention relates to a charger for a secondary battery-applied electric device that charges a secondary battery in a charged state, and an adapter used for the charger.

[0002]

2. Description of the Related Art Although a portable radio telephone uses a secondary battery as a power source to ensure its portability, it is possible to talk for a long time enough to obtain user satisfaction in terms of charging capacity. It hasn't arrived yet. This is because the portable wireless telephone has a liquid crystal display unit, a light source for its backlight, a microphone, a speaker, and a key operation unit for executing sequentially added multi-functions. This is because it tends to increase. In consideration of this point, a solar cell is installed in the phone body, and the solar cell drives the display section (the backlight is turned off) during the daytime, and the main battery is used at night. Japanese Patent Laid-Open Publication No. 6-224813).

[0003]

In the above portable radio telephone, the waiting time for receiving a call accounts for a considerable proportion of the full charge of one rechargeable battery compared to the call time. This is the current situation, and since it is necessary to continuously supply power from the secondary battery to the required circuit section to detect the presence or absence of a call even when there is no call, this call waiting In a state that is not directly related, the power that is wasted can not be ignored. In addition, it cannot be said that the dedicated charger is also formed in a small shape suitable for portability, so there is a possibility that the battery will run out and become unusable when going out. It may also impair the function of. In the mobile phone device described in the above publication, the power consumption of the solar cell is reduced by illuminating the display unit and the key operation unit from the back by uniformly turning on the backlight power source when an incoming call occurs regardless of the ambient brightness. To reduce power consumption as much as possible, not to reduce power consumption and battery charger for waiting call. In addition, there are many types of portable wireless telephones including PHS, and depending on each model and manufacturer,

Since the shape and electrode position of the secondary battery are different, and the shape of the telephone itself and the charging terminal are various, a dedicated charger is required for each, and on the other hand, as described above, the charger is not portable. There was a reality that it was difficult.

[0005] The present invention has been made in view of the above,

In addition to the original charging, we provide a charger that enables supplemental charging and alternative supply of the power consumed in the used or semi-used state (waiting for a call), or a different type of secondary battery or secondary battery applied electricity. To provide a charger for an electric device applied with a secondary battery and an adapter used for the charger, which makes it possible to charge the device as well as supplementary charge or substitute supply of power consumed in the used or semi-used state. It is intended.

[0006]

According to the first aspect of the present invention,

A charger for a secondary battery-applied electric device, which is connectable to an external power source and charges a secondary battery of the secondary battery-applied electric device, comprising: a first

mounting portion to which the secondary battery can be mounted at least; A second mounting portion to which at least a secondary battery application electric device can be mounted, and an electrode of a secondary battery provided in the first mounting portion and mounted on the output end of the charger and the first mounting portion. And a charging terminal of a secondary battery application electric device which is provided in the second mounting portion and is mounted on the output end of the charger and the second mounting portion. And a second connecting means for connecting at least and. With this configuration, the secondary battery mounted on the first mounting portion and the secondary battery application electric device mounted on the second mounting portion can be charged simultaneously from the external power source. When the secondary battery has a remaining capacity, the secondary battery and the secondary battery application electric device are connected via the charger when not connected to the external power supply. , The secondary battery application electric equipment is used from this secondary battery, the current consumption during the quasi use is supplemented and charged, and is supplied as an alternative, and the reduction in the capacity of the secondary battery installed in the secondary battery application electric equipment is suppressed. .

According to a second aspect of the present invention, both the secondary battery and the electric device for secondary battery application can be attached to the first and second attachment parts, and the first and second attachment parts can be attached. The connection means is capable of connecting the output end of the charger to both the electrode of the secondary battery and the charging terminal of the secondary battery application electric device. According to this configuration, the first

The secondary battery can be charged by both of the second mounting portions, and the secondary battery application electric device can be charged by both of them.

According to a third aspect of the present invention, the first and second mounting portions are formed so as to be detachable from the main body of the charger. If you prepare various types of mounting parts for secondary batteries and secondary battery-applied electrical equipment, you can charge and use various types of secondary batteries and secondary battery-applied electrical equipment with a single charger. , Replenishment charging at the time of semi-use, alternative supply becomes possible.

According to a fourth aspect of the present invention, it is attachable to and detachable from each output section of the main body having a charger that can be connected to an external power source and that can charge at least two secondary batteries of the secondary battery application electric device. A second adapter to which the main body is attached and the secondary battery is attached.

Corresponding to an electrode position corresponding to the type of the secondary battery in the second mounting portion, and a power source side electrode in contact with the output end of the charger in the first mounting portion. It is provided with a battery side electrode on which an electrode is formed, and a connecting means for connecting the power source side electrode and the battery side electrode. According to this configuration, regardless of the type of the secondary battery, if a corresponding adapter is prepared and the secondary battery is attached via this adapter, one charger can be used to perform various types of secondary batteries. A plurality of batteries can be charged at the same time.

According to a fifth aspect of the present invention, there is provided an adapter for use in the charger for secondary battery-applied electrical equipment according to the fourth aspect, and an equipment adapter detachably formed in the second mounting portion of the adapter. The device adapter has a loading section for loading the secondary battery application electric device, and

Corresponding to a first electrode that contacts the battery-side electrode in a portion where the adapter is mounted, and a charging terminal position according to a type of the secondary battery-applied electrical device in a portion where the secondary battery-applied electrical device is mounted Then, a second electrode having an electrode formed thereon and a connecting means for connecting the first and second electrodes are provided. According to this configuration, if the adapter for the secondary battery is further attached to the device adapter according to the type, it is possible to charge various types of secondary battery application electric devices with one charger. Become. In addition, it is possible to charge the secondary battery only with the adapter and the secondary battery applied electric device with the adapter and the device adapter at the same time. It can be used as a battery, recharged when semi-used, and supplied as an alternative.

According to a sixth aspect of the present invention, an adapter which is connectable to an external power source and has a charger capable of charging at least two secondary battery-applied electric devices

individually is detachably attached to each output section of the main body. And having a first mounting portion to which the main body is mounted and a second mounting portion to which the secondary battery application electric device is mounted, and the first mounting portion includes an output end of the charger. A power source side electrode to be in contact, a device side electrode in which an electrode is formed in the second mounting portion in correspondence with a charging terminal position according to the type of the secondary battery application electric device, the power source side electrode and the device It is provided with a connecting means for connecting to the side electrode. According to this configuration, regardless of the type of the secondary battery application electric device, if a corresponding adapter is prepared and the secondary battery application electric device is mounted through this adapter, one charger can be used. It is possible to charge a plurality of electric devices for secondary battery application of various types at the same time.

[0012]

FIG. 5 is a block diagram of a portable wireless telephone shown as an example of a secondary battery application electric apparatus to which the present invention is applied, in which (a) is a perspective view showing an external appearance, and (b)-(D) is a figure which shows the electrode arrangement structure of a secondary battery, (e) is a perspective view which shows the electrode structure of a battery pack BP. In the present embodiment, the portable radio telephone has a main body 1 having a substantially rectangular parallelepiped shape, a recessed step portion is formed in the lower half portion of the rear surface thereof, and a rectangular parallelepiped containing a secondary battery B therein. Battery pack B having a shape or a shape close thereto

P is detachably attached. A transmission / reception antenna 2 is provided on the top of the main body 1 so as to be pulled out upward. Further, on the front surface of the main body 1, a speaker 3 for converting a received signal into an audio signal, a display unit 4 made of a liquid crystal for displaying the other party's telephone number and other required contents, a ten-key pad and required operation buttons are arranged in this order from the upper side. A key input section 5 provided in a predetermined array and a microphone 6 for converting a voice from the outside into an electric signal are provided. A backlight light source 7 (see FIG. 6) is disposed inside the display unit 5 so as to face the display unit 5, and the backlight light source 7 is also provided on the back side of each button of the key input unit. It is provided depending on the type. Reference numeral 8 is a power switch for supplying power from the secondary battery B.

The secondary battery B in the battery pack BP is a secondary battery that can be charged and discharged, for example, a Ni-Cd type secondary battery. (For example, different ones) are generated and boosted as an operating voltage to a required internal circuit portion as it is, or boosted through a booster circuit (not shown) and converted to a required operating voltage to supply power. When the capacity of the secondary battery B inside the battery pack BP is consumed due to long-term use, the battery pack BP is removed from the main body 1 and a charger (FIG.

By connecting to (Fig. 4), it can be charged from a commercial power source or an in-vehicle power source when needed.

Further, the portable radio telephone is provided with charging terminals P .sub.I + , P .sub.I- on both sides of the positive and negative electrodes for ensuring electrical connection with a charger for charging the secondary battery B being mounted .sub.. Are exposed. FIGS. 5 (b) to 5 (d) show the arrangement positions and shapes of the charging terminals according to the type of the portable wireless telephone, and + and - symbols are also shown for both poles.

Further, as shown in FIG. 5 (e), in the present embodiment, the battery pack BP is provided with the electrodes P .sub.B + and P .sub.B- of both electrodes in an exposed state on the surface in contact with the portable radio telephone main body 1. On the other hand, on the rear surface of the portable radio telephone main body 1 on which the battery pack BP is mounted, a protrusion is formed at a position facing the electrodes P .sub.B + and P .sub.B- so as to ensure stable contact. Electrodes P .sub.+ and P .sub.- (see FIG. 6) are provided.

FIG. 6 is a circuit block diagram showing an embodiment of a portable radio telephone. In the figure, reference numeral 11 is a control unit for integrally controlling the operation control of the portable radio

telephone, which detects the presence or absence of an incoming call, supplies power to a required circuit unit, and performs various operations from the key input unit 5. It is intended to cause each circuit unit to perform a necessary operation.

Reference numeral 12 is a demodulation circuit that demodulates a radio frequency signal into an intermediate frequency or a voice frequency, 13 is a modulation circuit that modulates a voice frequency signal into a radio frequency signal, and 14 is a connection or disconnection between this device and a public telephone network. A network control unit (hereinafter, referred to as NCU) for controlling the microphone 15 is a microphone 3

Voice data from the key input unit 5 or key data input from the key input unit 5 via the control unit 11 is placed on the same line, or the voice data received from the other party and the key data are discriminated and switched to the speaker 6 and the control unit 11. It is a voice / data processing circuit to be guided. The demodulation circuit 12 and the modulation circuit 13

The switching between the transmitting and receiving signals is performed by using a duplexer that utilizes the difference in frequency between both signals as is known.

Further, when the battery pack BP is mounted on the main body 1, the electrodes P.sub.+ and P.sub.- of the main body 1 and the secondary battery B are

The terminals P.sub.B+ and P.sub.B- of are connected and the power switch 8

When is turned on, the output voltage from the secondary battery B remains unchanged,

Alternatively, the voltage is boosted by the control unit 11 (if the operating voltage of each circuit unit is different, it is converted into a required operating voltage), and then power is supplied to the required circuit unit. The charging terminals P.sub.I+ and P.sub.I- are short-circuited (within the portable radio telephone main body 1) between the corresponding electrodes P.sub.+ and P.sub.-.

The operation of the controller 11 will now be described. When the power switch 8 is turned on, the power supply from the secondary battery B to the required circuit is started. First, in the case of a call,

When you operate the key input section 5 and enter the destination telephone number,

The control unit 11 turns on the backlight power source 7 to display the input content on the display unit 4 and displays a message or a mark (calling, etc.) of the required content. Then, when transmission is performed from the antenna 2 and the line is connected (the other party picks up the receiver), power is supplied to the microphone 3 and the speaker 6, and bidirectional communication is possible. next,

When receiving a call, the power switch 8 is in the ON state, and the antenna 2, the demodulation circuit 12, and the NC are used to detect the presence or absence of a call.

Power is supplied to the U14, the voice / data processing circuit, and the control unit 11. When a call is received, the control circuit 11 outputs a control signal to the NCU 14 to hold the line, power is supplied to the speaker 6 to generate a call receiving sound, and the backlight power supply 7 is turned on. The display unit 4 is caused to display the telephone number of the other party. When the user operates the send / receive button in this state, the line is held by the NCU 14 and power is supplied to the microphone 3 to enable two-way communication.

Reference numeral 20 denotes a charger main body for charging the secondary battery B, which is a charger 2 for causing the secondary battery B to perform constant current charging.

1 and a power plug 22 connectable to a commercial power supply.

The charger body 20 has output terminals Q.sub.0+ and Q.sub.0- (charge terminals P.sub.I+ and P.sub.I- are connected in the figure) and output terminals R.sub.0+ and R.sub.0-.

And output terminals Q.sub.0+, Q.sub.0- and output terminals R.sub.0+,

R.sub.0- is as described later with reference to FIGS. 1 to 4, respectively.

The electrodes P.sub.B+, P.sub.B- of the secondary battery via the battery adapter 30

Or battery adapter 30 and telephone adapter 40

The charging terminals P.sub.I+ and P.sub.I- are configured to be connectable via the.

An embodiment of the circuit structure of the charger 21 will be described with reference to FIG. 4 together

with the operation. The charger 21 adopts, for example, a DC-DC inverter system.

A commercial power source input via the power source plug 22 is stepped down by a step-down means (not shown), first rectified by a diode bridge DB, smoothed by a capacitor C1 etc. and converted into a required DC voltage, and then a transformer T. The primary winding L1 and the switching element S1 are led to a series circuit. When a commercially available AC converter is used in the preceding stage, the diode bridge DB is built in this AC converter.

The switching element S1 is capable of self-excited oscillation using a circuit including a feedback winding L3 of the gate.

A predetermined high frequency switching pulse is applied to the base. Upon receiving this switching signal, the switching element S

1 repeatedly turns on and off, and the secondary winding L2 of the transformer T

Induce an AC voltage on the. The induced AC voltage is rectified and smoothed by the diode D1, the capacitor C2, etc., and further passed through the backflow prevention diode to output terminals Q .sub.0+ , Q of the charger 21.

.sub.0- and output terminals R .sub.0+ and R .sub.0- . In FIG. 4, the secondary battery B attached to the portable wireless telephone via the battery adapter 30 and the telephone adapter 40 at the output terminals Q .sub.0+ and Q .sub.0-.

Is connected, and the battery adapter 30 is connected to the output terminals R .sub.0+ and R .sub.0-.

The secondary battery B is independently connected via the.

The output current is detected in the form of a voltage by the current detection resistor R1 and fed back through the feedback circuit FB such as a photocoupler, and the duty of the switching pulse is changed and controlled by the PWM circuit. It is designed to operate as a constant current charging circuit. In addition, Constant voltage charging may be performed by feeding back the voltage across the capacitor C2. With this configuration, the output terminals Q .sub.0+ , Q .sub.0- and the output terminals R .sub.0+ , R

There is an advantage that the charging current can be stably supplied even when the secondary battery B or the portable wireless telephone is connected to either or both of .sub.0- . Reference numeral 23 is a connector for introducing a vehicle-mounted power source such as a cigarette lighter case, the input side of which is connected to the output side of the diode bridge DB of the charger 21. When the voltage and the current of the vehicle-mounted power supply have a charge voltage and the current rating of the secondary battery B that are more than the allowable values, a load (resistance) or a voltage dividing resistor may be interposed therebetween.

Further, by providing the output terminals Q .sub.0+ , Q .sub.0- and the output terminals R .sub.0+ , R .sub.0- in parallel on the output side of the charger 21, when the power source (including the vehicle-mounted power source) is turned on. , Both the secondary battery B and the secondary battery B mounted on the portable wireless telephone body 1 are charged. In the case of a modification mode (1) described later, instead of charging the portable wireless telephone, it is an alternative supply of electric power.

On the other hand, when the power is off, the secondary battery B currently mounted on the portable radio telephone main body 1 is connected to the secondary battery B alone (having the remaining capacity) from the secondary battery B. Electric power is replenished through the paths of the output terminals R .sub.0+ , R .sub.0- , Q .sub.0+ , Q .sub.0- (in this case, the secondary battery B installed in the portable wireless telephone body 1 receives the call). Power consumption in the waiting state can be reduced to half). In this case as well, according to the modification (1) described later, instead of charging the portable wireless telephone, the secondary battery B supplies the electric power instead.

Next, the structure of the charger and the members associated therewith will be described with reference to FIGS. FIG. 1 is a perspective view showing a state where a battery adapter and a telephone adapter are attached to a charger main body, FIG. 2 is a perspective view of the charger main body, and FIG.

FIG. 3A is an exploded perspective view showing the relationship between the battery adapter and the telephone adapter, and FIG. 3B is a side sectional view showing an embodiment of the engaging structure of both.

In these drawings, the charger main body 20 is made of, for example, resin and has a substantially rectangular parallelepiped shape.

The circuit portion shown in FIG. 4 that constitutes the charger 21 is housed in the lower part of the inside thereof. Opening 2 formed in the appropriate place on the lower side surface

From 01, a power plug 22 having a cord of a required length is provided so that it can be pulled out and stored. Also, the charger body 20

An opening 202 is formed on one side of the upper surface of the, and can be opened and closed by a slide-type lid 203. Charger 2

A connector 23 for a vehicle-mounted power supply having a cord of a required length is housed in the upper inner space of 1 so as to be drawn out through an opening 202.

In FIG. 2, the charger main body 20 has, for example, the same mounting structure on the front and rear side surfaces to which the battery adapter 30 can be mounted, and an output terminal Q .sub.0 for supplying a charging current to each side surface. .sub.+ And Q .sub.0- are provided so as to be exposed. In this embodiment, the secondary battery B of the type shown in FIG.

Required output terminals Q .sub.0+ and Q .sub.0- are arranged at positions corresponding to. Also, on the same side, these output terminals Q .sub.0+ , Q

Four concave engaging portions 20a are formed so as to surround .sub.0- .

In FIG. 3, the battery adapter 30 has a plate shape with a required thickness, and electrode structures are formed on the surface contacting the charger main body 20 and the surface contacting the telephone adapter 40, respectively, and corresponding to both side surfaces. The respective electrodes are electrically short-circuited by an internal wiring L (shown by a broken line in the figure). On the side in contact with the charger main body 20, an output terminal Q .sub.0+ while wearing the battery adapter 30 to the battery

charger main body 20, Q .sub.0- and a counter electrode in a position S .sub.+ ', S .sub.-' (in FIG. 3 (Indicated by broken lines) are arranged so as to be able to contact each other, while a position facing the electrode arrangement (for example, FIG. 5 (e)) of the secondary battery B to be mounted is provided on the surface side in contact with the telephone adapter 40. The electrodes S .sub.+ and S .sub.- are arranged so as to be in contact with each other. Although not visible in the figure, a convex engagement portion is formed on the back surface side of the battery adapter 30 at a position facing the concave engagement portion 20a so as to be fitted thereto. Thereby, as shown in FIG. 1, the secondary battery B is directly attached to the battery adapter 30 on the back side surface of the charger main body 20. Further, as shown in FIG. 3, four concave engagement portions 30a are formed on the front surface so as to surround the electrodes S .sub.+ and S .sub.- .

The telephone adapter 40 has a box shape capable of loading the portable radio telephone main body 1 in a stable posture, and has side walls 401 on the rear side and a bottom surface 402 in addition to the left and right side walls. Further, a convex engaging portion 40a (not visible in FIG. 3) is formed on the outer surface (back surface) of the side surface 401 at a position facing the concave engaging portion 30a on the front side of the battery adapter 30. That is, as shown in FIG. 3B, the concave engaging portion 30a has an engagement hole extending downward in the side wall,

On the other hand, the convex engaging portion 40a has an engaging shape that fits into the engaging hole of the concave engaging portion 30a. When the telephone adapter 40 is slid downward from the front side of the battery adapter 30 while being slidably in contact with the battery adapter 30, the concave engagement portion 30a is formed.

30a and the convex engaging portion 40a are fitted to each other, and the bottom 130a of the concave engaging portion 30a and the contact lower end 1 of the convex engaging portion 40a 1

40a abuts and the position is fixed. Further, on the side surface 401 of the telephone adapter 40 that contacts the battery adapter 30, the electrode T is provided at a position corresponding to the electrodes S .sub.+ and S .sub.- of the battery adapter 30.

.sub.+ , T .sub.- (shown by broken lines in the figure) are provided, and electrodes

U_{+} , U_{-} are provided on the bottom surface 402 via wiring L (shown by broken lines in the figure). The electrodes U_{+} and U_{-} are in a state where the portable radio telephone body 1 is loaded, and the portable radio telephone body 1 is

U_{+} are provided corresponding to the positions of the charging terminals P_{+} and P_{-} formed on the lower surface (see FIGS. 5B to 5D).

Next, the mode of use of this charger will be described. (1) In the case of charging one or two secondary batteries B In this case, the power plug 22 or the connector 23 is connected to the power supply side, and the secondary battery B to be charged (the battery pack BP is substantially the same).) Type of battery adapter 30 is prepared, this is attached to the charger main body 20, and the intended secondary battery B is attached to this battery adapter 30. When charging two batteries, it is sufficient to prepare two battery adapters 30. It is also possible to charge different types of secondary batteries B.

(2) When charging one or two portable wireless telephones In this case, the power plug 22 or the connector 23 is connected to the power source side, and the battery adapter of the type of the portable wireless telephone to be charged is connected. 30 and telephone adapter 40 are prepared, the battery adapter 30 is attached to the charger main body 20, the telephone adapter 40 is further attached, and then the planned portable wireless telephone main body 1 is loaded into the telephone adapter 40. do it. When charging two units, the battery adapter 30,

It suffices to prepare two telephone adapters 40 each, and even in this case, it is possible to charge different types of portable wireless telephones.

In addition, from the above (1) and (2), the secondary battery 1

It is also possible to charge an individual unit and one portable wireless telephone. In this case, it is also possible to charge a secondary battery B of a type different from the secondary battery B mounted on the mobile wireless telephone being charged.

(3) When one rechargeable battery and one portable radio telephone are connected to the charger main body 20 and the power of the secondary battery B is supplied to the portable radio telephone to replenish the call waiting power. With both the power plug 22 and the connector 23 disconnected from the power source, the battery adapter 30 is attached to one side of the charger main body 20.

Install the secondary battery B via the, and the battery adapter 3 on the other side.

The portable radio telephone main body 1 is attached via the telephone 0 and the telephone adapter 40. In this case, if the secondary battery B mounted on one side has a sufficient capacity, the secondary battery B is replenished to the portable wireless telephone by the amount of electric power consumed when waiting for a call. Therefore, it is possible to suppress the power consumption of the secondary battery B mounted on the portable wireless telephone body 1.

Therefore, when the portable wireless telephone is pulled out from the charger main body 20 and carried, the original secondary battery B that has not been unnecessarily discharged can be used effectively (that is, for a long time), and the battery can be carried while being carried. It is possible to prevent it from being cut. In addition, such a usage mode is extremely practical if the main body of the charger can suppress the incoming call waiting discharge of the portable wireless telephone as much as possible even if there is no power source around it.

In the present invention, the portable radio telephone and the secondary battery B have different shapes depending on the manufacturers and the like, and in particular, the positions (that is, types) of the electrodes are different. If you prepare the battery adapter 30 and the telephone adapter 40, one charger main body 2 When 0, all types of rechargeable batteries B and portable wireless telephones can be charged, and replenishment charging at the time of waiting for the call in the above (3) is possible. Therefore, if the charger main body 20 is installed in a house, a hall, an accommodation facility or the like where people gather, it will be extremely practical. Further, when using the on-vehicle power supply, it is possible to charge various types of secondary batteries and portable wireless telephones owned by the passenger. Moreover, even if there is no power source around, if the present charger is used, it is possible to use the same or different secondary battery to supplement the above-mentioned auxiliary charging of its own portable radio telephone.

The present invention can be modified as follows. (1) As shown in FIG.

Although the charging terminals P.sub.I+ and P.sub.I- having the configuration shown in (d) are provided, the charging terminal P.sub.I+ and P.sub.I- are usually provided on the bottom surface of the portable radio telephone main body 1 at positions adjacent to the charging terminals P.sub.I+ and P.sub.I-. The terminal of the shape is prepared. This terminal (herein referred to as another charging terminal) has a pair of shapes like the charging terminals P.sub.I+ and P.sub.I-, and when a connector for connecting to a power source is connected, the secondary battery B is mechanically connected. It is formed so that the side is open. When a connector from a power source is connected to the other charging terminal, power is directly supplied from the power source to the load part of the portable wireless telephone, and the secondary battery B can be put into a non-use state. Power can be supplied as an alternative to the secondary battery B. Therefore, in place of the electrodes U.sub.+ and U.sub.- of the telephone adapter 40 shown in FIGS. 1 to 3, a portable wireless telephone is loaded in the telephone adapter 40 and comes into contact with the other charging terminals. If the electrode (having the same structure as the above connector) is configured to open the secondary battery B, the secondary battery B connected to the other side of the charger main body 20 can directly connect to the portable wireless telephone. It becomes possible to supply electric power to the load portion as an alternative, and by adopting such a telephone adapter, it is possible to completely suppress the electric power consumption of the secondary battery B mounted on the portable wireless telephone. Become.

(2) In FIG. 4, a switch SW is provided in parallel with each backflow prevention diode, and this is provided in the charger main body 20.

The secondary battery B and the portable wireless telephone are attached to the charger main body 20 in a state where the power is not turned on by arranging them in an appropriate place outside the vehicle (for example, the ceiling or the side surfaces on the left and right sides) so as to be interlocked. At this time, it is possible to manually turn on / off the supplementary charging to the portable wireless telephone.

(3) The type of the secondary battery B of the present invention is not limited, and the present invention can be sufficiently applied to a lithium ion battery, and a portable radio telephone equipped with the lithium ion battery. The same can be applied to the same. In this case, the rechargeable battery B or the rechargeable battery B mounted on the portable radio telephone, or the battery adapter 30 used at that time. The charger has a function of identifying whether the telephone adapter 40 is a Nicad battery or a lithium-ion battery,

Alternatively, a manual switch may be attached to manually switch to either side. The charger needs to be provided with a charging circuit for charging the lithium ion battery.

(4) In the case of a portable radio telephone, a battery adapter 30 and a telephone adapter 4 are provided between the charger main body 20 and the portable telephone.

Although the embodiment in which 0 is interposed is described, it may be configured to be rechargeable only through the telephone adapter 40. That is, when the secondary battery B mounted on one side of the charger main body 20 is replenished and the portable wireless telephone mounted on the other side is replenished and charged, the secondary battery B mounted on the portable wireless telephone body 1 is recharged. As the secondary battery B, it is considered that the same type as the secondary battery mounted on the one side is usually used. Therefore, in such a case, the telephone adapter 40 is directly connected to the charger main body 20. This is because the relationships of the engaging portions are compatible and both can be engaged. This has the advantage that only one battery adapter 30 is required for such supplementary charging.

(5) Further, in the present embodiment, the concave and convex shape is adopted as each engaging structure with the charger main body 20, the battery adapter 30, and the telephone adapter 40, but the

present invention is not limited to this. Various mounting methods can be adopted, such as sliding mounting using a guide rail, mounting using the attraction force of a magnet or the like.

(6) The battery adapter 30 and the telephone adapter 40 step down the output voltage from the charger internally so as to obtain a voltage according to the type of portable radio telephone corresponding to the secondary battery to be mounted. If a circuit for boosting or boosting is provided, there is an advantage that a more appropriate voltage can be obtained.

(7) In the present embodiment, the mounting positions of the battery adapter 30 and the telephone adapter 40 with respect to the charger main body 20 are set to the side surfaces, but the present invention is not limited to this, and they may be arranged side by side on the same side surface. May be, especially battery adapter 30

In this case, if the one having a storage shape that integrally stores the secondary battery is adopted, the operability is also excellent.

(8) The number (number) of chargers to be attached to the charger main body 20 is not limited to two, and may be three or four or more, which improves efficiency.

(9) In addition to the portable wireless telephone, the present invention is

It can also be applied to secondary battery-applied electric devices, that is, portable personal computers, word processors, cameras and video cameras, portable stereos, and the like. In addition, the portable wireless telephone has a special state of waiting for a call, and it has been possible to perform supplementary charging and alternative supply for this, but in the above various devices, while using in various modes. To perform supplemental charging and alternative supply, or to supplement charging and alternative supply of power consumption while the device is in sleep (called semi-use), such as when waiting for a call in a portable wireless telephone. Good.

[0046]

According to the invention described in claim 1, a first mounting portion to which at least a secondary battery can be mounted, a second mounting portion to which at least a secondary battery application electric device can be mounted, and A first connecting means which is provided in the first mounting portion and which can connect at least the output end of the charger and the electrode of the secondary battery mounted in the first mounting portion; and the second mounting portion. Since it is provided with a second connection means that is capable of connecting at least the output end of the charger and the charging terminal of the secondary battery application electric device mounted in the second mounting portion, A single battery charger can charge a secondary battery and electrical equipment using a secondary battery at the same time. When the secondary battery is not connected to an external power source, the secondary battery supplies the secondary battery-applied electrical equipment with supplemental charging and substitute supply of the power consumption during use or in the semi-use state. It is possible to suppress the capacity reduction of the mounted secondary battery.

According to the invention of claim 2, the first,

Both the secondary battery and the electric device for secondary battery application can be mounted on the second mounting portion, and the first and second connecting means are connected to the output end of the charger and the electrode of the secondary battery. Also, since it is configured to be connectable to both the charging terminal of the above-mentioned secondary battery application electric device, the secondary battery can be charged by both of the first and second mounting parts, and the secondary battery can be applied by both of them. The electric device can be charged.

According to the invention of claim 3, the first,

Since the second mounting portion is formed so as to be attachable to and detachable from the main body of the charger, if various types of mounting portions for secondary batteries and secondary battery-applied electrical equipment are prepared, charging of one unit is possible. With a container, various types of rechargeable batteries and rechargeable battery-applied electric devices can be charged, replenished and replaced.

According to the fourth aspect of the invention, each output section of the main body has a charger that can be connected to an external power source and that can charge at least two individual secondary batteries of the secondary battery application electric equipment. An attachable / detachable adapter having a first mounting portion to which the main body is mounted and a second mounting portion to which the secondary battery is mounted, and the first mounting portion including the charger. A power source side electrode in

contact with the output end, a battery side electrode in which an electrode is formed in the second mounting portion corresponding to an electrode position according to the type of the secondary battery, the power source side electrode and the battery side Since it is configured to have a connecting means for connecting to the electrodes, regardless of the type of the secondary battery, a corresponding adapter is prepared in advance, and if the secondary battery is attached via this adapter, one charging can be performed. Use a container to store multiple batteries for various types of secondary batteries. And thus that can sometimes be charged.

According to the invention described in claim 5, the adapter used in the charger for the secondary battery applied electric device according to claim 4 and the device adapter detachably formed in the second mounting portion of the adapter. And the above device adapter,

The charging device has a loading part for loading the secondary battery application electric device, a first electrode in contact with the battery side electrode in a part where the adapter is installed, and a part where the secondary battery application electric device is installed in the part. Since the second electrode having the electrode formed corresponding to the position of the charging terminal according to the type of the secondary battery applied electric device and the connecting means for connecting the first and second electrodes are provided, By mounting the adapter for the secondary battery and the device adapter according to the type, it is possible to charge various types of secondary battery applied electric devices with one charger, and only the adapter. Thus, the secondary battery can be charged at the same time as the secondary battery application electric device by the adapter and the device adapter. Moreover, when the power supply is removed, the secondary battery can be made to perform replenishment charging and alternative supply in the used or semi-used state to the secondary battery application electric device.

According to the sixth aspect of the present invention, it is detachably attached to each output section of the main body having a charger that can be connected to an external power source and that can charge at least two individual secondary battery application electric devices. An adapter having a first mounting part to which the main body is mounted and a second mounting part to which the secondary battery application electric device is mounted, and the output of the charger to the first mounting part. The power source side electrode that contacts the end, and the second

A device-side electrode in which an electrode is formed in the mounting portion corresponding to the charging terminal position according to the type of the secondary battery application electric device, Since the constitution is provided with the connecting means for connecting the power source side electrode and the device side electrode, a corresponding adapter is prepared regardless of the type of the secondary battery application electric device, and the connection is made via this adapter. By mounting the secondary battery application electric device, it becomes possible to charge a plurality of secondary battery application electric devices of various types at the same time with one charger.

[Brief description of drawings]

FIG. 1 is a perspective view showing a state where a battery adapter and a telephone adapter are attached to a charger main body.

FIG. 2 is a perspective view of a charger main body.

FIG. 3A is an exploded perspective view showing a relationship between a battery adapter and a telephone adapter, and FIG. 3B is a side sectional view showing an embodiment of an engaging structure for both.

FIG. 4 is a circuit diagram showing an embodiment of a circuit configuration of a charger.

5A and 5B are configuration diagrams of a mobile wireless telephone as an example of a secondary battery application electric device to which the present invention is applied, in which FIG. 5A is a perspective view showing an external appearance, and FIGS. 5B to 5D are secondary batteries. FIG. 3E is a diagram showing the electrode arrangement structure of FIG. 3E, and FIG.

FIG. 6 is a circuit block diagram showing an embodiment of a portable wireless telephone.

[Explanation of symbols]

1 Mobile Radio Phone Main Body (Secondary Battery Applied Electrical Equipment Main Body) 20 Charger Main Body 21 Charger 22 Power Plug 23 Connector for In-Vehicle Power Supply 30 Battery Adapter 40 Telephone Adapter 20a, 30a Recessed Engagement Part B Secondary Battery R .sub.0+, R 0-, Q 0+, Q 0- output terminal P .sub.I +, P .sub.I- charging terminal P .sub.B +, P .sub.B- secondary battery terminals .sub.S +, S -, S + ', S -', T .sub.+ , T -, U +, U -, electrodes L wiring (connection means) SW switch

Claims

1. A charger for a secondary battery-applied electric device, which is connectable to an external power source and charges a secondary battery of the secondary battery-applied electric device, the first charger being capable of mounting at least the secondary battery. A mounting part, a second mounting part to which at least the secondary battery applied electric device can be mounted, and a first mounting part, which are mounted on the output end of the charger and the first mounting part. First that enables at least connection with an electrode of a secondary battery

Second connection means for connecting the output terminal of the charger and the charging terminal of the secondary battery application electric device mounted on the second mounting portion, the second connecting portion being connected to the second mounting portion. And a connecting means for connecting the battery to a battery charger for a secondary battery-applied electric device.

2. The first and second mounting parts can be mounted with both the secondary battery and the electric device for secondary battery application, and the first and second connecting means are the charging device. 2. The charging for a secondary battery application electric device according to claim 1, wherein an output end of the container is connectable to both the electrode of the secondary battery and a charging terminal of the secondary battery application electric device. vessel.

3. The secondary battery application according to claim 1, wherein the first and second mounting portions are detachably formed with respect to the main body of the charger. Charger for electrical equipment.

4. An adapter detachably attached to each output part of a main body having a charger that can be connected to an external power source and that can charge at least two individual secondary batteries of a secondary battery application electric device. And a power supply side electrode having a first mounting portion to which the main body is mounted and a second mounting portion to which the secondary battery is mounted, and the first mounting portion being in contact with the output end of the charger And a battery side electrode having electrodes formed on the second mounting portion corresponding to electrode positions corresponding to the type of the secondary battery, and a connecting means for connecting the power source side electrode and the battery side electrode. An adapter used for a charger for an electric device using a secondary battery, which is characterized by being provided.

5. An adapter for use in the charger for secondary battery-applied electrical equipment according to claim 4, and an equipment adapter detachably formed on the second mounting portion of the adapter, The device adapter has a loading section for loading the secondary battery applied electric device, and a first electrode that contacts the battery side electrode at a portion to which the adapter is mounted, and the secondary battery applied electric device. A second electrode in which an electrode is formed corresponding to the position of the charging terminal according to the type of the secondary battery application electric device, and a connecting means for connecting the first and second electrodes to the mounted part An adapter used for a battery charger for an electric device using a secondary battery.

6. An adapter detachably attached to each output section of a main body having a charger that can be connected to an external power source and that can charge at least two secondary battery application electric devices individually. And a power supply side electrode in contact with the output end of the charger, the first mounting part having a first mounting part and a second mounting part having the secondary battery applied electric device mounted thereon. , A device-side electrode in which an electrode is formed in the second mounting portion corresponding to a charging terminal position according to the type of the secondary battery application electric device, and the power-side electrode and the device-side electrode are connected. An adapter for use in a charger for an electric device using a secondary battery, which is provided with a connecting means.

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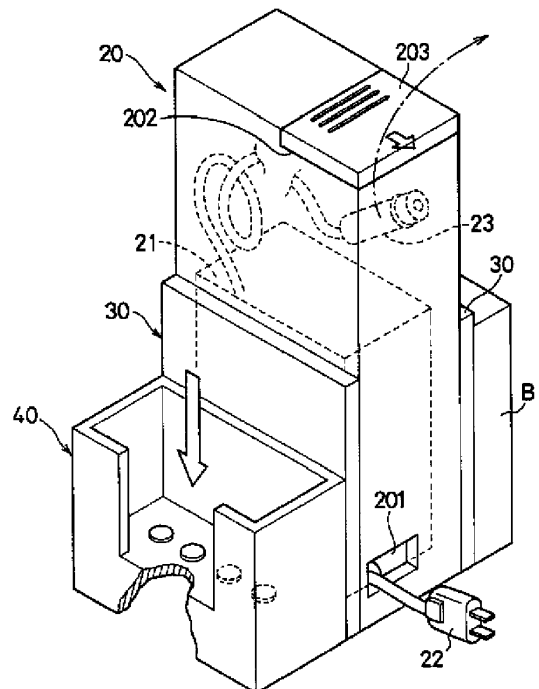
(21) 出願番号	特願平8-58045	(71) 出願人	594170532 杉中 順子 大阪市城東区諏訪2丁目4番23号
(22) 出願日	平成8年(1996)3月14日	(72) 発明者	杉中 順子 大阪市城東区諏訪2丁目4番23号
		(72) 発明者	西 勝利 大阪市中央区南船場1丁目16番23号
		(74) 代理人	弁理士 小谷 悦司 (外3名)

(54) 【発明の名称】 二次電池応用電気機器用充電器及び該充電器に用いるアダプタ

(57) 【要約】

【課題】 本来の充電に加え、使用乃至は準使用状態で消費する電力の補充充電や代替供給を可能にする充電器を提供し、ないしは異種の二次電池、二次電池応用電気機器に対しても本来の充電と使用乃至は準使用状態で消費する電力の補充充電や代替供給を可能にする。

【解決手段】 充電器本体20は正面と裏面に充電器21の出力端子 R_{0+} 、 R_{0-} 、 Q_{0+} 、 Q_{0-} が露出して設けられている。これらの面には電池アダプタ30が係合部を介して装着可能になされている。電池用アダプタ30は、両面に電極 S_+ 、 S_- 、 S_+' 、 S_-' が形成されており、出力端子 R_{0+} 、 R_{0-} や Q_{0+} 、 Q_{0-} との電気的な接触を反対面である二次電池Bの装着面となる面側に配線Lによって充電電流が導かれるようになっている。そして、この面に二次電池Bが装着されて、2個の二次電池が同時に充電可能にされる。



【特許請求の範囲】

【請求項1】 外部電源に接続可能され、二次電池応用電気機器の二次電池を充電する二次電池応用電気機器用充電器であって、上記二次電池が少なくとも装着可能な第1の装着部と、上記二次電池応用電気機器が少なくとも装着可能な第2の装着部と、上記第1の装着部に設けられ、上記充電器の出力端と上記第1の装着部に装着された二次電池の電極とを少なくとも接続可能にする第1の接続手段と、上記第2の装着部に設けられ、上記充電器の出力端と上記第2の装着部に装着された二次電池応用電気機器の充電端子とを少なくとも接続可能にする第2の接続手段とを備えたことを特徴とする二次電池応用電気機器用充電器。

【請求項2】 上記第1、第2の装着部は、上記二次電池及び上記二次電池応用電気機器のいずれもが装着可能にされ、上記第1、第2の接続手段は、上記充電器の出力端を上記二次電池の電極及び上記二次電池応用電気機器の充電端子の双方に対し接続可能にされていることを特徴とする請求項1記載の二次電池応用電気機器用充電器。

【請求項3】 上記第1、第2の装着部は、上記充電器の本体に対して着脱自在に形成されているものであることを特徴とする請求項1又は2記載の二次電池応用電気機器用充電器。

【請求項4】 外部電源に接続可能され、二次電池応用電気機器の二次電池を個々に少なくとも2個充電可能にする充電器を有する本体の各出力部に着脱自在にされたアダプタであって、上記本体が装着される第1の装着部と上記二次電池が装着される第2の装着部とを有するとともに、第1の装着部に上記充電器の出力端と接触する電源側電極と、上記第2の装着部に上記二次電池の種類に応じた電極位置に対応して電極が形成された電池側電極と、上記電源側電極と上記電池側電極とを接続する接続手段を備えたことを特徴とする二次電池応用電気機器用充電器に用いるアダプタ。

【請求項5】 請求項4記載の二次電池応用電気機器用充電器に用いるアダプタと、上記アダプタの第2の装着部に着脱自在に形成された機器用アダプタとからなり、上記機器用アダプタは、上記二次電池応用電気機器を装填する装填部を有するとともに、上記アダプタが装着される部分に上記電池側電極と接触する第1電極と、上記二次電池応用電気機器が装着される部分に該二次電池応用電気機器の種類に応じた充電端子位置に対応して電極が形成された第2電極と、上記第1、第2電極とを接続する接続手段とを備えたものであることを特徴とする二次電池応用電気機器用充電器に用いるアダプタ。

【請求項6】 外部電源に接続可能され、二次電池応用電気機器を個々に少なくとも2台充電可能にする充電器を有する本体の各出力部に着脱自在にされたアダプタであって、上記本体が装着される第1の装着部と上記二次

電池応用電気機器が装着される第2の装着部とを有するとともに、第1の装着部に上記充電器の出力端と接触する電源側電極と、上記第2の装着部に上記二次電池応用電気機器の種類に応じた充電端子位置に対応して電極が形成された機器側電極と、上記電源側電極と上記機器側電極とを接続する接続手段を備えたことを特徴とする二次電池応用電気機器用充電器に用いるアダプタ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、携帯無線電話器等、二次電池応用電気機器用の二次電池、および二次電池応用電気機器を充電（すなわち二次電池応用電気機器に装着された状態の二次電池を充電）する二次電池応用電気機器用充電器、および該充電器に用いるアダプタに関する。

【0002】

【従来の技術】携帯無線電話器はその携帯性を確保するべく二次電池が電源として採用されているものの、充電容量の点から利用者の満足を得るに十分な長時間の通話を可能にするには未だ至っていない。これは、携帯無線電話器は液晶表示部、そのバックライト用光源、その他マイク、スピーカー、更には順次追加される多機能を実行するためのキー操作部を有し、消費電力も少なくなく、むしろ増大している傾向にあるからである。この点に鑑みて、電話器本体に太陽電池を設け、日中は、太陽電池で表示部を駆動し（バックライトは消灯する）、夜間は、主電池を使用するようにして、可及的に主電池の容量低下を防止するものが提案されている（特開平6-224813号公報）。

【0003】

【発明が解決しようとする課題】上述の携帯無線電話器は、二次電池1回の満充電に対し、通話時間に比して受呼待ち時間の方がかなりの比率を占めているのが現状であり、しかも無通話状態でも受呼の有無を検出するべく二次電池から所要の回路部に電力供給を継続的に行っておく必要があることから、この受呼待ち、すなわち通話とは直接関係のない状態で、いわば無駄に消費する電力は無視出来ない。しかも、専用の充電器も携帯性に適した小型形状に形成されているとはいえず、従って外出先で電池切れとなって使用不能に陥る可能性も少なくなく、これでは携帯無線電話器本来の機能を損なうことにもなり兼ねない。上記公報記載の携帯電話装置は、周囲の明るさに関係なく、着呼が発生したら一律にバックライト用電源を点灯させて表示部やキー操作部を背後から照明することによる電力消費を太陽電池を利用してできるだけ省電せんとするものであり、受呼待ち状態に対する省電及び充電器に関するものではない。

【0004】また、PHSも含めて携帯無線電話器は多種類に及んでおり、それぞれの型式やメーカーによって、二次電池の形状、電極位置が異なり、更には電話器自体

の形状、充電端子も種々であることから、それぞれ専用の充電器が必要であり、その一方で、上述したように充電器の携帯が困難という現実があった。

【0005】本発明は、上記に鑑みてなされたもので、本来の充電に加え、使用乃至は準使用状態（受呼待ち状態）で消費する電力の補充充電や代替供給を可能にする充電器を提供し、ないしは異種の二次電池、二次電池応用電気機器に対しても本来の充電と使用乃至は準使用状態で消費する電力の補充充電や代替供給を可能にする二次電池応用電気機器用充電器及び該充電器に用いるアダプタを提供することを目的とするものである。

【0006】

【課題を解決するための手段】請求項1記載の発明は、外部電源に接続可能され、二次電池応用電気機器の二次電池を充電する二次電池応用電気機器用充電器であって、上記二次電池が少なくとも装着可能な第1の装着部と、上記二次電池応用電気機器が少なくとも装着可能な第2の装着部と、上記第1の装着部に設けられ、上記充電器の出力端と上記第1の装着部に装着された二次電池の電極とを少なくとも接続可能にする第1の接続手段と、上記第2の装着部に設けられ、上記充電器の出力端と上記第2の装着部に装着された二次電池応用電気機器の充電端子とを少なくとも接続可能にする第2の接続手段とを備えたものである。この構成によれば、第1の装着部に装着された二次電池及び第2の装着部に装着された二次電池応用電気機器に対し、外部電源から同時に充電が可能になる。また、外部電源に接続されていない状態では、充電器を介して二次電池と二次電池応用電気機器とは接続された状態になっているので、二次電池に残容量がある場合には、二次電池応用電気機器はこの二次電池から使用、準使用時の消費電流が補充充電、代替供給され、二次電池応用電気機器に装着されている二次電池の容量低下が抑制される。

【0007】請求項2記載の発明は、上記第1、第2の装着部に、上記二次電池及び上記二次電池応用電気機器のいずれもが装着可能にされ、上記第1、第2の接続手段が、上記充電器の出力端を上記二次電池の電極及び上記二次電池応用電気機器の充電端子の双方に対し接続可能にされているものである。この構成によれば、第1、第2の装着部の双方で二次電池が充電でき、また双方で二次電池応用電気機器が充電可能にされる。

【0008】請求項3記載の発明は、上記第1、第2の装着部が、上記充電器の本体に対して着脱自在に形成されているものであり、このように構成することで、二次電池、二次電池応用電気機器の種々のタイプの装着部を準備しておけば、1台の充電器でもって、種々のタイプの二次電池、二次電池応用電気機器に対する充電や、使用、準使用時の補充充電、代替供給が可能となる。

【0009】請求項4記載の発明は、外部電源に接続可能され、二次電池応用電気機器の二次電池を個々に少な

くとも2個充電可能にする充電器を有する本体の各出力部に着脱自在にされたアダプタであって、上記本体が装着される第1の装着部と上記二次電池が装着される第2の装着部とを有するとともに、第1の装着部に上記充電器の出力端と接触する電源側電極と、上記第2の装着部に上記二次電池の種類に応じた電極位置に対応して電極が形成された電池側電極と、上記電源側電極と上記電池側電極とを接続する接続手段を備えたものである。この構成によれば、二次電池のタイプに関係なく、対応するアダプタを準備しておき、このアダプタを介して二次電池を装着すれば、1台の充電器でもって種々のタイプの二次電池に対して複数個が同時に充電可能となる。

【0010】請求項5記載の発明は、請求項4記載の二次電池応用電気機器用充電器に用いるアダプタと、上記アダプタの第2の装着部に着脱自在に形成された機器用アダプタとからなり、上記機器用アダプタは、上記二次電池応用電気機器を装填する装填部を有するとともに、上記アダプタが装着される部分に上記電池側電極と接触する第1電極と、上記二次電池応用電気機器が装着される部分に該二次電池応用電気機器の種類に応じた充電端子位置に対応して電極が形成された第2電極と、上記第1、第2電極とを接続する接続手段を備えたものである。この構成によれば、二次電池用のアダプタに、更に、タイプに応じた機器用アダプタを装着すれば、種々のタイプの二次電池応用電気機器の充電が1台の充電器でもって可能になる。また、アダプタのみで二次電池を、アダプタと機器アダプタで二次電池応用電気機器を同時に充電が可能となり、さらには、電源を外した状態では、二次電池から二次電池応用電気機器に対して使用、準使用時の補充充電、代替供給が可能となる。

【0011】請求項6記載の発明は、外部電源に接続可能され、二次電池応用電気機器を個々に少なくとも2台充電可能にする充電器を有する本体の各出力部に着脱自在にされたアダプタであって、上記本体が装着される第1の装着部と上記二次電池応用電気機器が装着される第2の装着部とを有するとともに、第1の装着部に上記充電器の出力端と接触する電源側電極と、上記第2の装着部に上記二次電池応用電気機器の種類に応じた充電端子位置に対応して電極が形成された機器側電極と、上記電源側電極と上記機器側電極とを接続する接続手段を備えたものである。この構成によれば、二次電池応用電気機器のタイプに関係なく、対応するアダプタを準備しておき、このアダプタを介して二次電池応用電気機器を装着すれば、1台の充電器でもって種々のタイプの二次電池応用電気機器に対して複数台が同時に充電可能となる。

【0012】

【発明の実施の形態】図5は、本発明が適用される二次電池応用電気機器の一例として示す携帯無線電話器の構成図で、(a)は外観を示す斜視図、(b)～(d)は二次電池の電極配置構造を示す図、(e)はバッテリー

パックB Pの電極構造を示す斜視図である。

【0013】携帯無線電話器は、本実施形態では、ほぼ直方体形状の本体1を有し、その後面の下半部に窪み状の段部が形成され、ここに二次電池Bを内蔵する直方体形状乃至はそれに近い形状を有するバッテリーパックB Pが着脱可能に取り付けられている。本体1の頂部には送受信用のアンテナ2が上方に引出可能に設けられている。また、本体1の前面には、その上側から順に、受信信号を音声信号に変換するスピーカ3、相手先電話番号その他所要の内容を表示する液晶からなる表示部4、テンキーや所要の操作釦が所定の配列で設けられたキー入力部5及び外部からの音声を電気信号に変換するマイク6が設けられている。表示部5の内部には、この表示部5と対向してバックライト用光源7（図6参照）が配設され、またこのバックライト用光源7はキー入力部の各釦の裏面側にも種類によっては配設されている。8は二次電池Bからの電源供給を行わせる電源スイッチである。

【0014】バッテリーパックB P内の二次電池Bは充放電可能な、例えばNi-Cd系等の二次電池で、複数個を直列に接続するなどして、例えば7V（種類により出力電圧の少し異なるものもある）を発生して内部の所要の回路部にそのまま動作電圧として、あるいは図示しない昇圧回路を介して昇圧され、所要の動作電圧に変換されて電力供給を行っている。バッテリーパックB Pは長時間使用によって内部の二次電池Bの容量が消費されると、本体1から取り外して、後述する充電器（図1～図4）に接続することで、商用電源から、あるいは車載電源から必要時に充電し得るようになってい

る。【0015】また、携帯無線電話器は、その底面に、装着中の二次電池Bを充電する充電器との電気的接続を確保するための+、-両極の充電端子P_{I+}、P_{I-}が露出状態で配設されている。図5（b）～（d）は携帯無線電話器の種類に応じた、充電端子の配列位置、形状を示すもので、それぞれ両極に対しては+、-の符号を併記している。

【0016】また、図5（e）に示すように、バッテリーパックB Pは、本実施形態では、携帯無線電話器本体1と接する面に両極の電極P_{B+}、P_{B-}が露出状態で設けられており、一方、携帯無線電話器本体1のバッテリーパックB Pを装着する後面には上記電極P_{B+}、P_{B-}と対向する位置に、安定した接触が確保し得るように突起状に形成された電極P₊、P₋（図6参照）が設けられている。

【0017】図6は、携帯無線電話器の一実施形態を示す回路ブロック図である。図において、11は携帯無線電話器の動作制御を統括的に制御する制御部で、受呼の有無の検出、所要の回路部への電源供給及びキー入力部5からの種々の操作に応じて各回路部に必要な動作を行わせるものである。

【0018】12は無線周波信号を中間周波乃至は音声周波に復調する復調回路、13は音声周波信号を無線周波信号に変調する変調回路、14は本装置と公衆電話回線網との接続、遮断を制御するネットワークコントロールユニット（以下、NCUという。）、15はマイク3からの音声データやキー入力部5から制御部11を介して入力されるキーデータを同一ラインに載せ、あるいは相手方からの受信音声データとキーデータとを判別してスピーカ6、制御部11に切り換えて導く音声/データ処理回路である。なお、復調回路12及び変調回路13の送受信信号に対する切換えは、公知のように両信号の周波数の差異を利用するデュプレクサーを用いて行われている。

【0019】また、本体1にバッテリーパックB Pが装着された状態では、本体1の電極P₊、P₋と二次電池Bの端子P_{B+}、P_{B-}とが接続状態とされ、電源スイッチ8がオンされると、二次電池Bから出力電圧がそのまま、あるいは制御部11で昇圧されて（各回路部の動作電圧が異なる場合には、それぞれ所要の動作電圧に変換して）から所要の回路部にそれぞれ電源供給される。なお、充電端子P_{I+}、P_{I-}は対応する電極P₊、P₋との間で（携帯無線電話器本体1内で）短絡されているものである。

【0020】ここで、制御部11の動作について説明すると、電源スイッチ8の投入により二次電池Bから必要な回路部に電源供給が開始される。先ず、発呼の場合、キー入力部5を操作して相手先電話番号を入力すると、制御部11はバックライト用電源7を点灯させてその入力内容を表示部4に表示させるとともに必要な内容のメッセージやマーク（呼出し中など）を表示させる。そして、アンテナ2から送信が行われ、回線が接続される（相手方が受話器を取る）と、マイク3、スピーカ6に電源供給が行われて双方向の通話が可能となる。次に、受呼の場合、電源スイッチ8はオン状態にあり、受呼の有無を検出するべく、アンテナ2、復調回路12、NCU14、音声/データ処理回路及び制御部11に電源供給が行われている。そして、受呼が発生すると、制御回路11はNCU14に制御信号を出力して回線を保持させるとともに、スピーカ6に電源供給を行って受呼音を発生させ、かつバックライト用電源7を点灯させて表示部4に相手側の電話番号等の表示を行わせる。この状態で、使用者が送/受釦を操作すると、NCU14により回線が保持され、かつマイク3に電源供給が行われて双方向の通話が可能となる。

【0021】20は、二次電池Bを充電する充電器本体で、二次電池Bに定電流充電を行わせるための充電器21及び商用電源と接続可能な電源プラグ22を有する。充電器本体20は出力端子Q_{o+}、Q_{o-}（図中、充電端子P_{I+}、P_{I-}が接続されている）及び出力端子R_{o+}、R_{o-}を設けてなり、出力端子Q_{o+}、Q_{o-}及び出力端子R_{o+}、

R_{0-} はそれぞれ、図1～図4を用いて後述するように、電池アダプタ30を介して二次電池の電極 P_{B+} 、 P_{B-} 、あるいは電池アダプタ30及び電話器アダプタ40を介して充電端子 P_{I+} 、 P_{I-} が接続可能に構成されている。

【0022】充電器21の回路構成の一実施形態を、図4を用いて動作と共に説明すると、この充電器21は例えばDC-DCインバータ方式を採用してなるもので、電源プラグ22を介して入力される商用電源を、図略の降圧手段で降圧した後、まずダイオードブリッジDBで整流し、コンデンサC1等で平滑して所要の直流電圧に変換した後、トランスTの一次巻線L1とスイッチング素子S1との直列回路に導くようにしている。なお、市販のACコンバータを前段で用いる場合、このACコンバータにはダイオードブリッジDBは内蔵されている。

【0023】スイッチング素子S1はゲートの帰還巻線L3を含む回路を利用して自励発振可能にされており、所定の高周波のスイッチングパルスをベースに印加する。このスイッチング信号を受けてスイッチング素子S1はオン、オフを繰り返し、トランスTの二次巻線L2に交流電圧を誘起させる。この誘起交流電圧はダイオードD1、コンデンサC2等で整流、平滑され、更に逆流防止用ダイオードを経て充電器21の出力端子 Q_{0+} 、 Q_{0-} 及び出力端子 R_{0+} 、 R_{0-} に導かれる。図4では、出力端子 Q_{0+} 、 Q_{0-} に、電池アダプタ30及び電話器アダプタ40を介して携帯無線電話器に装着された二次電池Bが接続され、出力端子 R_{0+} 、 R_{0-} に、電池アダプタ30を介して二次電池Bが単独で接続されている。

【0024】出力電流は電流検出抵抗R1で電圧の形で検出され、フォトカプラ等のフィードバック回路FBを介して帰還されてPWM回路で上記スイッチングパルスのデューティを変更制御し、これにより充電器21は定電流充電回路として動作するようにされている。なお、コンデンサC2の両端電圧をフィードバックするようにして定電圧充電を行わせるようにしてもよく、このように構成すれば出力端子 Q_{0+} 、 Q_{0-} 及び出力端子 R_{0+} 、 R_{0-} のいずれか一方あるいは両方に二次電池Bや携帯無線電話器が接続される場合でも、充電電流を安定供給し得るという利点がある。23はシガーライターケース等の車載電源を導入可能にするコネクタで、その入力側は充電器21のダイオードブリッジDBの出力側に接続されている。車載電源の電圧、電流が二次電池Bの充電電圧、電流の定格と許容以上の差があるときは、その間に負荷（抵抗）や分圧抵抗を介在させておけばよい。

【0025】また、充電器21の出力側に出力端子 Q_{0+} 、 Q_{0-} 及び出力端子 R_{0+} 、 R_{0-} を並列に設けることで、電源（車載電源含む）が投入された状態では、二次電池B及び携帯無線電話器本体1に装着されている二次電池Bの双方に対して充電が行われる。なお、後述する変形態様（1）の場合には、携帯無線電話器に対しては

充電ではなく、電力の代替供給となる。

【0026】一方、電源が抜かれているときは、携帯無線電話器本体1に装着中の二次電池Bに対して、単独で接続されている（残容量を有する）他方の二次電池Bから出力端子 R_{0+} 、 R_{0-} 、 Q_{0+} 、 Q_{0-} の経路で電力が補充されることとなる（この場合、携帯無線電話器本体1に装着中の二次電池Bは、受待ち状態での消費電力を半分に抑制し得る）。なお、この場合も、後述する変形態様（1）によれば、携帯無線電話器に対しては充電ではなく、他方の二次電池Bによる電力の代替供給となる。

【0027】続いて、充電器及びこれに付随する部材の構造について図1～3を用いて説明する。図1は、充電器本体に電池アダプタ及び電話器アダプタが装着された状態を示す斜視図、図2は、充電器本体の斜視図、図3（a）は電池アダプタと電話器アダプタとの関係を示す分解斜視図、図3（b）は両者の係合構造の一実施形態を示す側面断面図である。

【0028】これらの図において、充電器本体20は例えば樹脂等で形成され、ほぼ直方体形状を有してなり、その内部下方には充電器21を構成する図4に示す回路部が収納されている。下部側面適所に形成された開口201からは所要長のコードを有する電源プラグ22が引出、収納可能に設けられている。また、充電器本体20の上部面の一方側には、開口202が形成され、スライド式の蓋203により開閉可能にされている。充電器21の上部内空間には、所要長のコードを有する車載電源用のコネクタ23が開口202を介して引出し可能に収納されている。

【0029】図2において、充電器本体20は、例えば前後側面に電池アダプタ30が装着可能な同一装着構造が形成されており、これら各側面には、充電電流を供給するための出力端子 Q_{0+} 、 Q_{0-} が露出して設けられている。この実施形態では、図5（b）タイプの二次電池Bに対応する位置に所要の出力端子 Q_{0+} 、 Q_{0-} が配設されている。また、同側面には、これらの出力端子 Q_{0+} 、 Q_{0-} を囲むようにして、4個の凹状係合部20aが形成されている。

【0030】図3において、電池アダプタ30は、所要厚の板状を有し、充電器本体20と接する面及び電話器アダプタ40と接する面にそれぞれ電極構造が形成されるとともに、両側面の対応する電極間はそれぞれ内部配線L（図中破線で示している）により電気的に短絡されている。充電器本体20と接する面側には、電池アダプタ30を充電器本体20に装着した状態で出力端子 Q_{0+} 、 Q_{0-} と対向する位置に電極 S_+ 、 S_- （図3では破線で示している）が互いに接触可能に配設され、一方、電話器アダプタ40と接する面側には、装着予定の二次電池Bの電極配置（例えば図5（e））と対向する位置に電極 S_+ 、 S_- が互いに接触可能に配設されている。なお、図では見えていないが、電池アダプタ30の

裏面側には、凹状係合部20aと嵌合するように対向する位置に凸状係合部が形成されている。これにより、図1に示すように、充電器本体20の裏側面には電池アダプタ30に二次電池Bが直接装着されている。また、正面側の面には、図3に示すように、電極 S_+ 、 S_- を囲むようにして、4個の凹状係合部30aが形成されている。

【0031】電話器アダプタ40は、携帯無線電話器本体1を安定姿勢で装填可能なボックス形状を有し、左右両側壁の他、後方側の側面401、底面402を有する。また、側面401の外面（裏面）には電池アダプタ30の正面側の凹状係合部30aと対向する位置に凸状係合部40a（図3では見えていない）が形成されている。すなわち、図3（b）に示すように、凹状係合部30aは側壁内に下方に延びる係合穴が形成されてなり、一方、凸状係合部40aは上記凹状係合部30aの係合穴に嵌合する係合形状を有している。そして、電話器アダプタ40を電池アダプタ30の正面側の上方より摺接させながら下方にスライドさせると、上記凹状係合部30aと凸状係合部40aとが嵌合し合い、かつ凹状係合部30aの底130aと凸状係合部40aの当接下端140aが当接して位置固定される。また、電話器アダプタ40の電池アダプタ30と接する側面401には、電池アダプタ30の電極 S_+ 、 S_- と対応する位置に電極 T_+ 、 T_- （図中、破線で示す）が設けられるとともに、底面402には配線L（図中、破線で示す）を介して電極 U_+ 、 U_- が設けられている。電極 U_+ 、 U_- は携帯無線電話器本体1が装填された状態で、携帯無線電話器本体1の下面に形成されている充電端子 P_{I+} 、 P_{I-} の位置（図5（b）～（d）参照）に対応して設けられている。

【0032】続いて、本充電器の使用態様について説明する。

（1）二次電池Bを1個～2個充電する場合
この場合には、電源プラグ22あるいはコネクタ23を電源側に接続するとともに、充電予定の二次電池B（バッテリーパックBPとしても実質同じ）のタイプの電池アダプタ30を準備して、これを充電器本体20に装着し、この電池アダプタ30に予定の二次電池Bを装着すればよい。2個充電する場合には、電池アダプタ30を2個準備すればよい。異なるタイプの二次電池Bも充電することは可能である。

【0033】（2）携帯無線電話器を1台～2台充電する場合
この場合には、電源プラグ22あるいはコネクタ23を電源側に接続するとともに、充電予定の携帯無線電話器のタイプの電池アダプタ30及び電話器アダプタ40を準備して、電池アダプタ30を充電器本体20に装着し、更に電話器アダプタ40を装着してから、この電話器アダプタ40に予定の携帯無線電話器本体1を装填すればよい。2台充電する場合には、電池アダプタ30、

電話器アダプタ40を夫々2個準備すれば良く、この場合でも、異なるタイプの携帯無線電話器を充電することは可能である。

【0034】また、上記（1）、（2）から二次電池1個と携帯無線電話器1台とをそれぞれ充電することもできる。この場合、充電中の携帯無線電話器に装着される二次電池Bとは異なるタイプの二次電池Bを充電することも可能である。

【0035】（3）二次電池1個と携帯無線電話器1台を充電器本体20に接続し、二次電池Bの電力を携帯無線電話器に供給して受待ち電力を補充する場合
電源プラグ22及びコネクタ23の双方を電源から外した状態で、充電器本体20の一方側に電池アダプタ30を介して二次電池Bを装着し、他方側に電池アダプタ30及び電話器アダプタ40を介して携帯無線電話器本体1を装着する。この場合、一方側に装着された二次電池Bが十分な容量を有しておれば、この二次電池Bから携帯無線電話器に対して受待ち時に消費する電力分の補充が行われるので、携帯無線電話器本体1に装着されている二次電池Bの電力の消費を抑制することができる。従って、携帯無線電話器を充電器本体20から引き抜いて、携帯する場合には、不必要に放電されていない元の二次電池Bを効果的に（すなわち長時間）使用でき、携帯中に電池切れになるということが可及的に防止できる。また、このような使用態様は、充電器本体があれば、回りに電源がなくとも、携帯無線電話器の受待ち放電を可及的に抑制し得るので、きわめて実用的となる。

【0036】なお、本発明は、携帯無線電話器や二次電池Bがメーカー等によりそれぞれ異なる形状、特に電極の配設位置（すなわちタイプ）が異なることから、それぞれのタイプ等に対応するように電池アダプタ30や電話器アダプタ40を準備しておけば、1台の充電器本体20で全てタイプの二次電池Bや携帯無線電話器に対する充電、及び上記（3）の受待ち時の補充充電が可能となる。従って、本充電器本体20を人が集まる家屋や会館、宿泊施設その他に設備しておけば、きわめて実用的となる。また、車載電源の利用時には、搭乗者の所有する種々のタイプの二次電池、携帯無線電話器に対して充電を可能にすることができる。しかも、回りに電源がない場合でも、本充電器があれば、同一乃至は異なる二次電池を利用して自己の携帯無線電話器を上記補助充電できる。

【0037】なお、本発明は、以下の変形態様が可能である。

（1）携帯無線電話器本体1の底面には図5（b）～（d）に示す構成の充電端子 P_{I+} 、 P_{I-} が設けられているが、通常、携帯無線電話器本体1の底面にはこの充電端子 P_{I+} 、 P_{I-} に隣接する位置に、他の形状の端子が準備されている。この端子（ここでは、他の充電端子とい

う)は、上記充電端子 P_{1+} 、 P_{1-} と同様に一対形状を有するとともに、電源と接続するためのコネクタを接続すると、機構的に二次電池B側がオープンになるように形成されている。そして、上記他の充電端子に電源からのコネクタが接続された場合には、直接、携帯無線電話器の負荷部に電源から電力が供給され、二次電池Bを不使用状態にできて、いわば二次電池Bに対する代替として電力供給が可能になるようになっている。そこで、電話器用アダプタ40の電極 U_{+} 、 U_{-} として、図1~3のものに代えて、携帯無線電話器が電話器アダプタ40に装填された状態で、上記他の充電端子と接触し、二次電池Bをオープンするように(上記コネクタと同様な構造の)電極を構成しておけば、充電器本体20の他方側に接続されている二次電池Bから直接、携帯無線電話器の負荷部に代替的に電力供給が可能になり、このような電話器アダプタを採用することで、携帯無線電話器に装着されている二次電池Bの電力消費を完全に抑制することが可能となる。

【0038】(2)図4において、スイッチSWを各逆流防止ダイオードに並列に設け、これを充電器本体20の外部適所(例えば天井部や左右側の側面)に運動操作可能に配設することで、電源未投入状態で、充電器本体20に二次電池Bと携帯無線電話器とが装着されているとき、携帯無線電話器への補充充電をマニュアル指示でオン、オフするようにすることができる。

【0039】(3)本発明は、二次電池Bの種類は限定されるものではなく、リチウムイオン電池に対しても充分適用可能であり、このリチウムイオン電池が装着される携帯無線電話器に対しても同様に適用し得る。この場合、二次電池Bや携帯無線電話器に装着されている二次電池Bが、あるいはその際に使用する電池アダプタ30や電話器アダプタ40がニッカド系の電池であるかリチウムイオン電池であるかの識別機能を充電器に持たせ、あるいはマニュアルスイッチを付設して、マニュアルでいずれか側に切り替えるようにすることもできる。なお、この充電器には、リチウムイオン電池を充電可能にするための充電回路が設けられている必要がある。

【0040】(4)携帯無線電話器の場合、充電器本体20との間に、電池アダプタ30及び電話器アダプタ40を介在させた実施形態で説明したが、電話器アダプタ40のみを介して充電可能にする構成としてもよい。すなわち、充電器本体20を介在させて一方側に装着された二次電池Bから他方側に装填された携帯無線電話器を補充充電する際には、携帯無線電話器本体1に装着されている二次電池Bは、通常、上記一方側に装着されている二次電池と同タイプが利用されると考えられるから、このような場合にあっては、電話器アダプタ40を直接充電器本体20と係合部の関係が対応しており、両者が係合可能となっているからである。こうすることにより、かかる補充充電に際して電池アダプタ30が1個

で済むという利点がある。

【0041】(5)また、本実施形態では、充電器本体20、電池アダプタ30、電話器アダプタ40との各係合構造として凹凸形状を採用しているが、本発明はこれに限定されず、ガイドレールを用いてスライド装着させるもの、マグネット等の吸引力を利用して装着するもの等、種々の装着方法を採用することができる。

【0042】(6)電池アダプタ30、電話器アダプタ40は、装着される二次電池に対応する携帯無線電話器のタイプに応じた電圧を得るべく、内部等に充電器からの出力電圧を降圧し、あるいは昇圧するための回路を設けておけば、より適正な電圧が得られるという利点がある。

【0043】(7)本実施形態では、充電器本体20に対する電池アダプタ30、電話器アダプタ40の装着位置を側面としたが、本発明はこれに限定されず、同一側面に並設するようにしてもよく、特に電池アダプタ30の場合、二次電池を一体的に収納する収納形状を有するものを採用するようにすれば、操作性にも優れる。

【0044】(8)充電器本体20への装着個数(台数)は2個に限定されず、3個でもよく、4個以上でもよく、このようにすれば効率上がる。

【0045】(9)本発明は、携帯無線電話器以外に、二次電池応用電気機器、すなわち携帯用としてパーソナルコンピュータ、ワードプロセッサ、カメラやビデオカメラ、携帯用ステレオ等にも適用できる。なお、携帯無線電話器では受待ちという特殊な状態があり、これに対する補充充電、代替供給を可能にしたが、上記各種の機器にあっては、それぞれに応じた状態での使用中に対して補充充電、代替供給を行うようにしたり、また携帯無線電話器における受待ち時の如き、例えば機器のスリープ中(準使用という)に対して消費電力を補充充電、代替供給するようにしてもよい。

【0046】

【発明の効果】請求項1記載に発明によれば、二次電池が少なくとも装着可能な第1の装着部と、二次電池応用電気機器が少なくとも装着可能な第2の装着部と、上記第1の装着部に設けられ、充電器の出力端と上記第1の装着部に装着された二次電池の電極とを少なくとも接続可能にする第1の接続手段と、上記第2の装着部に設けられ、上記充電器の出力端と上記第2の装着部に装着された二次電池応用電気機器の充電端子とを少なくとも接続可能にする第2の接続手段とを備えた構成としたので、1台の充電器でもって二次電池と二次電池応用電気機器を同時に充電できる。また、外部電源に接続されていない状態で、二次電池から二次電池応用電気機器に対して使用乃至は準使用状態での消費電力が補充充電、代替供給され、二次電池応用電気機器に装着されている二次電池の容量低下を抑制することができる。

【0047】請求項2記載の発明によれば、上記第1、

第2の装着部に、上記二次電池及び上記二次電池応用電気機器のいずれもを装着可能にし、上記第1、第2の接続手段を上記充電器の出力端と上記二次電池の電極及び上記二次電池応用電気機器の充電端子との双方に対し接続可能にした構成としたので、第1、第2の装着部の双方で二次電池を充電でき、また双方で二次電池応用電気機器を充電できることとなる。

【0048】請求項3記載の発明によれば、上記第1、第2の装着部を、上記充電器の本体に対して着脱自在に形成したので、二次電池、二次電池応用電気機器の種々のタイプの装着部を準備しておけば、1台の充電器でもって、種々のタイプの二次電池、二次電池応用電気機器に対する充電、補充充電や代替供給を可能にすることができる。

【0049】請求項4記載の発明によれば、外部電源に接続可能され、二次電池応用電気機器の二次電池を個々に少なくとも2個充電可能にする充電器を有する本体の各出力部に着脱自在にされたアダプタであって、上記本体が装着される第1の装着部と上記二次電池が装着される第2の装着部とを有するとともに、第1の装着部に上記充電器の出力端と接触する電源側電極と、上記第2の装着部に上記二次電池の種類に応じた電極位置に対応して電極が形成された電池側電極と、上記電源側電極と上記電池側電極とを接続する接続手段を備えた構成としたので、二次電池のタイプに関係なく、対応するアダプタを準備しておき、このアダプタを介して二次電池を装着すれば、1台の充電器でもって種々のタイプの二次電池に対して複数個を同時に充電させることができることとなる。

【0050】請求項5記載の発明によれば、請求項4記載の二次電池応用電気機器用充電器に用いるアダプタと、上記アダプタの第2の装着部に着脱自在に形成された機器用アダプタとからなり、上記機器用アダプタは、上記二次電池応用電気機器を装填する装填部を有するとともに、上記アダプタが装着される部分に上記電池側電極と接触する第1電極と、上記二次電池応用電気機器が装着される部分に該二次電池応用電気機器の種類に応じた充電端子位置に対応して電極が形成された第2電極と、上記第1、第2電極とを接続する接続手段を備えた構成としたので、二次電池用のアダプタに、更に、タイプに応じた機器用アダプタを装着することで、種々のタイプの二次電池応用電気機器の充電を1台の充電器で行うことができ、また、アダプタのみで二次電池を、アダプタと機器用アダプタで二次電池応用電気機器を同時に充電することができることとなる。しかも、電源を外した状態では、二次電池から二次電池応用電気機器に対して使用乃至は準使用状態での補充充電、代替供給を行わせることができることとなる。

【0051】請求項6記載の発明によれば、外部電源に接続可能され、二次電池応用電気機器を個々に少なくとも2台充電可能にする充電器を有する本体の各出力部に着脱自在にされたアダプタであって、上記本体が装着される第1の装着部と上記二次電池応用電気機器が装着される第2の装着部とを有するとともに、第1の装着部に上記充電器の出力端と接触する電源側電極と、上記第2の装着部に上記二次電池応用電気機器の種類に応じた充電端子位置に対応して電極が形成された機器側電極と、上記電源側電極と上記機器側電極とを接続する接続手段を備えた構成としたので、二次電池応用電気機器のタイプに関係なく、対応するアダプタを準備しておき、このアダプタを介して二次電池応用電気機器を装着することで、1台の充電器でもって種々のタイプの二次電池応用電気機器に対して複数台を同時に充電させることができることとなる。

【図面の簡単な説明】

【図1】充電器本体に電池アダプタ及び電話器アダプタが装着された状態を示す斜視図である。

【図2】充電器本体の斜視図である。

【図3】(a)は電池アダプタと電話器アダプタとの関係を示す分解斜視図、(b)は両者の係合構造の一実施形態を示す側面断面図である。

【図4】充電器の回路構成の一実施形態を示す回路図である。

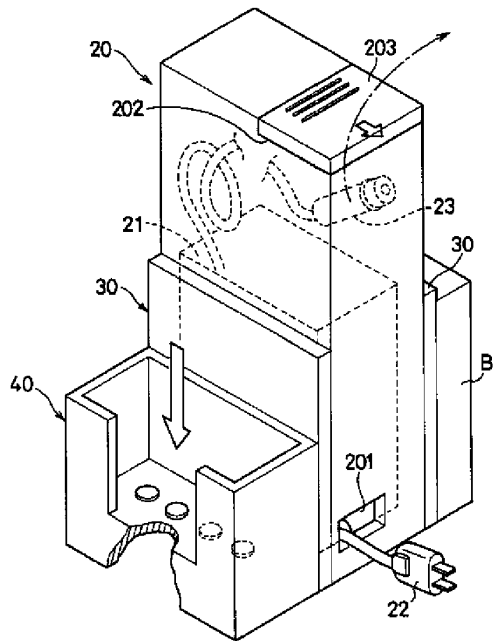
【図5】本発明が適用される二次電池応用電気機器の一例として示す携帯無線電話器の構成図で、(a)は外観を示す斜視図、(b)～(d)は二次電池の電極配置構造を示す図、(e)はバッテリーパックBPの電極構造を示す斜視図である。

【図6】携帯無線電話器の一実施形態を示す回路ブロック図である。

【符号の説明】

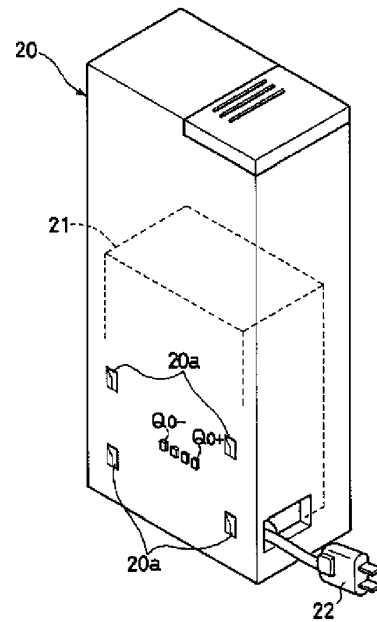
- 1 携帯無線電話器本体（二次電池応用電気機器本体）
- 20 充電器本体
- 21 充電器
- 22 電源プラグ
- 23 車載電源用のコネクタ
- 30 電池アダプタ
- 40 電話器用アダプタ
- 20a, 30a 凹状係合部
- B 二次電池
- R₀₊, R₀₋, Q₀₊, Q₀₋ 出力端子
- P₁₊, P₁₋ 充電端子
- P_{B+}, P_{B-} 二次電池の端子
- S₊, S₋, S₊', S₋', T₊, T₋, U₊, U₋ 電極
- L 配線（接続手段）
- SW スイッチ

【図 1】

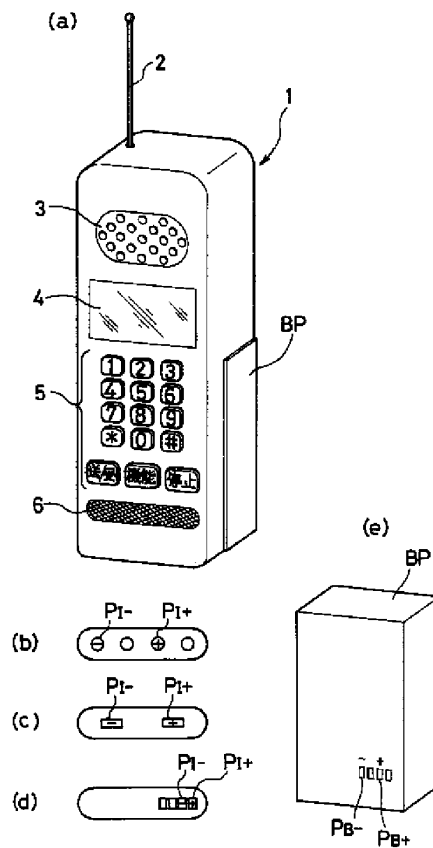
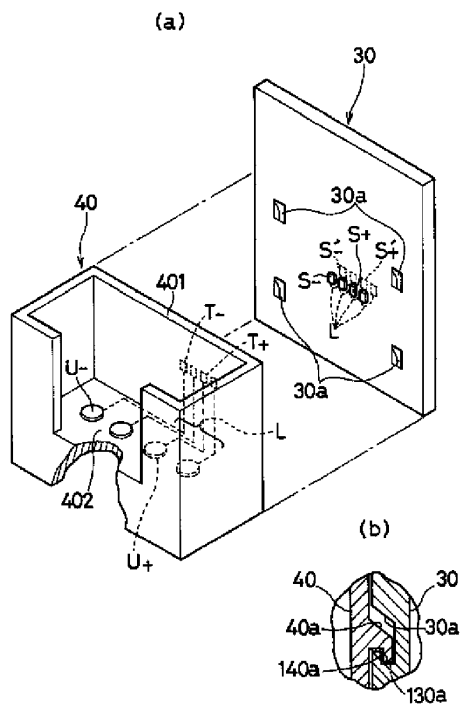


【図 3】

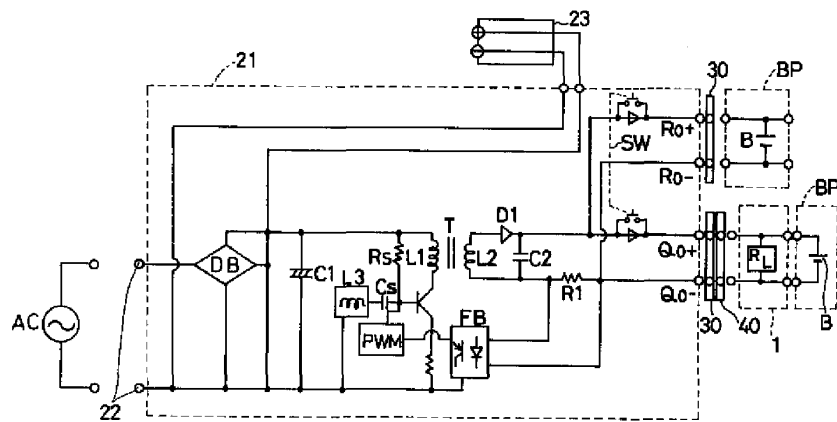
【図 2】



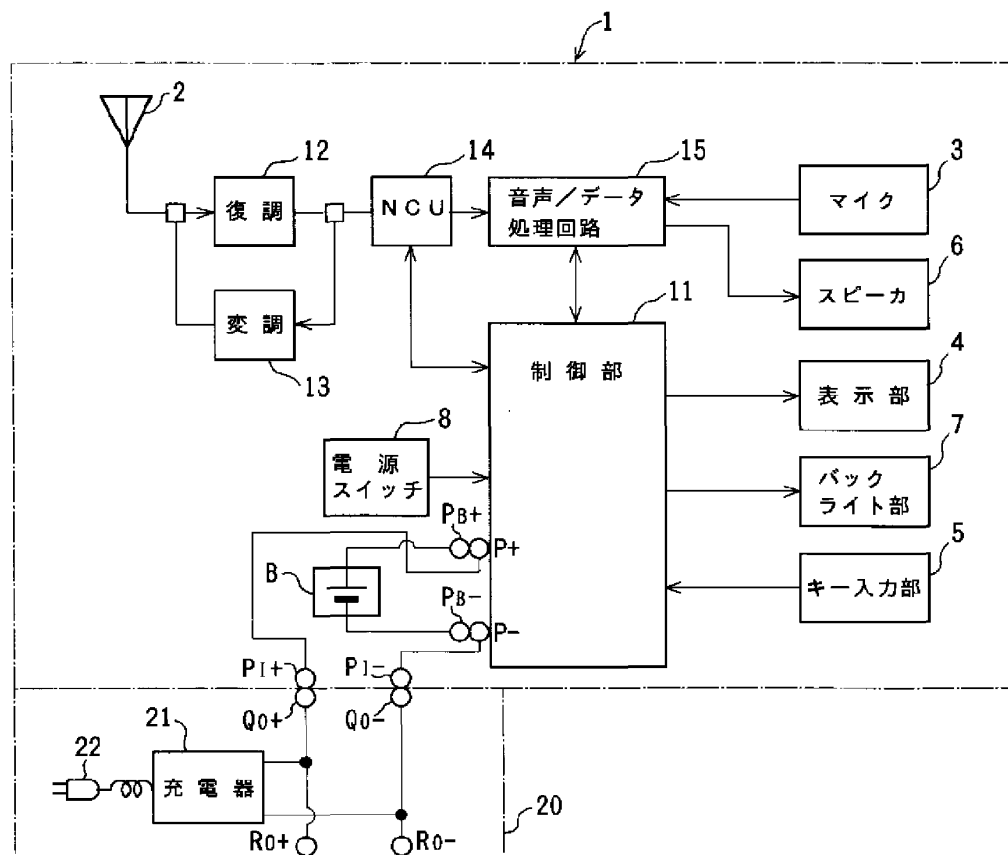
【図 5】



【図4】



【図6】



Reexamination 	Application/Control No. 96/000,355	Applicant(s)/Patent Under Reexamination 8013568
	Certificate Date	Certificate Number

Requester Correspondence Address: ☒ Patent Owner ☐ Third Party
K&L Gates LLP-Chicago P.O. Box 1135 Chicago, IL 60690

LITIGATION REVIEW ☒	AD (examiner initials)	22 June 2021 (date)
Case Name		Director Initials

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER

<i>Search Notes</i> 	Application/Control No. 96/000,355	Applicant(s)/Patent Under Reexamination 8013568
	Examiner ANJAN K DEB	Art Unit 3992

CPC - Searched*		
Symbol	Date	Examiner
H02J/00308	09/27/2021	AD
H02J/00308	09/27/2021	AD
H02J50/10	09/27/2021	AD
H02J7/025	09/27/2021	AD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	108	09/27/2021	AD

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Searched IDS	06/24/2021	AD
Searched Prosecution History	06/24/2021	AD
PE2E search attached	09/27/2021	AD

<i>Search Notes</i> 	Application/Control No. 96/000,355	Applicant(s)/Patent Under Reexamination 8013568
	Examiner ANJAN K DEB	Art Unit 3992

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

<i>Notice of References Cited</i>	Application/Control No. 96/000,355		Applicant(s)/Patent Under Reexamination 8013568	
	Examiner ANJAN K DEB		Art Unit 3992	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6016046-A	01-2000	Kaite; Osamu	H02J50/10	320/108
*	B	US-6184651-B1	02-2001	Fernandez; Jose M.	H02J50/12	320/108
*	C	US-7208915-B2	04-2007	Kubota; Atsumasa	H02J7/0072	320/134
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	JPH09251865	09-1997	JP	Junko Suginaka	Y02E60/10
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20210917



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,355	03/12/2021	8013568	0313071.00020	1538
24573	7590	09/29/2021	EXAMINER	
K&L Gates LLP-Chicago			DEB, ANJAN K	
P.O. Box 1135				
Chicago, IL 60690				
			ART UNIT	PAPER NUMBER
			3992	
			MAIL DATE	DELIVERY MODE
			09/29/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action in Ex Parte Reexamination	Control No. 96/000,355	Patent Under Reexamination 8013568	
	Examiner ANJAN K DEB	Art Unit 3992	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

- a. ☒ Responsive to the communication(s) filed on 31 August 2021.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☐ This action is made FINAL.

- c. ☒ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire 2 month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c)**. If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☒ Notice of References Cited by Examiner, PTO-892.	3. ☐ Interview Summary, PTO-474.
2. ☐ Information Disclosure Statement, PTO/SB/08.	4. ☐ _____.

Part II SUMMARY OF ACTION

- 1a. ☒ Claims 1-48 are subject to reexamination.
- 1b. ☐ Claims _____ are not subject to reexamination.
2. ☐ Claims _____ have been canceled in the present reexamination proceeding.
3. ☐ Claims _____ are patentable and/or confirmed.
4. ☒ Claims 1-48 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ The drawings, filed on _____ are acceptable.
7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have
 - 1 ☐ been received.
 - 2 ☐ not been received.
 - 3 ☐ been filed in Application No. _____.
 - 4 ☐ been filed in reexamination Control No. _____.
 - 5 ☐ been received by the International Bureau in PCT application No. _____.
- * See the attached detailed Office action for a list of the certified copies not received.
9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.
10. ☐ Other: _____

cc: Requester (if third party requester)

U.S. Patent and Trademark Office

PTOL-466 (Rev. 08-13)

Office Action in Ex Parte Reexamination

Part of Paper No. 20210917

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DETAILED ACTION

1.0 SUMMARY

This Office action addresses claims 1-48 of United States Patent Number US 8,013,568 (hereinafter "the '568 patent"), issued September 6, 2011 to Park et al. in response to Applicant's amendment with remarks filed on 8/30/2021, which is in response to the non-final rejection mailed on 6/30/2021.

1.1 Priority

As noted on its front page, the '568 patent claims priority from:

KR 10-2005-0069871 filed July 29, 2005

KR 10-2006-0038960 filed April 28, 2006

1.2 Status of Claims

Claims 1-48 are pending.

Claims 3, 9, 11-12, and 16 have been amended.

New claims 25-48 are added. Support for the new claims are provided in the Remarks pages 15 and 16.

Claims 1-48 are rejected.

1.3 References Cited In Request

The examiner has considered a substantial new question of patentability has been raised by at least the following prior art reference submitted by Third Party Requester:

Korean Patent No. KR950005819B1 to Hong Chung-Sik, English Language Translation
("Chung-Sik")

1.4 Issues Raised in the Request

Issue 1: Primary reference: Chung-Sik (KR950005819B1)

Requester states that the teaching of Chung-Sik references raises a substantial new question of patentability with respect to claims 1-24 of the '568 Patent (Request pages, 4-26).

1.5 Rejections Proposed in the Request

The following rejection is proposed in the request:

Claims 1-24 of the '568 Patent are obvious under 35 U.S.C. § 103(a) over Chung-Sik taken alone (Request pages 4-26).

2.0 RESPONSE TO ARGUMENTS

35 U.S.C. 112 6th paragraph

Applicant referred to the previous telephone interview to clarify that the claims are not subject to interpretation under 112 U.S.C. 112 6th paragraph, and that specific claim features discussed during the telephone interview (*e.g.*, constant voltage/constant current supplier and overvoltage monitoring unit) are well supported by the specification, connote sufficient definite structure to persons skilled in the art reading the specification, and each and every word of the claims should be given patentable weight. Additionally, Applicant submits that support for the claimed "constant voltage/constant current supplier" is found in column 2, lines 13-20; column 7, lines 33-44; and column 10, lines 39-44 of the specification. Furthermore, support for the

claimed "overvoltage monitoring unit" is found at column 4, lines 14-45 and column 7, lines 43 to column 8, line 63. (Remarks, page 14 and 15).

The Examiner disagrees, the claims are being interpreted under 112 U.S.C. 112 6th paragraph as per analysis provided below.

Response to Claim Rejection - 35 USC § 102 (anticipated by Chung-Sik)

Regarding the rejection of claim(s) 1-3, 5-9, 11-15 and 20 under pre-AIA 35 U.S.C. 102(b) as being anticipated by Chung-Sik (KR 950005819B1), Applicant has amended claims 3, 9, 11-12, and 16, submitted new claims 25-48, and made the following arguments.

a) Claims 1-6 and 25-29

i) **Chung-Sik fails to teach or suggest a constant voltage/constant current supplier that receives a DC current from a rectifier and that supplies a charging power to a battery cell in a constant voltage/constant current mode (Remarks, pages 17-20).**

Examiner disagrees, because Chung-Sik discloses a constant voltage supplier that receives a DC current from a rectifier 80 and supplies the charging power to a battery cell 32 in a constant voltage mode (Chung-Sik. Fig. 2). The rectified voltage IDC is smoothened by a capacitor 82 to provide a constant voltage that supplies a charging power to the battery 32 at a constant voltage through a current limiting resistor 84 and diode 85. Further evidence that the rectified voltage IDC is a constant voltage can be inferred from the fact that the voltage V1 obtained from the rectified voltage IDC is constant ("reference voltage V1 is constant") (Chung-Sik. English Translation, page 8-5, line 5). Additionally, Chung-Sik discloses voltage rectifying unit in the portable device detects an induced voltage proportional to a time change ratio of a flux linkage and rectifies the detected induced voltage to a DC voltage at a predetermined level,

and the rectified voltage is applied to the rechargeable battery. Rectifying the detected induced voltage to a DC voltage at a predetermined level ("DC voltage at a predetermined level") is broadly considered the same as supplying the charging power to a battery cell in a constant voltage mode. Thus contrary to Applicant's arguments, Chung-Sik discloses constant voltage/constant current supplier that: (1) receives the DC current from the rectifier and (2) supplies a charging power to the battery cell (3) in a constant voltage/constant current mode.

Applicant further provided an argument that Chung-Sik's constant voltage unit 42 is not even part of Chung-Sik's portable device 18 or Chung-Sik's contactless charging unit 38 (where Chung-Sik's rectifier 80 and ChungSik's battery 32 are disposed), rather, Chung-Sik's alleged constant voltage unit 42 is disposed in a different physical device (the base unit 12), which does not include the rectifier 80 or the battery 32, as clearly shown in Fig. 2 of Chung-Sik. The Examiner recognizes that Chung-Sik's constant voltage unit 42 is on the base unit so as to provide a well regulated input voltage to the induced voltage generating unit 46 and providing an output voltage from the coil 79 of the induced voltage detecting unit 81, and a rectifier 80 for rectifying the voltage output from the coil 79 of the induced voltage detecting unit 81. The rectified voltage is smoothened by a capacitor 82 to provide a constant voltage that supplies a charging power to the battery 32 at a constant voltage through a current limiting resistor 84 and diode 85 (Fig. 2).

Regarding Applicant's argument that Chung-Sik's reference voltage V1 cannot correspond to the claimed "constant voltage/constant current supplier." At best, Chung-Sik's reference voltage V1 seems to be a value at a node, and thus clearly not a supplier (or other circuit component) that receives the DC current from the rectifier and supplies the charging power to the battery cell in a constant voltage/constant current mode. In response to Applicant's

above argument, the Examiner refers to the previous section wherein the Examiner explained that the rectified voltage IDC output from the rectifier 80 and smoothened by a capacitor is a constant voltage can also be inferred from the fact that the voltage V1 at a node obtained from the rectified voltage is constant (“reference voltage V1 is constant”).

ii) Chung-Sik fails to teach or suggest an overvoltage monitoring unit that transmits a monitoring result so as to induce a change of intensity of the magnetic field (Remarks, page 20).

Examiner disagrees, because Chung-Sik discloses over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 by switching on and off the transistor 64 (Fig. 1, 2) (page 8-2, lines 31-34, 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

In response to Applicant’s argument that Chung-Sik fails to teach to induce a change of intensity of the magnetic field when the overvoltage monitoring unit transmits a monitoring result, Chung-Sik specifically teaches when voltage of the battery 32 is determined to be completely charged to a set voltage level, the portable device is determined to be normal and performs operation 112 (Fig. 3A) to stop charging (induce a change of intensity of the magnetic field).

iii). Claims 1-6 and 25-29 are allowable over Chung-Sik and Cho

Applicant submits that claims 1-6 and 25-29 are allowable over Chung-Sik and Cho, for the same reasons as claim 1 is allowable over Chung-Sik, and Cho does not make up for the shortcomings of Chung-Sik (Remarks, page 22).

For the reasons given with respect to above arguments i) and ii) the Examiner finds that claim 1 is not allowable over the prior art and the Examiner maintains the rejection of claims 1-6 and 25-29.

b) Claims 7-12 and 30-34

Regarding the rejection of independent claim 7, Applicant did not specifically address the limitations of claim 7, rather than arguing claim 7 recites similar limitations as in claim 1 and is allowable for the same reasons as claim 1.

The Examiner disagrees, Claims 7-12 and 30-34 are not allowable for the same reasons as claim 1 is not allowable.

c) Claims 13-20 and 35-39

Regarding the rejection of independent claim 13, Applicant submits that Chung-Sik and Cho fail to teach or suggest the claimed "constant voltage/constant current supplier" recited in claim 13, for at least the same reasons described above in the response to the rejection of claims 1 and 7. Furthermore, Applicant submits that Chung-Sik and Cho fail to teach or suggest the claimed "charging power adjusting unit" recited in claim 13, which adjusts the power applied to the magnetic field based on a monitoring result provided by a contact-less chargeable battery, for at least some of the same reasons described above in connection with the "overvoltage monitoring unit" of claim 1. (Remarks, page 23).

Examiner disagrees for the same reasons as given for claims 1 and 7, that Chung-Sik discloses the claimed "constant voltage/constant current supplier." Chung-Sik discloses voltage the monitoring unit 54 (Fig. 2) compares a voltage V2 (function of battery voltage) with the reference voltage V1, and the second microcomputer 56 that receives the power information transmitted from the first microcomputer 48 of the base unit 12 reads the output (VDL) of the comparator 96 and searches for whether or not a charge voltage of the battery 32 is normal (120 of FIG. 3B) and adjusts the power applied to the charging unit accordingly by switching transistor 64 at a frequency of 10 KHZ so as to induce an AC voltage from the coil 77 to the inductively coupled coil 79. The AC voltage output from the opposite terminals of the coil 79 is applied to an AC voltage terminal of a bridge diode 80, and is output with full-wave rectification. The DC voltage which is full-wave rectified at the bridge diode 80 is smoothened out by a capacitor 82 and a voltage at a predetermined level is obtained by passing the DC current through a resistor 84 and diode 86, and the voltage at the predetermined level is applied to battery 32 for charging the battery (Chung-Sik, English Translation, page 8-4).

Thus, contrary to Applicant's arguments, Chung-Sik discloses charging power adjusting unit" recited in claim 13, which adjusts the power applied to the magnetic field based on a monitoring result provided by a contact-less chargeable battery, for at least some of the same reasons described above in connection with the "overvoltage monitoring unit" of claim 1. Dependent claims 14-20 and 35-39 are also not allowable for the reason that they depend from claim 13.

d) Claims 21-22 and 40-44

Regarding the rejection of independent claim 21, Applicant submits that Chung-Sik and Cho fail to teach or suggest the claimed "constant voltage/constant current supplier" and the claimed "overvoltage monitoring unit" recited in claim 21, for at least the same reasons described above in the response to the rejection of claims 1 and 7. (Remarks, page 23 and 24).

The Examiner disagrees, because Chung-Sik discloses the claimed "constant voltage/constant current supplier" and the claimed "overvoltage monitoring unit" recited in claim 21, as discussed above with respect to independent claims 1, 7, and 13. Dependent claims 22 and 40-44 are also not allowable for the reason that they depend from claim 21.

e) Claims 23-24 and 56-48

Regarding the rejection of independent claim 23, Applicant submits that Chung-Sik and Cho fail to teach or suggest the claimed "constant voltage/constant current supplier" recited in claim 23, for at least the same reasons described above in the response to the rejection of claims 1 and 7. (Remarks, page 23 and 24).

The Examiner disagrees, because Chung-Sik discloses the claimed "constant voltage/constant current supplier" recited in claim 23, as discussed above with respect to independent claims 1, 7, and 13. Dependent claims 24 and 45-48 are also not allowable for the reason that they depend from claim 23.

f) Newly added claims 25, 30, 35, and 40

Regarding newly added independent claim 25, Applicant submits that claim 25 recites "wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor." Claim 25 provides further structural specifics and further distinguishes the claimed overvoltage monitoring unit and the claimed constant voltage/constant current supplier from Chung-Sik and Cho. Claims 30, 35, and 40 recite similar limitations. (Remarks, page 25).

The Examiner disagrees, because Chung-Sik discloses the claimed "overvoltage monitoring unit" and the "constant voltage/constant current supplier" recited in claim 25, as discussed above with respect to independent claims 1, 7, 13, and 21. Chung-Sik further discloses the claimed "overvoltage monitoring unit" and the "constant voltage/constant current supplier" is controlled by at least one microprocessor (48, 56) (Fig. 2).

For the reasons given above claim 25, and similarly claims 30, 35, and 40 are not allowable and are rejected in this office action.

g) Newly added claims 26, 31, 36, 41, and 48

Regarding newly added independent claim 26, Applicant submits that claim 26 further distinguishes the claimed overvoltage monitoring unit and the claimed constant voltage/constant current supplier from Chung-Sik's system, and provides additional structural limitations and submits that Chung-Sik does not teach or suggest controlling (through wireless feedback control) the voltages at both ends of a constant voltage/constant current supplier by inducing the change of intensity of the magnetic field. (Remarks, page 26).

The Examiner disagrees, because Chung-Sik discloses the claimed "overvoltage monitoring unit" and the "constant voltage/constant current supplier" recited in claim 26, as discussed above with respect to independent claims 1, 7, 13, and 21. Chung-Sik further discloses

controlling (through wireless feedback control) the voltages at both ends of a constant voltage/constant current supplier by inducing the change of intensity of the magnetic field. Specifically, Chung-Sik discloses feedback is provided wirelessly to the base unit 12 by the output (VDL) of the comparator 96 for controlling the voltages at both ends of a constant voltage/constant current supplier by inducing the change of intensity of the magnetic field by switching transistor 64 at a frequency of 10 KHZ so as to induce an AC voltage from the coil 77 to the inductively coupled coil 79. (Chung-Sik, English Translation, page 8-4).

For the reasons given above claim 26, and similarly claims 31, 36, 41, and 48 are not allowable and are rejected in this office action.

h) Newly added claims 27, 32, 37, 42, and 45

Regarding newly added independent claim 27, Applicant submits Claim 27 recites "wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell." Thus, Applicant argued that the claim limitations recited in claim 27 (e.g., front end of supplier where DC current is received from rectifier, and rear end of supplier where charging power is supplied) provide further structural limitations for the constant voltage/constant current supplier to further distinguish the constant voltage/constant current supplier from Chung-Sik's constant voltage unit 42 (which does not receive a DC current from a rectifier at a front end or supply a charging voltage to a battery cell at a rear end). (Remarks, page 26).

Applicant's above argument is not convincing because Chung-Sik disclosed the claimed constant voltage/constant current supplier as set forth above. Additionally, with respect to the

added limitation in claim 27, Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

For the reasons given above claim 27, and similarly claims 32, 37, 42, and 45 are not allowable, and are rejected in this office action.

i) New added claims 28, 33, 38, 43, and 46

Regarding newly added independent claim 28, Applicant submits, Claim 28 recites "wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage." Thus, Applicant argued that claim 28 further distinguishes the claimed constant voltage/constant current supplier from Chung-Sik (which does not teach or suggest charging a battery cell in a constant current mode initially and then in a constant voltage mode at a later stage). (Remarks, page 26).

Applicant's above argument is not convincing because Chung-Sik and Kaito disclosed the above limitation as set forth below in the rejection of the claims.

j) New added claims 29, 34, 39, 44, and 47

Regarding newly added independent claim 29, Applicant submits Claim 29 recites "wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level." Thus, Applicant argued that Claim 29 further distinguishes the claimed constant voltage/constant current supplier from Chung-Sik because Chung-Sik does not teach or suggest charging a battery

cell in a constant current mode based on a charging voltage of a battery cell exceeding a predetermined level. At best, Chung-Sik teaches charging a battery only when a contactless charging device is mounted on a base unit. (Remarks, page 27).

Applicant's above argument is not convincing because Chung-Sik and Kaite disclosed the above limitation as set forth below in the rejection of the claims.

3.0 CLAIM INTERPRETATION UNDER 35 U.S.C. §112(6TH)

The MPEP explains when a limitation invokes 35 U.S.C. 112(f) and how to interpret such limitations. See MPEP 2181-2183; *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2015) (en banc). As noted in MPEP 2181, a three prong test is used to determine whether a limitation invokes 112(f):

- (A) the claim limitation uses the term “means” or “step” or a term used as a substitute for “means” that is a generic placeholder (also called a nonce term or a non-structural term having no specific structural meaning) for performing the claimed function
- (B) the term “means” or “step” or the generic placeholder is modified by functional language, typically, but not always linked by the transition word “for” (e.g., “means for”) or another linking word or phrase, such as “configured to” or “so that”
- (C) the term “means” or “step” or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

The following analysis is provided to clarify the record of claim interpretation for each of the functional phrase (FP) recited in the claims.

FP1. “constant voltage/constant current supplier” (claim 1)

FP1 in claim 1 recites “constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode.”

FP1 does not use means, but it provides no structure therefore it can be deemed a generic placeholder that substitutes for means. FP1 is modified by functional language, “for receiving the

DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode”

Thus the constant voltage/constant current supplier is used to supply charging power to a battery at a predetermined DC voltage. There is no further structure of the term recited in FP1. The three-prong test is met and 112(f) is invoked. The specification does not provide any corresponding structure or algorithm to perform the entire claimed function other than the box 290 in Fig. 5. For the purpose of examination, Examiner considers the corresponding structure for FP1 is a DC power supply that is inherently required to supply a constant voltage to a device for proper operation of the device by providing a stabilized DC power supply.

FP2. “overvoltage monitoring unit” (claim 1)

FP2 in claim 1 recites, “overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.”

FP2 does not use means, but it provides no structure therefore it can be deemed a generic placeholder that substitutes for means. FP2 is modified by functional language, “for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.”

Thus the **overvoltage monitoring unit** is for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external

contact-less charging device by means of wireless communication. There is no further structure of the term recited in FP2 in claim 1. The three-prong test is met and 112(f) is invoked.

Corresponding structure of the claimed “**overvoltage monitoring unit**” is found from the specification (col. 4, lines 13-45, and col. 7, line 43 to col. 8 line 63) which includes first and second voltage detectors (350, 360), a voltage comparison unit (380), microprocessor (310) for outputting a monitoring result to the wireless transmitting unit (320), a charge pause detection unit (390) for receiving the high frequency AC current output from the high frequency AC current inducing unit 270 (Fig. 5). While the structure of voltage detectors (350, 360) such as voltage sensors, voltage comparison unit (380) such as a comparator, and wireless transmitting unit (320) such as a wireless transmitter, and current inducing unit (270) such as a coil, is known in the art, the Examiner is unable to determine a structure, i.e. circuit of the charge pause detection unit, and a structure of the microprocessor absent an algorithm or a flowchart. Therefore, 112(f) is also invoked separately for the claimed microprocessor (310) recited in claim 3 and the charge pause detection unit (390) recited in claim 4 (see 112 (f) analysis for microprocessor and pause detection unit below).

FP3. “microprocessor” (claim 3)

FP3 in claim 3 recites, “microprocessor for outputting the monitoring result according to the voltage comparison result to the wireless transmitting unit”.

FP3 does not use means, but it provides no structure therefore it can be deemed a generic placeholder that substitutes for means. FP3 is modified by functional language, “for outputting the monitoring result according to the voltage comparison result to the wireless transmitting unit.”

Thus the microprocessor 310 is used for outputting the monitoring result according to the voltage comparison result to the wireless transmitting unit. There is no further structure provided, by way of an algorithm or a flowchart for the performing the entire claimed function recited in FP3 other than the box 310 in Fig. 5. The three-prong test is met and 112(f) is invoked. For the purpose of examination, the Examiner considers the corresponding structure of FP3 is any microprocessor.

FP4. “charging pause detecting unit” (claim 4)

FP4 in claim 4 recites, “a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor.”

FP4 does not use means, but it provides no structure therefore it can be deemed a generic placeholder that substitutes for means. FP4 is modified by functional language, “for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor.” There is no further structure of the term recited in FP4 in claim 4 other than the box 390 in Fig. 5. The three-prong test is met and 112(f) is invoked. For the purpose of examination, the Examiner considers the corresponding structure of FP4 is a circuit for determining the ON/OFF period of charging the battery as described in the specification (col.8, line 64 to col. 9, line 15, col. 10, lines 1-3).

FP 5. “constant voltage supplying part” (claim 16)

FP5 in claim 16 recites, “constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit.”

FP5 in claim 16 does not use means, but it provides no structure therefore it can be deemed a generic placeholder that substitutes for means. FP5 is modified by functional language, “for converting the common AC current into a DC current, and then supplying a constant-voltage.”

Thus the **constant voltage supplying part** converts a common AC current, into a DC current, and then supplying a constant-voltage. There is no further structure of the term recited in FP5 other than the box 260c in Fig. 4. The three-prong test is met and 112(f) is invoked. For the purpose of examination, the Examiner considers the corresponding structure of FP5 is a rectifier that converts AC to DC. A constant DC power supply voltage is inherently required to supply a stabilized voltage to a device for proper operation of the device.

Additional terms not invoking 35 USC 112 (f)

Following additional terms are recited in the claims that use means for type language but do not invoke interpretation under 112 (f) because these are terms of art having a known structure, therefore fail prong A of the three prong test: “rectifier”, “wireless transmitting unit”, “first and second voltage detectors”, “voltage comparator”, “magnetic field generating unit”, “high frequency power driving unit”, “charging power adjusting unit”, “wireless receiving unit”, “pulse signal generator”, “power driving part”, “overvoltage filter.”

4.0 CLAIM REJECTION - 35 USC § 112

4.1 112 1st Paragraph

The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

(a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 4, 7, 13, 21, and 23 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for applications subject to pre-AIA 35 U.S.C. 112, the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 1, 7, 10, 13, 21, and 23 recite “constant voltage/constant current supplier” without providing sufficient written description of a circuit structure to implement the same.

Claims 1, 7, 13, and 21, recite “over voltage monitoring unit” without providing sufficient written description of a circuit structure to implement the same.

Claims 10 and 13 further recite over voltage monitoring unit comprising “charge pause detection unit” without providing sufficient written description of a circuit structure to implement the same.

The specification (col. 4, lines 14-45, and col. 8 lines 32-53) describes the “over voltage monitoring unit” as comprising wireless transmitting unit (320), first and second voltage detectors (350, 360), a voltage comparator (380), microprocessor (310) for outputting a monitoring result to the wireless transmitting unit (320), a charge pause detection unit (390) for receiving the high frequency AC current output from the high frequency AC current inducing unit. (Fig. 5). While a

wireless transmitting unit (320), first and second voltage detectors (350, 360), and voltage comparator (380) are terms of art having a known structure, the structure of the microprocessor (310) and charge pause detection unit (390) is not known for performing the entire claimed function. The specification does not provide any structure in the form of a circuit for the claimed charge pause detection unit and does not provide an algorithm or a flowchart to implement the microprocessor, therefore these terms fail to comply with the written description requirement.

4.2 112 2nd Paragraph

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim limitations “constant voltage/constant current supplier”, “over voltage monitoring unit”, “charge pause detection unit”, “microprocessor” invokes 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. However, the written description fails to disclose the corresponding structure, material, or acts for performing the entire claimed function and to clearly link the structure, material, or acts to the function. Therefore, the claim is indefinite and is rejected under 35 U.S.C. 112(b) or pre-AIA 35 U.S.C. 112, second paragraph.

Applicant may:

- (a) Amend the claim so that the claim limitation will no longer be interpreted as a limitation under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph;

- (b) Amend the written description of the specification such that it expressly recites what structure, material, or acts perform the entire claimed function, without introducing any new matter (35 U.S.C. 132(a)); or
- (c) Amend the written description of the specification such that it clearly links the structure, material, or acts disclosed therein to the function recited in the claim, without introducing any new matter (35 U.S.C. 132(a)).

If applicant is of the opinion that the written description of the specification already implicitly or inherently discloses the corresponding structure, material, or acts and clearly links them to the function so that one of ordinary skill in the art would recognize what structure, material, or acts perform the claimed function, applicant should clarify the record by either:

- (a) Amending the written description of the specification such that it expressly recites the corresponding structure, material, or acts for performing the claimed function and clearly links or associates the structure, material, or acts to the claimed function, without introducing any new matter (35 U.S.C. 132(a)); or
- (b) Stating on the record what the corresponding structure, material, or acts, which are implicitly or inherently set forth in the written description of the specification, perform the claimed function. For more information, see 37 CFR 1.75(d) and MPEP §§ 608.01(o) and 2181.

5.0 CLAIM REJECTION - 35 USC § 102

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5.1 Chung-Sik (cl. 1-15, 19-48)

Claim(s) 1-15, and 19-48, are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Chung-Sik (KR 950005819B1).

1. A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:

Chung-Sik discloses system for charging a battery 32 in a portable device by inductively coupling a voltage from a charger 12 (base unit) to a portable device 18. Inductively coupling a voltage from a charger to a portable device 18 is considered the same as contact-less chargeable battery (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

Chung-Sik disclosed high frequency AC current inducing unit 38 (CONTACTLESS CHARGING UNIT) to which a high frequency AC current (10 KHZ) is induced by means of a magnetic field generated from an external contact-less charging device (induced voltage generating unit) (page 8-2, lines 17-18, and page 8-4, lines 47-51).

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

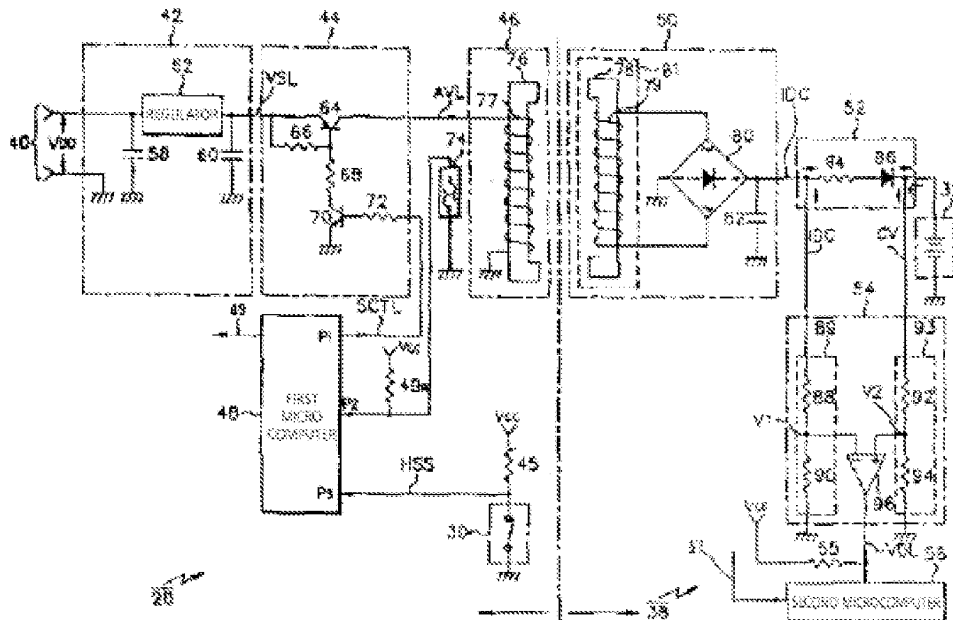
Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19) (Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 52 for receiving DC current (DC voltage IDC) from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage IDC. Chung-Sik specifically discloses a constant reference voltage V1 (reference voltage) is obtained by using resistors 88 and 90 for splitting the DC voltage IDC (See “voltage V1 is constant”, page 8-5 line 5). Since voltage V1 is constant, therefore the voltage IDC is constant, and the constant voltage/current supplier 52 is receiving a constant DC voltage from rectifier 80 for supplying a charging power to the battery cell in a constant voltage/constant current mode.

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

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Chung-Sik. Fig. 2

2. The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Chung-Sik discloses wherein the high frequency AC current inducing unit is a coil 79 to which a magnetic flux of a magnetic field generated from the external (coil 77) contact-less charging device is linked. (Fig. 2).

3. The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

Chung-Sik discloses over voltage monitoring unit 54 for monitoring voltages by first and second voltage detectors (V1, V2) at front and rear ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means

of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field (page 8-2, paragraphs 7-8) of the induced voltage generating unit 46 (Fig. 2) (page 8-3, lines 31-34; page 8-5, lines 31-34) (Fig. 2).

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result; and a microprocessor for outputting the monitoring result according to the voltage comparison result to the wireless transmitting unit.

Chung-Sik discloses voltage comparator 96 for comparing first and second voltages (V1, V2) detected by the first and second voltage detectors and outputs a voltage comparison result (charge state VDL).

Chung-Sik further disclosed microprocessor 56 for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit (Fig. 2, page 8-4, 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

4. The contact-less chargeable battery according to claim 3,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 3 as set forth above.

wherein a magnetic field generated by the contact-less charging device is generated intermittently,

Chung-Sik discloses magnetic field generated by the contact-less charging device is generated intermittently (switches on/off transistor 64, 70) (Fig. 2, page 8-4).

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and

Chung-Sik discloses a control signal (SCTL) output from the output port PI of FIRST MICRO COMPUTER 48 is applied to a base of the transistor 70 through a resistor 72 and switches "on/off" the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between "low" and "high" depending on a period of the control signal (SCT) and the signal is applied to a base of the transistor 64." (Chung-Sik, English Translation, page 8-4 and Fig. 2).

Regarding charge pause detection unit and detecting a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, Chung-Sik discloses that the charging of battery continues until the detection voltage V2 in the overvoltage detection unit 54 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). The transition to logic "high" from logic "low" is considered a time point when the induction of high frequency AC current ends, and then outputting the end time point (charge completion) to the microprocessor. The

microcomputer 56 is broadly considered the same as charging pause detecting unit that produces charging completion alarm when the voltage of battery is determined to be normal and completely charged. Thus the microprocessor 56 determines the ON/OFF period of charging the battery.

Additionally, Chung-Sik specifically disclosed a “time point” when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Chung-Sik discloses wherein the monitoring result is transmitted to the external contact-less charging device 12 by means of wireless communication by RADIO UNIT 34. (Chung-Sik, page 8-5, lines 35-43, Fig. 1, 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Additionally, Chung-Sik specifically disclosed a “time point” when the charge operation may be automatically stopped by communication between contact less charging unit 38 and

power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

~~Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.~~

5. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

Chung-Sik discloses outputting a charge state signal (VDL) which is input to second microcomputer 56 for controlling the portable device 18 (battery) (Fig. 2, page 8-3).

6. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage

(V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

7. A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:

Chung-Sik disclosed contact-less charging circuit module electrically connected to a battery cell 32 of portable device 18 and used for charging an electric energy to the battery cell 32 in a contact-less method (Fig. 1, page 8-1).

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

Chung-Sik disclosed high frequency AC current inducing unit 38 (CONTACTLESS CHARGING UNIT) to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device (induced voltage generating unit) (page 8-2, lines 17-18).

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19).(Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 28-33). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See “voltage V1 is constant”, page 8-5 line 5).

5 terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2
6 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) broadly interpreted the same as voltage detectors (V1, V2) at both ends of the constant voltage/current supplier 52, and a comparator 96 for comparing the voltages

(V1, V2), and a transmitter for transmitting a monitoring result from comparator 96 to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34), and a microprocessor 48 providing signal SCTL at the output port P1 based on the monitoring result for controlling the switching ON/OFF of transistors (70, 64) for controlling AC line voltage (AVL) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 1, 2) (page 8-2, lines 31-34, 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

8. The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Chung-Sik discloses contact-less chargeable battery according to claim 7 as set forth above.

Chung-Sik discloses wherein the high frequency AC current inducing unit is a coil 79 to which a magnetic flux of a magnetic field generated from the external (coil 77) contact-less charging device is linked. (Fig. 2).

9. The contact-less charging circuit module according to claim 7,

Chung-Sik discloses contact-less chargeable battery according to claim 7 as set forth above.

wherein the overvoltage monitoring unit includes:

a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna;

Chung-Sik disclosed wireless transmitting unit (antenna connected to radio unit 34) for wirelessly propagating the monitoring result through an antenna connected to radio unit 34 (Fig. 1, and Fig. 2, page 8-5).

In this case, the data input to the line 49 is input as data that is wirelessly transmitted from the portable device 18 when the battery 32 is completely charged. If analysis of input data in operation 110 indicates the portable device is abnormal (i.e. charge is incomplete), the first microcomputer 48 jumps to the aforementioned step 106 to continuously generate a charge voltage, and when the portable device is normal, the first microcomputer 48 jumps to operation 112 to stop charging.

When a charge level of the battery 32 is increased through the aforementioned operation, the charge level detection voltage V2 of a second voltage splitter 93 increases, and when the detection voltage V2 becomes higher than the reference voltage V1, the output VDL of the comparator 96 is transitioned to logic "high" from logic "low" and is input to the second microcomputer 56.

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 56 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

Chung-Sik also discloses first and second voltage detectors (V1, V2) for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier 52 (Fig. 2).

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result; and

Chung-Sik discloses voltage comparator 96 for comparing first and second voltages (V1, V2) detected by the first and second voltage detectors and outputs a voltage comparison result (charge state VDL) (Fig. 2, page 8-4).

a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.

Chung-Sik discloses second microprocessor 56 for outputting a monitoring result according to the voltage comparison result through line 37 to the wireless transmitting unit (antenna connected to radio unit 34). (Fig. 1, 2 and page 8-5).

10. The contact-less charging circuit module according to claim 9,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 9 as set forth above.

wherein a magnetic field generated by the contact-less charging device is generated intermittently,

Chung-Sik discloses magnetic field generated by the contact-less charging device is generated intermittently (switches on/off transistor 70) (Fig. 2, page 8-4).

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and

Chung-Sik discloses a control signal (SCTL) output from the output port P1 of FIRST MICRO COMPUTER 48 is applied to a base of the transistor 70 through a resistor 72 and switches "on/off" the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between "low" and "high" depending on a period of the control signal (SCTL) and the signal is applied to a base of the transistor 64." (Chung-Sik, page 8-4, Fig. 2).

Regarding detecting a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, Chung-Sik discloses that the charging of battery continues until the detection voltage V2 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). The transition to logic "high" from logic "low" is considered a time point when the induction of high frequency AC current ends, and then outputting the end time point (charge completion) to the microprocessor 56. The microcomputer 56 is broadly considered the same as charging pause detecting unit that produces charging completion alarm when the voltage of battery is determined to be normal and completely charged.

Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Chung-Sik discloses wherein the monitoring result (VDL) output to second microprocessor 56 is transmitted to the external contact-less charging device by means of wireless communication by an antenna connected to radio unit 34. (Fig. 2, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 57 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Additionally, Chung-Sik specifically disclosed a “time point” when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

11. The contact-less charging circuit module according to claim 7,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the monitoring result is a charging power adjustment request signal.

Chung-Sik discloses outputting a charge state signal (VDL) which is input to second microcomputer 56 for controlling the portable device 18 (battery) (Fig. 2, page 8-3).

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

12. The contact-less charging circuit module according to claim 7, Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a

charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

13. A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and,

Chung-Sik discloses contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery 32 that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode (page 8-2, lines 6-7) (Fig. 1).

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

Chung-Sik discloses constant voltage/current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See “voltage V1 is constant”, page 8-5 line 5).

wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:

Chung-Sik discloses wirelessly transmitting a monitoring result for voltages at both ends of the constant voltage/constant current supplier (Chung-Sik, English Translation, pages 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

Chung-Sik discloses magnetic field generating unit 46 (induced voltage generating unit) for receiving an AC current and forming a magnetic field in an outer space (space around coil 77). (Chung-Sik, English Translation, page 8-4 lines 47-51; and Fig. 2).

10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and

Chung-Sik discloses a high frequency power driving unit (transistor 64) for applying a high frequency AC current to the magnetic field generating unit 46 (Fig. 2, page 8-4).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication by antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

14. The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.

Chung-Sik discloses contact-less chargeable battery according to claim 13 as set forth above.

Chung-Sik discloses wherein the magnetic field generating unit is a coil (77, 78) to both sides of which a high frequency AC current is applied. (Fig. 2, page 8-3).

15. The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and

Chung-Sik discloses wireless receiving unit (radio unit 26 connected to antenna) for wirelessly receiving the monitoring result through the antenna (Fig. 1).

a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.

Chung-Sik discloses first microprocessor 48 for receiving the monitoring result from the wireless receiving unit (radio unit 26) and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit (Fig. 1, 2 & 3A, pages 8-4, 8-5).

48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 119 of FIG. 3A (the portable device is normal), and performs operation 112.

19. The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and

Chung-Sik discloses a high frequency power driving unit 44 (voltage switching unit) for intermittently applying a high frequency AC current by switching on/off transistor (64, 70) to the magnetic field generating unit 46 (induce voltage generating unit) (Fig. 2, page 8-3).

wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.

Chung-Sik discloses wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication. (Chung-Sik, page 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 57 in operation 122. The charge completion alarm signal through line 57 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

20. The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

21. A battery charging set including a contact-less chargeable battery and a contact-less charging device, wherein the battery includes:

Chung-Sik discloses battery charging set including a contact-less chargeable battery and a contact-less charging device. (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;

Chung-Sik discloses high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device. (Fig. 2, page 8-4).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19) (Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 52 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See "constant voltage unit", page 8-3, lines 24-

27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See “voltage V1 is constant”, page 8-5 line 5).

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced, wherein the charging device includes:

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field (page 8-2, lines 49-55) of the induced voltage generating unit 46 (Fig. 2) (page 8-3, lines 29-34; page 8-5, lines 35-43) (Fig. 2).

Chung-Sik further discloses wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication. (Chung-Sik, pages 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

Chung-Sik discloses magnetic field generating unit 46 (induced voltage generating unit) for receiving an AC current and forming a magnetic field in an outer space (space around coil 77). (Fig. 2, page 8-4).

a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and

Chung-Sik discloses a high frequency power driving unit 44 (voltage switching unit) for intermittently applying a high frequency AC current by switching on/off transistor 70 to the magnetic field generating unit 46 (induced voltage generating unit) (Fig. 2, page 8-3).

a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik discloses charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by wireless communication through antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 &

3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and

Chung-Sik discloses contactless charge device for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (Chung-Sik , English Translation, page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 2)(Chung-Sik , English Translation, page 8-2, lines 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.

Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by means of wireless

communication by antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

22. The battery charging set according to claim 21,

Chung-Sik and Kaite et al. discloses battery charging set according to claim 21 as set forth above.

wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second

microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage ($V1-V2$).

Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

23. A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:

Chung-Sik discloses method for controlling charging of a contact-less chargeable battery 32 in a portable device by means of electromagnetic induction phenomenon by inductively coupling a voltage from a charger 12 (base unit) to a portable device 18 comprising contactless charging unit 38 for charging chargeable battery 32 (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;

Chung-Sik discloses intermittently applying a high frequency AC current to a primary coil 77 provided to the charging device by a voltage switching unit 44 by turning on/off transistor 64 so as to intermittently generate a magnetic field in an outer region around coil 77 (Fig. 2).

(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;

Chung-Sik discloses linking a magnetic flux of the generated magnetic field of coil 77 to a secondary coil 79 provided to the battery 32 so as to intermittently output an electromagnetically-induced high frequency AC current (Fig. 2).

(c) rectifying the output high frequency AC current to be converted into a DC current;

Chung-Sik discloses rectifying the high frequency AC current output from coil 79 by rectifier 80 and converted into a DC current (Fig. 2, page 8-3).

The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting unit 81 that is inductively coupled to the induced voltage generating unit 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81.

(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;

Chung-Sik discloses applying the DC current to a battery cell 32 through a constant voltage/constant current supplier (80, 52) (see “constant voltage V1”) so as to charge the battery cell in a constant voltage/constant current mode (Fig. 2, page 8-4, lines 59-62; page 8-5, line 5).

In this case, the rectified voltage IDC is input to a first voltage splitter 89, simultaneously limited to a predetermined level through the resistor 84 and the diode 86, then applied to the battery 32. That is, the battery 32 is charged. In the above case, the resistor 84 is a current limiter resistor, and the diode 86 is a diode for preventing countercurrent when the voltage IDC is lower than a voltage of the battery 32.

terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2

(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and

Chung-Sik discloses contactless charge device for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (Chung-Sik , English Translation, page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) at both ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 2)(Chung-Sik , English Translation, page 8-2, lines 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.

Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication by antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the

magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

24. The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses method according to claim 23 as set forth above.

Chung-Sik discloses battery voltage detector circuit 54 includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

Claim 25 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

Claim 26 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Chung-Sik discloses feedback is provided wirelessly to the base unit 12 by the output (VDL) of the comparator 96 in the overvoltage monitoring unit 54 for controlling the voltages at both ends of a constant voltage/constant current supplier 52 by inducing the change of intensity of the magnetic field in coil 77 by switching transistor 64 at a frequency of 10 KHZ so as to induce an AC voltage from the coil 77 to the inductively coupled coil 79 and AC voltage output from coil 79 is rectified by the rectifier 80 so as to control the voltages at both ends of the

constant voltage/constant current supplier 52 for charging the battery 32. (Chung-Sik, English Translation, page 8-4).

Claim 27 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Claim 28 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English

Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

Claim 29 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

Claim 30 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier 52 and the overvoltage monitoring unit 54 include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

Claim 31 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik discloses contact-less chargeable battery according to claim 7 as set forth above.

wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Chung-Sik discloses overvoltage monitoring unit 54 controls, through wireless feedback by (RADIO UNIT 34) to control of the charging of the battery cell 32 by switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46 to control the voltages at both ends of the constant voltage/constant current supplier 52. (Fig. 2).

Claim 32 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik discloses contact-less chargeable battery according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the

front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Claim 33 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

Claim 34 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

Claim 35 (New): The contact-less chargeable battery according to claim 13,

Chung-Sik and Kaite et al discloses contact-less chargeable battery according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier 52 and the overvoltage monitoring unit 54 include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

Claim 36 (New): The contact-less charging circuit module according to claim 35,

Chung-Sik discloses contact-less charging circuit module according to claim 35 as set forth above.

wherein the at least one microprocessor controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Chung-Sik discloses wherein the at least one microprocessor (48, 56) controls through wireless feedback by (RADIO UNIT 34), the charging of the battery cell 32 by switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46 to control the voltages at both ends of the constant voltage/constant current supplier 52 for charging battery 32. (Fig. 2).

Claim 37 (New): The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less chargeable battery according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, and wherein the constant voltage/constant current supplier receives a DC current from a rectifier at the front end and supplies a charging power at the rear end.

Chung-Sik discloses wherein the constant voltage/constant current supplier 52 has a front end and a rear end, and wherein the constant voltage/constant current supplier receives a DC current from a rectifier 80 at the front end and supplies a charging power at the rear end to battery 32 (Chung-Sik, English Translation, page 8-4, last paragraph) (Fig. 2).

Claim 38 (New): The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier charges the battery in a constant current mode at an initial charging stage and then charges the battery in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

Claim 39 (New): The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier charges the battery in a constant voltage mode based on a charging voltage of the battery exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

Claim 40 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al discloses battery charging set according to claim 21 as set forth above.

wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier 52 and the overvoltage monitoring unit 54 include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

Claim 41 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al. discloses battery charging set according to claim 21 as set forth above.

wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing a change of intensity of the magnetic field.

Chung-Sik discloses overvoltage monitoring unit 54 controls, through wireless feedback by (RADIO UNIT 34), the charging of the battery cell 32, by switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46 to control the voltages at both ends of the constant voltage/constant current supplier 52. (Fig. 2).

Claim 42 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al discloses battery charging set according to claim 21 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Claim 43 (New): The battery charging set according to claim 21,

Chung-Sik discloses battery charging set according to claim 21, as set forth above.

wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

Claim 44 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al discloses battery charging set according to claim 21, as set forth above.

wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

Claim 45 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al. discloses the method of claim 23, as set forth above.

receiving, by the constant voltage/constant current supplier, the DC current at a front end of the constant voltage/constant current supplier; and

supplying, by the constant voltage/constant current supplier, the DC current at a rear end of the constant voltage/constant current supplier to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Claim 46 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al. discloses the method of claim 23, as set forth above.

supplying, by the constant voltage/constant current supplier, the DC current to the battery cell in a constant current mode during an initial charging stage and then in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English

Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

Claim 47 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al discloses the method of claim 23, as set forth above.

charging, by the constant voltage/constant current supplier, the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

Claim 48 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al discloses the method of claim 23, as set forth above.

controlling, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing a change of intensity of the magnetic field.

Chung-Sik discloses controlling (by microprocessor 48, 56), through wireless feedback by (RADIO UNIT 34), switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46, to control the voltages at both ends of the constant voltage/constant current supplier 52 for charging battery 32. (Fig. 2).

6.0 CLAIM REJECTIONS - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6.1 Chung-Sik, Kaite (cl. 1-15, 19-48)

Claims 1-15 and 19-48, are rejected under 35 U.S.C. 103(a) as being obvious over Chung-Sik (KR 950005819B1) and Kaite et al. (US 6,016,046).

1. A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:

Chung-Sik discloses system for charging a battery 32 in a portable device by inductively coupling a voltage from a charger 12 (base unit) to a portable device 18. Inductively coupling a voltage from a charger to a portable device 18 is considered the same as contact-less chargeable battery (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

Chung-Sik disclosed high frequency AC current inducing unit 38 (CONTACTLESS CHARGING UNIT) to which a high frequency AC current (10 KHZ) is induced by means of a magnetic field generated from an external contact-less charging device (induced voltage generating unit) (page 8-2, lines 17-18, and page 8-4, lines 47-51).

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19) (Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 52 for receiving DC current (DC voltage IDC) from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage IDC. Chung-Sik specifically discloses a constant reference voltage V1 (reference voltage) is obtained by using resistors 88 and 90 for splitting the DC voltage IDC (See “voltage V1 is constant”, page 8-5 line 5). Since voltage V1 is constant, therefore the voltage IDC is constant, and the constant voltage/current supplier 52 is receiving a constant DC voltage from rectifier 80 for supplying a charging power to the battery cell in a constant voltage/constant current mode.

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode it would have been obvious over Kaite et al.

Kaite et al. specifically disclosed constant voltage constant current supplier 123 for receiving DC current from rectifier 122 and supplying a charging power to the battery cell 111 in a constant voltage/constant current mode (col. 6, lines 41-44) (Fig. 2).

charge. Therefore, the charging control section 123 is provided with a constant current constant voltage circuit to stabilize output from the rectifying circuit 122, and a switching device to stop charging when the rechargeable batteries 111 reach full charge under control of the computation circuit 124. The constant current constant voltage circuit measures charging current and battery voltage to control the output to a constant current and constant voltage. The

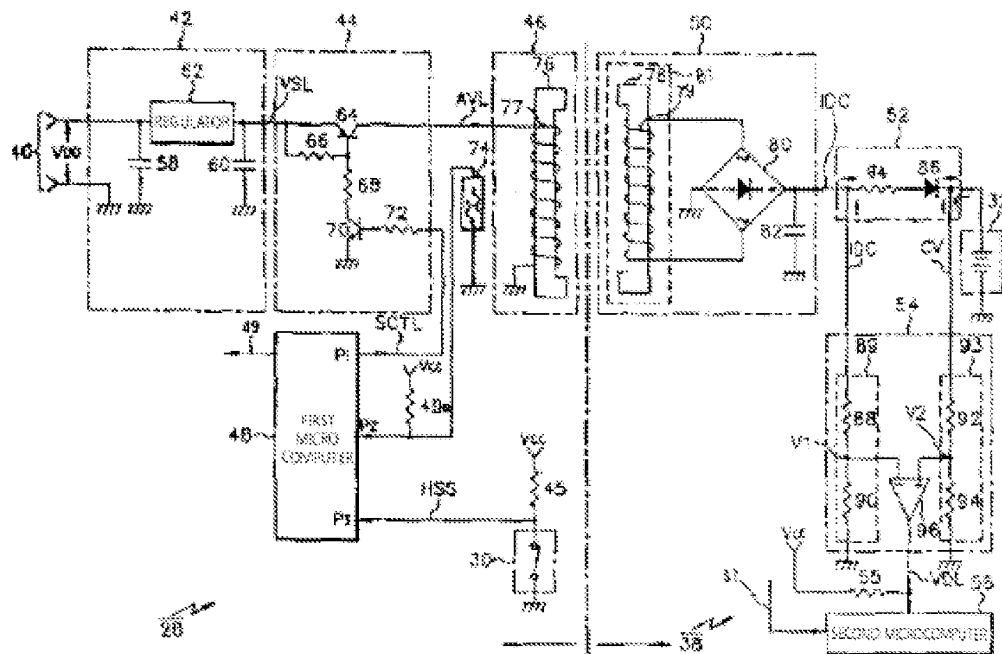
At the time the invention was made it would have been obvious to one of ordinary skill in the to modify the constant voltage supplier disclosed by Chung-Sik by adding the constant current constant voltage circuit disclosed by Kaite et al. to stabilize output from the rectifying circuit.

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for

monitoring voltages (V1, V2) broadly interpreted the same as the claimed voltage detectors (V1, V2) at both ends of the constant voltage/current supplier 52, and a comparator 96 for comparing the voltages (V1, V2), and a transmitter for transmitting a monitoring result from comparator 96 to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34), and a microprocessor (48, 56) providing signal SCTL at the output port P1 based on the monitoring result for controlling the switching ON/OFF of transistors (70, 64) for controlling AC line voltage (AVL) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 1, 2) (page 8-2, lines 31-34, 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

MAN 2



Chung-Sik. Fig. 2

2. The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Chung-Sik discloses wherein the high frequency AC current inducing unit is a coil 79 to which a magnetic flux of a magnetic field generated from the external (coil 77) contact-less charging device is linked. (Fig. 2).

3. The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

Chung-Sik discloses over voltage monitoring unit 54 for monitoring voltages (V1, V2) (V1, V2 are first and second voltage detectors) at front and rear ends of the constant voltage/current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a

change of intensity of the magnetic field (page 8-2, paragraphs 7-8) of the induced voltage generating unit 46 (Fig. 2) (page 8-3, lines 31-34; page 8-5, lines 31-34) (Fig. 2).

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result; and a microprocessor for outputting the monitoring result according to the voltage comparison result to the wireless transmitting unit.

Chung-Sik discloses voltage comparator 96 for comparing first and second voltages (V1, V2) detected by the first and second voltage detectors (V1, V2) and outputs a voltage comparison result (charge state VDL). Chung-Sik further disclosed microprocessor 56 for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit (Fig. 2, page 8-4, 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and uplink the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

4. The contact-less chargeable battery according to claim 3,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 3 as set forth above.

wherein a magnetic field generated by the contact-less charging device is generated intermittently,

Chung-Sik discloses magnetic field generated by the contact-less charging device is generated intermittently (switches on/off transistor 64, 70) (Fig. 2, page 8-4).

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and

Chung-Sik discloses a control signal (SCTL) output from the output port P1 of FIRST MICRO COMPUTER 48 is applied to a base of the transistor 70 through a resistor 72 and switches "on/off" the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between "low" and "high" depending on a period of the control signal (SCT) and the signal is applied to a base of the transistor 64." (Chung-Sik, English Translation, page 8-4 and Fig. 2).

Regarding charge pause detection unit and detecting a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, Chung-Sik discloses that the charging of battery continues until the detection voltage V2 in the overvoltage detection unit 54 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). The transition to logic "high" from logic "low" is considered a time point when the induction of high frequency AC current ends, and then outputting the end time point (charge completion) to the microprocessor. The microcomputer 56 is broadly considered the same as charging pause detecting unit that produces charging completion alarm when the voltage of battery is determined to be normal and

completely charged. Thus the microprocessor 56 determines the ON/OFF period of charging the battery. Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

~~Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.~~

To the extent that Chung-Sik may not specifically disclose charging pause detecting unit it would have been obvious to modify the overvoltage monitoring circuit disclosed by Chung-Sik by adding a charging pause detecting unit because Chung-Sik specifically disclosed battery begins to be charged from a "time point" and the charge operation may be automatically stopped by communication between devices.

wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Chung-Sik discloses wherein the monitoring result is transmitted to the external contact-less charging device 12 by means of wireless communication by RADIO UNIT 34. (Chung-Sik, page 8-5, lines 35-43, Fig. 1, 2).

~~Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.~~

Additionally, Chung-Sik specifically disclosed a “time point” when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

~~Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.~~

To the extent that Chung-Sik may not specifically disclose communication while a high frequency AC current is not induced in the secondary coil after the end time point is input it would have been obvious for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious to modify overvoltage monitoring unit disclosed by Chung-Sik by transmitting monitoring result to the external charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

5. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a charging power adjustment request signal.

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

Chung-Sik discloses outputting a charge state signal (VDL) which is input to second microcomputer 56 for controlling the portable device 18 (battery) (Fig. 2, page 8-3).

6. The contact-less chargeable battery according to claim 1, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier 52 (Fig. 2). The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

7. A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:

Chung-Sik disclosed contact-less charging circuit module electrically connected to a battery cell 32 of portable device 18 and used for charging an electric energy to the battery cell

32 in a contact-less method (Fig. 1, page 8-1).

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;

Chung-Sik disclosed high frequency AC current inducing unit 38 (CONTACTLESS CHARGING UNIT) to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device (induced voltage generating unit) (page 8-2, lines 17-18).

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19).(Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 28-33). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1

(reference voltage). (See "voltage V1 is constant", page 8-5 line 5).

5 terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2
6 varies depending on a charge voltage level of the battery 32. Thus, when the first microcomputer 48 outputs the control signal

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode it would have been obvious over Kaite et al.

Kaite et al. specifically disclosed constant voltage constant current supplier 123 for receiving DC current from rectifier 122 and supplying a charging power to the battery cell 111 in a constant voltage/constant current mode (col. 6, lines 41-44) (Fig. 2).

charge. Therefore, the charging control section 123 is provided with a constant current constant voltage circuit to stabilize output from the rectifying circuit 122, and a switching device to stop charging when the rechargeable batteries 111 reach full charge under control of the computation circuit 124. The constant current constant voltage circuit measures charging current and battery voltage to control the output to a constant current and constant voltage. The

At the time the invention was made it would have been obvious to one of ordinary skill in the to modify the constant voltage supplier disclosed by Chung-Sik by adding the constant current constant voltage circuit disclosed by Kaite et al. to stabilize output from a rectifying circuit.

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) broadly interpreted the same as the claimed voltage detectors (V1, V2) at both ends of the constant voltage/current supplier 52, and a comparator 96 for comparing the voltages (V1, V2), and a transmitter for transmitting a monitoring result from comparator 96 to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34), and a microprocessor (48, 56) providing signal SCTL at the output port P1 based on the monitoring result for controlling the switching ON/OFF of transistors (70, 64) for controlling AC line voltage (AVL) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 1, 2) (page 8-2, lines 31-34, 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

8. The contact-less charging circuit module according to claim 7, wherein the high frequency AC current inducing unit is a coil to which a magnetic flux of a magnetic field generated from the external contact-less charging device is linked.

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

Chung-Sik discloses wherein the high frequency AC current inducing unit is a coil 79 to which a magnetic flux of a magnetic field generated from the external (coil 77) contact-less charging device is linked. (Fig. 2).

9. The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna;

Chung-Sik disclosed wireless transmitting unit (antenna connected to radio unit 34) for wirelessly propagating the monitoring result through an antenna connected to radio unit 34 (Fig. 1, and Fig. 2, page 8-5).

In this case, the data input to the line 49 is input as data that is wirelessly transmitted from the portable device 18 when the battery 32 is completely charged. If analysis of input data in operation 110 indicates the portable device is abnormal (i.e. charge is incomplete), the first microcomputer 48 jumps to the aforementioned step 106 to continuously generate a charge voltage, and when the portable device is normal, the first microcomputer 48 jumps to operation 112 to stop charging.

When a charge level of the battery 32 is increased through the aforementioned operation, the charge level detection voltage V2 of a second voltage splitter 93 increases, and when the detection voltage V2 becomes higher than the reference voltage V1, the output VDL of the comparator 96 is transitioned to logic "high" from logic "low" and is input to the second microcomputer 56.

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

first and second voltage detectors for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier;

Chung-Sik also discloses first and second voltage detectors (V1, V2) for respectively detecting voltages at front and rear ends of the constant voltage/constant current supplier 52 (Fig. 2).

a voltage comparator for comparing first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result; and

Chung-Sik discloses voltage comparator 96 for comparing first and second voltages (V1, V2) detected by the first and second voltage detectors and outputs a voltage comparison result (charge state VDL) (Fig. 2, page 8-4).

a microprocessor for outputting a monitoring result according to the voltage comparison result to the wireless transmitting unit.

Chung-Sik discloses second microprocessor 56 for outputting a monitoring result according to the voltage comparison result through line 37 to the wireless transmitting unit (antenna connected to radio unit 34). (Fig. 1, 2 and page 8-5).

10. The contact-less charging circuit module according to claim 9,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 9 as set forth above.

wherein a magnetic field generated by the contact-less charging device is generated intermittently,

Chung-Sik discloses magnetic field generated by the contact-less charging device is generated intermittently (switches on/off transistor 70) (Fig. 2, page 8-4).

wherein the overvoltage monitoring unit further includes a charging pause detecting unit for receiving the high frequency AC current output from the high frequency AC

current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and

Chung-Sik discloses a control signal (SCTL) output from the output port P1 of FIRST MICRO COMPUTER 48 is applied to a base of the transistor 70 through a resistor 72 and switches "on/off" the transistor 70 around ten thousand times per second. In this case, a potential of a collector terminal of the transistor 70 is switched between "low" and "high" depending on a period of the control signal (SCTL) and the signal is applied to a base of the transistor 64." (Chung-Sik, page 8-4, Fig. 2).

Regarding detecting a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, Chung-Sik discloses that the charging of battery continues until the detection voltage V2 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). The transition to logic "high" from logic "low" is considered a time point when the induction of high frequency AC current ends, and then outputting the end time point (charge completion) to the microprocessor 56. The microcomputer 56 is broadly considered the same as charging pause detecting unit that produces charging completion alarm when the voltage of battery is determined to be normal and completely charged.

Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

~~Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 13 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.~~

To the extent that Chung-Sik may not specifically disclose a charging pause detecting unit it would have been obvious to modify the overvoltage monitoring unit disclosed by Chung-Sik by adding a charging pause detecting unit because Chung-Sik specifically disclosed battery begins to be charged from a "time point" and the charge operation may be automatically stopped by communication between devices.

wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.

Chung-Sik discloses wherein the monitoring result (VDL) output to second microprocessor 56 is transmitted to the external contact-less charging device by means of wireless communication by an antenna connected to radio unit 34. (Fig. 2, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

Additionally, Chung-Sik specifically disclosed a "time point" when the charge operation may be automatically stopped by communication between contact less charging unit 38 and power transmitter 28 (Chung-Sik, English Translation, page 8-5, lines 44-46 and Fig. 1).

Thus, in the present invention according to the above embodiments, a battery begins to be charged from a time point when the portable device 18 operated at an operating voltage of the battery is installed on the base unit 12, and the charge operation may be automatically stopped either by communication between devices or overheating of the devices.

Although Chung-Sik did not specifically disclose communication while a high frequency AC current is not induced in the secondary coil after the end time point is input it would have been obvious for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to transmit a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

11. The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the monitoring result is a charging power adjustment request signal.

Chung-Sik discloses outputting a charge state signal (VDL) which is input to second microcomputer 56 for controlling the portable device 18 (battery) (Fig. 2, page 8-3).

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage

(V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

12. The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

13. A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and,

Chung-Sik discloses contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery 32 that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

Chung-Sik discloses constant voltage/current supplier 42 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See “constant voltage unit”, page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See “voltage V1 is constant”, page 8-5 line 5).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode it would have been obvious over Kaite et al.

Kaite et al. specifically disclosed constant voltage constant current supplier 123 for receiving DC current from rectifier 122 and supplying a charging power to the battery cell 111 in a constant voltage/constant current mode (col. 6, lines 41-44) (Fig. 2).

charge. Therefore, the charging control section 123 is provided with a constant current constant voltage circuit to stabilize output from the rectifying circuit 122, and a switching device to stop charging when the rechargeable batteries 111 reach full charge under control of the computation circuit 124. The constant current constant voltage circuit measures charging current and battery voltage to control the output to a constant current and constant voltage. The

At the time the invention was made it would have been obvious to one of ordinary skill in the to modify the constant voltage supplier disclosed by Chung-Sik by adding the constant current constant voltage circuit disclosed by Kaite et al. to stabilize output from the rectifying circuit.

wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:

Chung-Sik discloses wirelessly transmitting a monitoring result for voltages at both ends of the constant voltage/constant current supplier (Chung-Sik, English Translation, pages 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

Chung-Sik discloses magnetic field generating unit 46 (induced voltage generating unit) for receiving an AC current and forming a magnetic field in an outer space (space around coil

77). (Chung-Sik, English Translation, page 8-4 lines 47-51; and Fig. 2).

10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and

Chung-Sik discloses a high frequency power driving unit (transistor 64) for applying a high frequency AC current to the magnetic field generating unit 46 (Fig. 2, page 8-4).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a charging power adjusting unit for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication by antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is

adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

14. The contact-less charging device according to claim 13, wherein the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 13 as set forth above.

Chung-Sik discloses wherein the magnetic field generating unit is a coil (77, 78) to both sides of which a high frequency AC current is applied. (Fig. 2, page 8-3).

15. The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the charging power adjusting unit includes: a wireless receiving unit for wirelessly receiving the monitoring result through an antenna; and

Chung-Sik discloses wireless receiving unit (radio unit 26 connected to antenna) for wirelessly receiving the monitoring result through the antenna (Fig. 1).

a microprocessor for receiving the monitoring result from the wireless receiving unit and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit.

Chung-Sik discloses first microprocessor 48 for receiving the monitoring result from the wireless receiving unit (radio unit 26) and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit (Fig. 1, 2 & 3A, pages 8-4, 8-5).

48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

19. The contact-less charging device according to claim 13,

Chung-Sik and Kaite et al. discloses contact-less charging device according to claim 13 as set forth above.

wherein the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and

Chung-Sik discloses a high frequency power driving unit 44 (voltage switching unit) for intermittently applying a high frequency AC current by switching on/off transistor (64, 70) to the magnetic field generating unit 46 (induce voltage generating unit) (Fig. 2, page 8-3).

wherein the charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.

Chung-Sik discloses wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication. (Chung-Sik, page 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

To the extent that Chung-Sik may not specifically disclose charging power adjusting unit receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit it would have been obvious for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to transmit a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

20. The contact-less charging device according to claim 13,

Chung-Sik and Kaite et al. discloses contact-less charging device according to claim 13 as set forth above.

wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the

voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

21. A battery charging set including a contact-less chargeable battery and a contact-less charging device, wherein the battery includes:

Chung-Sik discloses battery charging set including a contact-less chargeable battery and a contact-less charging device. (page 8-2, lines 6-7) (Fig. 1).

~~The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.~~

a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device;

Chung-Sik discloses high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field intermittently generated from an external contact-less charging device. (Fig. 2, page 8-4).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.

a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;

Chung-Sik discloses rectifier 80 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current (page 8-2, lines 17-19) (Fig. 2).

a constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode; and

Chung-Sik discloses constant voltage/current supplier 52 for receiving DC current from the rectifier 80 and supplying a charging power to the battery cell 32 in a constant voltage/constant current charge mode (Fig. 2). (See "constant voltage unit", page 8-3, lines 24-27). Chung-Sik further discloses rectifier 80 supplies DC current at a constant voltage V1 (reference voltage). (See "voltage V1 is constant", page 8-5 line 5).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier for receiving the DC current from the rectifier and supplying a charging power

to the battery cell in a constant voltage/constant current mode it would have been obvious over Kaite et al.

Kaite et al. specifically disclosed constant voltage constant current supplier 123 for receiving DC current from rectifier 122 and supplying a charging power to the battery cell 111 in a constant voltage/constant current mode (col. 6, lines 41-44) (Fig. 2).

charge. Therefore, the charging control section 123 is provided with a constant current constant voltage circuit to stabilize output from the rectifying circuit 122, and a switching device to stop charging when the rechargeable batteries 111 reach full charge under control of the computation circuit 124. The constant current constant voltage circuit measures charging current and battery voltage to control the output to a constant current and constant voltage. The

At the time the invention was made it would have been obvious to one of ordinary skill in the to modify the constant voltage supplier disclosed by Chung-Sik by adding the constant current constant voltage circuit disclosed by Kaite et al. to stabilize output from a rectifying circuit.

an overvoltage monitoring unit for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced, wherein the charging device includes:

Chung-Sik also discloses contactless charge system for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (page 8-2, lines 8-9)(Fig. 1) and specifically disclosed an over voltage monitoring unit 54 for monitoring voltages (V1, V2) broadly interpreted the same as the claimed voltage detectors (V1, V2) at both ends of the constant voltage/current supplier 52, and a comparator 96 for comparing

the voltages (V1, V2), and a transmitter for transmitting a monitoring result from comparator 96 to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34), and a microprocessor (48, 56) providing signal SCTL at the output port P1 based on the monitoring result for controlling the switching ON/OFF of transistors (70, 64) for controlling AC line voltage (AVL) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 1, 2) (page 8-2, lines 31-34, 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2). Chung-Sik further discloses wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication. (Chung-Sik, pages 8-5, Fig. 2).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

To the extent that Chung-Sik did not specifically disclose transmitting a monitoring result to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced it would have been obvious for charging the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious to modify the overvoltage monitoring unit disclosed by Chung-Sik to transmit the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit for starting charging of the battery when voltage of the battery is determined to be less than normal.

a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;

Chung-Sik discloses magnetic field generating unit 46 (induced voltage generating unit) for receiving an AC current and forming a magnetic field in an outer space (space around coil 77). (Fig. 2, page 8-4).

a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and

Chung-Sik discloses a high frequency power driving unit 44 (voltage switching unit) for intermittently applying a high frequency AC current by switching on/off transistor 70 to the magnetic field generating unit 46 (induced voltage generating unit) (Fig. 2, page 8-3).

a charging power adjusting unit for, while a high frequency AC current is not applied to the magnetic field generating unit, receiving the monitoring result by means of wireless communication and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted to the battery is adjusted.

Chung-Sik discloses charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by wireless communication through antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 &

3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

To the extent that Chung-Sik may not specifically disclose charging power adjusting unit 48 (first microcomputer) receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit 46 (induced voltage generating unit) it would have been obvious to do so for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit for starting charging of the battery when voltage of the battery is determined to be less than normal.

22. The battery charging set according to claim 21,

Chung-Sik and Kaite et al. discloses battery charging set according to claim 21 as set forth above.

wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik discloses battery voltage detector circuit 54 that includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state signal (VDL) to second microcomputer 56 based on the difference of voltage (V1-V2) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage (V1-V2). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

23. A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by means of electromagnetic induction phenomenon, the method comprising:

Chung-Sik discloses method for controlling charging of a contact-less chargeable battery 32 in a portable device by means of electromagnetic induction phenomenon by inductively coupling a voltage from a charger 12 (base unit) to a portable device 18 comprising contactless charging unit 38 for charging chargeable battery 32 (page 8-2, lines 6-7) (Fig. 1).

The present invention relates to a charge system of a radio-telephone. More specifically, the present invention relates to a contactless charge system of a radio-telephone for charging a battery in a portable device without contact between a charger of a radio-telephone and a voltage terminal of the portable device.

(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;

Chung-Sik discloses intermittently applying a high frequency AC current to a primary coil 77 provided to the charging device by a voltage switching unit 44 by turning on/off transistor 64 so as to intermittently generate a magnetic field in an outer region around coil 77 (Fig. 2).

(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;

Chung-Sik discloses linking a magnetic flux of the generated magnetic field of coil 77 to a secondary coil 79 provided to the battery 32 so as to intermittently output an electromagnetically-induced high frequency AC current (Fig. 2).

(c) rectifying the output high frequency AC current to be converted into a DC current;

Chung-Sik discloses rectifying the high frequency AC current output from coil 79 by rectifier 80 and converted into a DC current (Fig. 2, page 8-3).

The induced voltage rectifying unit 50 includes a core 78 and a coil 79 wound around the core 78, and includes an induced voltage detecting unit 81 that is inductively coupled to the induced voltage generating unit 46, and a rectifier 80 for rectifying a voltage output from the coil 79 of the induced voltage detecting unit 81.

(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;

Chung-Sik discloses applying the DC current to a battery cell 32 through a constant voltage/constant current supplier (80, 52) (see "constant voltage V1") so as to charge the battery cell in a constant voltage/constant current mode (Fig. 2, page 8-4, lines 59-62; page 8-5, line 5).

In this case, the rectified voltage IDC is input to a first voltage splitter 89, simultaneously limited to a predetermined level through the resistor 84 and the diode 86, then applied to the battery 32. That is, the battery 32 is charged. In the above case, the resistor 84 is a current limiter resistor, and the diode 86 is a diode for preventing countercurrent when the voltage IDC is lower than a voltage of the battery 32.

terminal (+) of the comparator 96. In this case, the reference voltage V1 is constant and the charge level detection voltage V2

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode it would have been obvious over Kaite et al.

Kaite et al. specifically disclosed constant voltage constant current supplier 123 for receiving DC current from rectifier 122 and supplying a charging power to the battery cell 111 in a constant voltage/constant current mode (col. 6, lines 41-44) (Fig. 2).

charge. Therefore, the charging control section 123 is provided with a constant current constant voltage circuit to stabilize output from the rectifying circuit 122, and a switching device to stop charging when the rechargeable batteries 111 reach full charge under control of the computation circuit 124. The constant current constant voltage circuit measures charging current and battery voltage to control the output to a constant current and constant voltage. The

At the time the invention was made it would have been obvious to one of ordinary skill in the to modify the constant voltage supplier disclosed by Chung-Sik by adding the constant current constant voltage circuit disclosed by Kaite et al. to stabilize output from a rectifying circuit.

(e) monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil; and

Chung-Sik discloses contactless charge device for detecting a voltage of a rechargeable battery 32 to control the charge between the charger 12 and the portable device 18 (Chung-Sik , English Translation, page 8-2, lines 8-9)(Fig. 1) and monitoring voltages (V1, V2) at both ends of constant voltage/constant current supplier 52 and transmitting a monitoring result to the external contactless charging device 12 by means of wireless communication (RADIO UNIT 34) so as to induce a change of intensity of the magnetic field of the induced voltage generating unit 46 (Fig. 2)(Chung-Sik , English Translation, page 8-2, lines 40-55; page 8-3, lines 36-40; page 8-5, lines 35-43) (Fig. 2).

To the extent that Chung-Sik did not specifically disclose communication while a high frequency AC current is not induced in the secondary coil it would have been obvious to do so for charging of the battery when voltage of the battery is determined to be less than normal (Fig. 2).

At the time the invention was made it would have been obvious for the charging power adjusting unit disclosed by Chung-Sik to transmit a monitoring result to the charging device by means of wireless communication while a high frequency AC current is not induced in the secondary coil for starting charging of the battery when voltage of the battery is determined to be less than normal.

(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result.

Chung-Sik disclosed charging power adjusting unit 48 (first microcomputer) for receiving the monitoring result from the contact-less chargeable battery by means of wireless communication by antenna connected to radio unit 34 and controlling the high frequency power driving unit (transistor 64) to adjust a power of the high frequency AC current applied to the magnetic field generating unit 46 so that a charging power transmitted to the battery 32 is adjusted. (Figs. 1, 2 & 3A, page 8-5).

Here, in the aforementioned operation 120 of FIG. 3B, the second microcomputer 56 that scans the output VDL of the comparator 96 and searches for whether or not the charge voltage is normal determines that the charge voltage of the battery 32 is normal. That is, a voltage of the battery 32 is determined to be completely charged to a set voltage level, and a charge completion alarm signal is output through line 37 in operation 122. The charge completion alarm signal through line 37 is transmitted to the base unit 12 through the audio and logic unit 36 and the radio unit 34, and the radio unit 25 and the audio and logic unit 24 of the base unit 12 receive and demodulate the signal and input the signal to the first microcomputer 48 through the line 49. The first microcomputer 48 that receives a data signal through the line 49 determines that the charge completion signal is received from the portable device 18 in the aforementioned operation 110 of FIG. 3A (the portable device is normal), and performs operation 112.

24. The method according to claim 23, wherein the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.

Chung-Sik and Kaite et al. discloses method according to claim 23 as set forth above.

Chung-Sik discloses battery voltage detector circuit 54 includes first and second voltage splitters 89 and 93 for comparing a voltage V1 of an input terminal of the charging unit 52 with a voltage V2 of an output terminal and clocking the result, and a comparator 96 for comparing outputs of the first and second voltage splitters 89 and 93 (V1, V2) and outputting a charge state

signal (VDL) to second microcomputer 56 based on the difference of voltage ($V_1 - V_2$) at both ends of the constant voltage/constant current supplier. The second microcomputer 56 searches for whether or not a charge voltage of the battery 32 is normal in an operation (120 of FIG. 3B) based on the result of the difference of voltage ($V_1 - V_2$). Additionally, Chung-Sik discloses outputting code (NO) indicating (overvoltage state) if charge voltage is not normal (see (120 of FIG. 3B) (Fig. 2, page 8-4, lines 40-42).

Claim 25 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

Claim 26 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Chung-Sik discloses feedback is provided wirelessly to the base unit 12 by the output (VDL) of the comparator 96 in the overvoltage monitoring unit 54 for controlling the voltages at both ends of a constant voltage/constant current supplier 52 by inducing the change of intensity of the magnetic field in coil 77 by switching transistor 64 at a frequency of 10 KHZ so as to induce an AC voltage from the coil 77 to the inductively coupled coil 79 and AC voltage output from coil 79 is rectified by the rectifier 80 so as to control the voltages at both ends of the constant voltage/constant current supplier 52 for charging the battery 32. (Chung-Sik, English Translation, page 8-4).

Claim 27 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Claim 28 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage it would have been obvious over Kaite et al. (US 6,016,046).

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage (col. 6, lines 61-65) (Fig. 2).

Claim 29 (New): The contact-less chargeable battery according to claim 1,

Chung-Sik and Kaite et al. discloses contact-less chargeable battery according to claim 1 as set forth above.

wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) charges the battery cell (batteries 111) (Fig. 2) in a constant voltage mode based on a charging voltage measured by the VOLTAGE MEASURING SECTION 126 of the battery cell 111 exceeding a predetermined level (“battery voltage or current are outside the specified range”) (col. 6, line 64 to col. 7, line 4; col. 7, lines 45-46). Kaite et al. discloses computational circuit 124 stops charging (SWITCHING DEVICE OFF) (Fig. 3) when the rechargeable batteries 111 have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section 126 (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by adding computational circuit disclosed by Kaite et al to stop charging when the rechargeable batteries have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section.

Claim 30 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier 52 and the overvoltage monitoring unit 54 include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

To the extent that Chung-Sik may not specifically disclose wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) and the overvoltage monitoring unit 126 include circuitry controlled by at least one microprocessor 120 (CONTROL CIRCUIT). Kaite et al. discloses that the control circuit 120 may be a microprocessor (col. 7, lines 28-36) (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by adding microprocessor disclosed by Kaite et al. for controlling the battery charging switching device (Fig. 3).

Claim 31 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Chung-Sik discloses overvoltage monitoring unit 54 controls, through wireless feedback by (RADIO UNIT 34) to control of the charging of the battery cell 32 by switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46 to control the voltages at both ends of the constant voltage/constant current supplier 52 (Fig. 2).

Claim 32 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Additionally, Kaite et al. disclosed constant voltage/constant current supplier 123 has a front end and a rear end, wherein the constant voltage/constant current supplier 123 receives the

DC current at the front end from the rectifier 122 and supplies the charging power at the rear end to the battery cell 111 (col. 6, lines 25-36) (Fig. 2).

Claim 33 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage it would have been obvious over Kaite et al. (US 6,016,046).

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) supplies the charging power in a constant current mode at an initial charging stage and then

supplies the charging power in a constant voltage mode at a later charging stage (col. 6, lines 61-65) (Fig. 2).

Claim 34 (New): The contact-less charging circuit module according to claim 7,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 7 as set forth above.

wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) charges the battery cell (batteries 111) (Fig. 2) in a constant voltage mode based on a charging voltage measured by the VOLTAGE MEASURING SECTION 126 of the battery cell 111 exceeding a predetermined level (“battery voltage or current are outside the specified range”) (col. 6, line 64 to col. 7, line 4; col. 7, lines 45-46). Kaite et al. discloses computational circuit 124 stops charging (SWITCHING DEVICE OFF) (Fig. 3) when the rechargeable

batteries 111 have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section 126 (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by adding computational circuit disclosed by Kaite et al to stop charging when the rechargeable batteries have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section.

Claim 35 (New): The contact-less chargeable battery according to claim 13,

Chung-Sik and Kaite et al discloses contact-less chargeable battery according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier 52 and the overvoltage monitoring unit 54 include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

To the extent that Chung-Sik may not specifically disclose wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) and the overvoltage monitoring unit 126 include circuitry controlled by at least one microprocessor 120 (CONTROL CIRCUIT). Kaite et al. discloses that the control circuit 120 may be a microprocessor (col. 7, lines 28-36) (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by adding microprocessor disclosed by Kaite et al. for controlling the battery charging switching device (Fig. 3).

Claim 36 (New): The contact-less charging circuit module according to claim 35,

Chung-Sik and Kaite et al. discloses contact-less charging circuit module according to claim 35 as set forth above.

wherein the at least one microprocessor controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.

Chung-Sik discloses wherein the at least one microprocessor (48, 56) controls through wireless feedback by (RADIO UNIT 34), the charging of the battery cell 32 by switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46 to control the voltages at both ends of the constant voltage/constant current supplier 52 for charging battery 32. (Fig. 2).

Claim 37 (New): The contact-less charging device according to claim 13,

Chung-Sik and Kaite et al discloses contact-less charging device according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, and
wherein the constant voltage/constant current supplier receives a DC current from a
rectifier at the front end and supplies a charging power at the rear end.

Claim 38 (New): The contact-less charging device according to claim 13,

Chung-Sik and Kaite et al discloses contact-less charging device according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier charges the battery in a constant current mode at an initial charging stage and then charges the battery in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage it would have been obvious over Kaite et al. (US 6,016,046).

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) supplies the charging power in a constant current mode at an initial charging stage and then

supplies the charging power in a constant voltage mode at a later charging stage (col. 6, lines 61-65) (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the charge control circuit disclosed by Chung-Sik by adding constant voltage/constant current supplier (122, 123) disclosed by Kaite et al. for charging the battery in a constant current mode at an initial charging stage for charging the battery and then supplies the charging power in a constant voltage mode at a later charging stage so that the charging current may gradually decrease according to the charging state of battery until the battery is fully charged.

Claim 39 (New): The contact-less charging device according to claim 13,

Chung-Sik discloses contact-less charging device according to claim 13 as set forth above.

wherein the constant voltage/constant current supplier charges the battery in a constant voltage mode based on a charging voltage of the battery exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) charges the battery cell (batteries 111) (Fig. 2) in a constant voltage mode based on a charging voltage measured by the VOLTAGE MEASURING SECTION 126 of the battery cell

111 exceeding a predetermined level (“battery voltage or current are outside the specified range”) (col. 6, line 64 to col. 7, line 4; col. 7, lines 45-46). Kaite et al. discloses computational circuit 124 stops charging (SWITCHING DEVICE OFF) (Fig. 3) when the rechargeable batteries 111 have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section 126 (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by adding computational circuit disclosed by Kaite et al to stop charging when the rechargeable batteries have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section.

Claim 40 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al discloses battery charging set according to claim 21 as set forth above.

wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor.

Chung-Sik discloses wherein the constant voltage/constant current supplier 52 and the overvoltage monitoring unit 54 include circuitry controlled by at least one microprocessor (48, 56) (Fig. 2).

To the extent that Chung-Sik may not specifically disclose wherein the constant voltage/constant current supplier and the overvoltage monitoring unit include circuitry controlled by at least one microprocessor, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) and the overvoltage monitoring unit 126 include circuitry controlled by at least one microprocessor 120 (CONTROL CIRCUIT). Kaite et al. discloses that the control circuit 120 may be a microprocessor (col. 7, lines 28-36) (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by adding microprocessor disclosed by Kaite et al. for controlling the battery charging switching device (Fig. 3).

Claim 41 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al. discloses battery charging set according to claim 21 as set forth above.

wherein the overvoltage monitoring unit controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing a change of intensity of the magnetic field.

Chung-Sik discloses overvoltage monitoring unit 54 controls, through wireless feedback by (RADIO UNIT 34), the charging of the battery cell 32, by switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46 to control the voltages at both ends of the constant voltage/constant current supplier 52. (Fig. 2).

Claim 42 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al discloses battery charging set according to claim 21 as set forth above.

wherein the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Additionally, Kaite et al. disclosed constant voltage/constant current supplier 123 has a front end and a rear end, wherein the constant voltage/constant current supplier 123 receives the DC current at the front end from the rectifier 122 and supplies the charging power at the rear end to the battery cell 111 (col. 6, lines 25-36) (Fig. 2).

Claim 43 (New): The battery charging set according to claim 21,

Chung-Sik discloses battery charging set according to claim 21, as set forth above.

wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when

the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage it would have been obvious over Kaite et al. (US 6,016,046).

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage (col. 6, lines 61-65) (Fig. 2).

Claim 44 (New): The battery charging set according to claim 21,

Chung-Sik and Kaite et al discloses battery charging set according to claim 21, as set forth above.

wherein the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) charges the battery cell (batteries 111) (Fig. 2) in a constant voltage mode based on a charging voltage measured by the VOLTAGE MEASURING SECTION 126 of the battery cell 111 exceeding a predetermined level (“battery voltage or current are outside the specified range”) (col. 6, line 64 to col. 7, line 4; col. 7, lines 45-46). Kaite et al. discloses computational circuit 124 stops charging (SWITCHING DEVICE OFF) (Fig. 3) when the rechargeable batteries 111 have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section 126 (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by adding computational circuit disclosed by Kaite et al to stop charging when the rechargeable batteries have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section.

Claim 45 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al. discloses the method of claim 23, as set forth above.

receiving, by the constant voltage/constant current supplier, the DC current at a front end of the constant voltage/constant current supplier; and supplying, by the constant voltage/constant current supplier, the DC current at a rear end of the constant voltage/constant current supplier to the battery cell.

Chung-Sik disclosed constant voltage/constant current supplier 52 receives the DC current at the front end from the rectifier 80 and supplies the charging power at the rear end to the battery cell 32 (The other end of the battery 32 is grounded) (Fig. 2).

Additionally, Kaite et al. disclosed constant voltage/constant current supplier 123 has a front end and a rear end, wherein the constant voltage/constant current supplier 123 receives the DC current at the front end from the rectifier 122 and supplies the charging power at the rear end to the battery cell 111 (col. 6, lines 25-36) (Fig. 2).

Claim 46 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al. discloses the method of claim 23, as set forth above.

supplying, by the constant voltage/constant current supplier, the DC current to the battery cell in a constant current mode during an initial charging stage and then in a constant voltage mode at a later charging stage.

Chung-Sik discloses constant voltage/constant current supplier 52 supplies the charging power in a constant current mode at an initial charging stage by limiting the current drawn by the battery 32 by a resistor 84 (“the resistor 84 is a current limiter resistor”) (Chung-Sik, English Translation, page 8-4, last paragraph 2nd last line) connected in series with diode 86 and when the battery begins to get charged the current drawn by the battery reduces (current is no longer constant) and supplies the charging power at a constant voltage until the battery is fully charged. (Fig. 2).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage it would have been obvious over Kaite et al. (US 6,016,046).

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) supplies the charging power in a constant current mode at an initial charging stage and then

supplies the charging power in a constant voltage mode at a later charging stage (col. 6, lines 61-65) (Fig. 2).

Claim 47 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al discloses the method of claim 23, as set forth above.

charging, by the constant voltage/constant current supplier, the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.

Chung-Sik discloses constant voltage/constant current supplier 52 charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level 120 (charge voltage normal?) (Fig. 3B).

To the extent that Chung-Sik may not specifically disclose constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level, it would have been obvious over Kaite et al.

In analogous art Kaite et al. discloses constant voltage/constant current supplier (122, 123) charges the battery cell (batteries 111) (Fig. 2) in a constant voltage mode based on a charging voltage measured by the VOLTAGE MEASURING SECTION 126 of the battery cell 111 exceeding a predetermined level (“battery voltage or current are outside the specified range”) (col. 6, line 64 to col. 7, line 4; col. 7, lines 45-46). Kaite et al. discloses computational circuit 124 stops charging (SWITCHING DEVICE OFF) (Fig. 3) when the rechargeable batteries 111 have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section 126 (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the constant voltage/constant current supplier disclosed by Chung-Sik by

adding computational circuit disclosed by Kaite et al to stop charging when the rechargeable batteries have reached full charge based on the charging voltage of the battery cell exceeding a predetermined level measured by voltage measuring section.

Claim 48 (New): The method of claim 23, further comprising:

Chung-Sik and Kaite et al discloses the method of claim 23, as set forth above.

controlling, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing a change of intensity of the magnetic field.

Chung-Sik discloses controlling (by microprocessor 48, 56), through wireless feedback by (RADIO UNIT 34), switching on and off transistor 64, inducing the change of intensity of the magnetic field in coil 77 of the induced voltage generating unit 46, to control the voltages at both ends of the constant voltage/constant current supplier 52 for charging battery 32. (Fig. 2).

6.2 Chung-Sik, Cho, Kaite (cl. 16-18)

Claims 16-18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Chung-Sik and Kaite as applied to claim 15 above, and further in view of Cho Gyu Hyeong et al. (KR 100451606 B1)(Hereafter Cho et al).

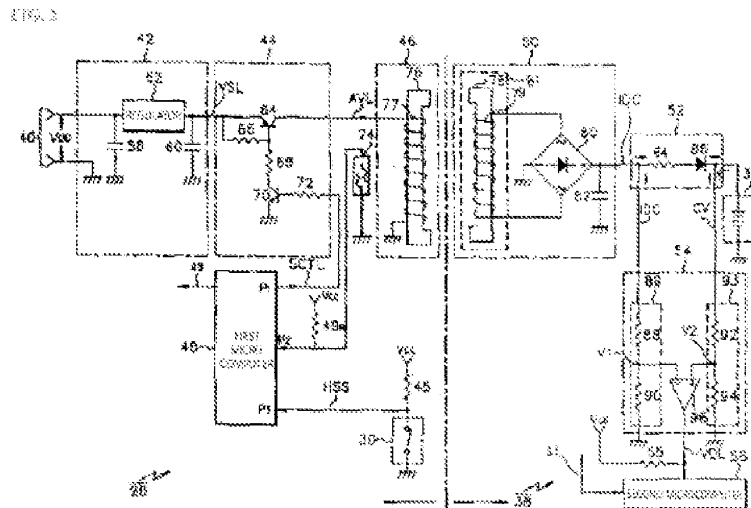
16. The contact-less charging device according to claim 15,

Chung-Sik and Kaite et al. discloses contact-less charging device according to claim 15 as set forth above.

further comprising a constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit,

Chung-Sik discloses constant voltage supplier 42 (constant voltage unit) that regulates the voltage input to power line 40 and outputting the voltage as a constant voltage, and then supplying a constant-voltage current to the high frequency power driving unit 44. Specifically, Chung-Sik discloses AC power having a period of about 10 KHZ is generated from a collector of the transistor 64 in the high frequency power driving unit 44. (Fig. 2, page 8-3, lines 24-27, page 8-4, lines 40-51).

control signal (SCTL), and the signal is applied to a base of the transistor 64. Thus, when the control signal (SCTL) having a period of about 10 KHZ is output from the output port P1 of the first microcomputer 48, AC power having a period of about 10 KHZ is generated from a collector of the transistor 64. The AC voltage of 10 KHZ generated from the collector of the transistor 64 is applied to the coil 77 wound in the induced voltage generating unit 46 through the alternating current line (AVL). When current of an AC voltage that alternates with a period of 10 KHZ flows in the coil 77, an electromagnetic field is generated around the coil 77, and a portion of a magnetic line of force is linked with the coil 79 wound around the core 78 in the induced voltage detecting unit 81.



Chung-Sik. Fig. 2

Chung-Sik did not disclose constant voltage supplier for converting a common AC current, converting the common AC current into a DC current, because Chung-Sik receives 12 VDC directly from the power line 40 (Fig. 1, page 8-4, lines 4-5). However, if a DC power supply is not available it would have been obvious to one of ordinary skill in the art to add a rectifier for the conversion of power line AC voltage to DC.

In analogous art Cho et al. (KR 100451606 B1) disclosed AC / DC rectifier 11 receives a low frequency AC input voltage, such as 110V or 220V, and converts it into direct current Vdc (Fig. 1). Cho et al. (KR 100451606 B1) further discloses a constant voltage supplying part (DC/DC converter 12) for receiving the converted DC current Vdc and outputs a constant voltage current (Vdc). (Fig. 2).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the contact-less charging device disclosed by Chung-Sik by adding a rectifier for rectifying the AC current received from AC power line to convert the AC current into a DC current disclosed by Cho et a. (KR 100451606 B1) and adding a constant voltage supplying part for receiving the converted DC current disclosed by Cho et a. (KR 100451606 B1) to output a constant voltage current.

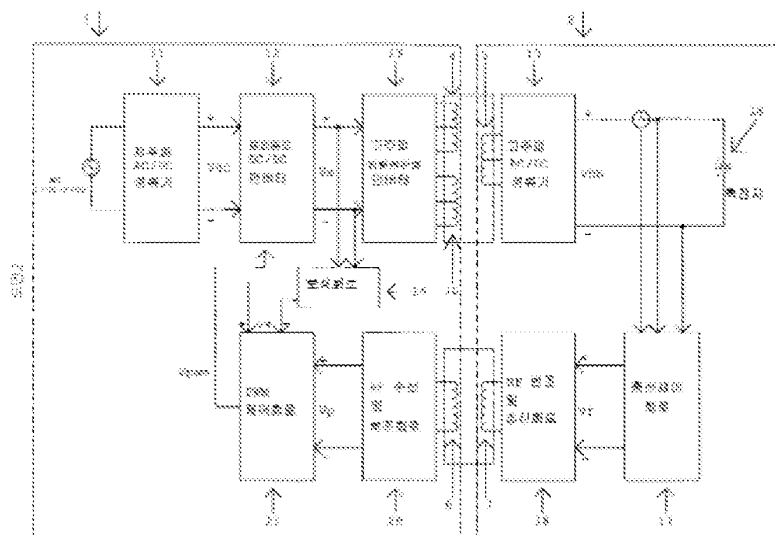


Fig. 2. Cho et al. (KR 100451606 B1)

wherein the high frequency power driving unit includes:

**a pulse signal generator for receiving a pulse driving signal from the microprocessor
and outputting a pulse signal; and**

Chung-Sik discloses high frequency power driving unit (voltage switching unit 44) receives driving signal SCTL (control signal) of predetermined period is output from first microprocessor 48 and applied to voltage switching unit 44 (charge voltage generating unit 28 shown in Fig. 1) comprising transistors 72 and 64 (Fig. 2, page 8-3, lines 28-35. Chung-Sik specifically disclosed the charge voltage generating device includes a charge control pulse generator which generates a pulse sequence with a predetermined period. (Fig. 2, page 8-6, lines

21-24).

a charge voltage generating device including a charge control pulse generator which generates a pulse sequence with a predetermined period in response to input of a charge initiation signal, a voltage switch which converts and outputs a DC voltage at a predetermined level into an AC voltage in response to input of the generated pulse sequence, and a voltage

In an analogous art, Cho et al. disclosed contact-less chargeable battery comprising control circuit (PWM 21) configured to receive a control signal and generate a pulse width modulated signal (Vpwm) to be applied to the DC / DC converter to adjust the DC voltage (Fig. 2, Cho et al. English Translation, page 3, 2nd paragraph).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify Chung-Sik by adding pulse signal generator for generating a pulse width modulated signal (PWM) disclosed by Cho et al. for adjusting charging power for charging a contact-less chargeable battery.

a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.

Chung-Sik discloses power driving part (voltage switching unit 44) for receiving the pulse signal (SCTL) from the first microprocessor 48 to rapidly switch the constant-voltage current input from the constant voltage supplier 42, thereby generating a high frequency AC current in a pulse pattern (Fig. 2). Chung-Sik specifically discloses charge control pulse generator which generates a pulse sequence (pulse pattern) with a predetermined period. (Fig. 2, page 8-6, lines 21-24).

a charge voltage generating device including a charge control pulse generator which generates a pulse sequence with a predetermined period in response to input of a charge initiation signal, a voltage switch which converts and outputs a DC voltage at a predetermined level into an AC voltage in response to input of the generated pulse sequence, and a voltage

Additionally, Cho et al. disclosed power driving part (DC / DC converter 12) for receiving the pulse signal (Vpwm) to rapidly switch the constant-voltage current input from the constant voltage supplier Vdc, thereby generating a high frequency AC current in a pulse pattern input to winding 4 of transformer (Fig. 2).

17. The contact-less charging device according to claim 16, wherein the charging power adjusting unit adjusts a charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or the number of pulses.

Chung-Sik and Kaite et al. discloses contact-less charging device according to claim 16 as set forth above.

Chung-Sik discloses voltage switching unit 44 for switching a power voltage at a predetermined level in response to an input of a control signal SCTL with a predetermined period and converting and outputting an AC voltage. When the control signal (SCTL) is blocked, both the transistors 64 and 70 with respect to the voltage switching unit 44 are switched "off" to block a voltage of the AC line (AVL). Thus voltage switching unit 44 adjusts the charging power by switching on transistor 64 in response to the control signal SCTL with a predetermined period (Fig. 2, page 8-3, lines 28-33). Chung-Sik further discloses that the charging of battery continues until the detection voltage V2 becomes higher than V1 and the output signal VDL of comparator 96 is transitioned to logic "high" from logic "low" and is input to second microcomputer 56 to produce charging completion alarm (Fig. 2, page 8-5, lines 31-43). Thus Chung-Sik discloses adjusting the charging power by providing a number of pulses until charge completion.

Additionally, Cho et al. disclosed control circuit (PWM 21) configured to receive a control signal and generates a pulse width modulated signal (Vpwm) to be applied to the DC / DC converter to adjust the DC voltage (Fig. 2, Cho et al. English Translation, page 3, 2nd paragraph).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify Chung-Sik by adding PWM that receives a control signal to generate a pulse width modulated signal (Vpwm) disclosed by Cho et al. for adjusting charging power for charging a battery.

18. The contact-less charging device according to claim 16,

Chung-Sik and Kaite et al. discloses contact-less charging device according to claim 16 as set forth above.

wherein the constant voltage supplier includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current.

Chung-Sik discloses an overvoltage filter by capacitor 58 for receiving the power supply 20 current and intercepting an overvoltage current (Fig. 2, page 8-4, lines 6-7).

power transmitter 28 inputs a power voltage through the line 40. The power of the line 40 may be filtered by a capacitor 58 in the constant voltage unit 42 and is input to the regulator 62. The regulator 62 (which is a model No. 78×8 regulator series according to the present invention) regulates the input voltage of 12 VDC and outputs the voltage to the power supplying line (VSL).

a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and a constant voltage supplying part for receiving the converted DC current and outputs a constant voltage current.

Chung-Sik discloses current passing through the filter is input to regulator 62 that provides regulated 12 VDC. (Fig. 2).

Chung-Sik did not disclose rectifying an AC current because, Chung-Sik receives 12 VDC directly from the power line 40 (Fig. 1, page 8-4, lines 4-5). However, if a DC power supply is not available it would have been obvious to one of ordinary skill in the art to add a rectifier for the conversion of power line AC voltage to DC.

In analogous art Cho et al. (KR 100451606 B1) disclosed AC / DC rectifier 11 receives a low frequency AC input voltage, such as 110V or 220V, and converts it into direct current V_{dc} (Fig. 1). Cho et al. (KR 100451606 B1) further discloses a constant voltage supplying part (DC/DC converter 12) for receiving the converted DC current V_{dc} and outputs a constant voltage current (V_{dc}).

At the time the invention was made it would have been obvious to one of ordinary skill in the art to modify the contact-less charging device disclosed by Chung-Sik by adding a rectifier for rectifying the AC current received from AC power line to convert the AC current into a DC current disclosed by Cho et al. (KR 100451606 B1) and adding a constant voltage supplying part for receiving the converted DC current disclosed by Cho et al. (KR 100451606 B1) to output a constant voltage current.

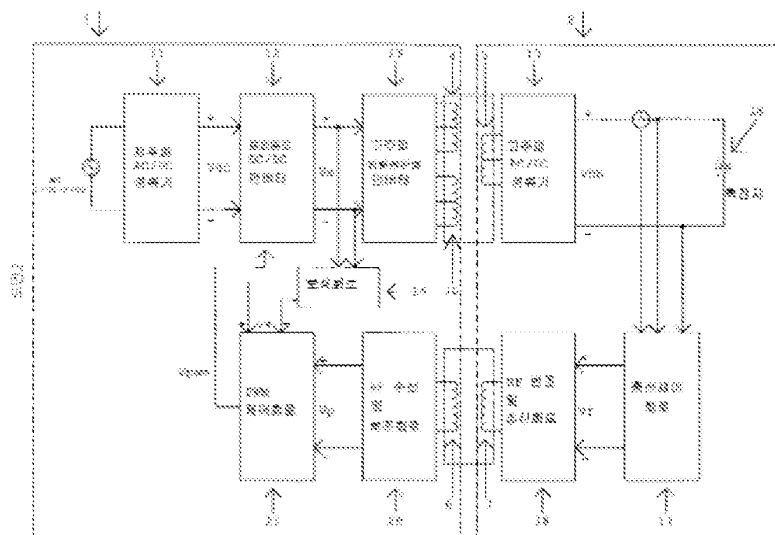


Fig. 2. Cho et al. (KR 100451606 B1)

7.0 CONCLUSION

7.1 Pertinent Art

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Junko et al.(JP H09251865 A) discloses constant voltage/constant current supplier for charging a battery B comprising high frequency AC current inducing unit (T), rectifier D1 for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current, a constant voltage/constant current supplier 30 (battery adaptor) for receiving the DC current from the rectifier and supplying a charging power to the battery cell B in a constant voltage/constant current mode, an overvoltage monitoring unit ("Constant voltage

charging may be performed by feeding back the voltage across the capacitor C2”) for monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.

Fernandez et al (US 6,184,651 B1) published 2001-02-06, disclosed contactless charging system, charging energy is transferred across an inductive coupler to charge a battery (21) of a portable device, such as a two-way radio, cellular phone, paging device, or wireless communicator (Abstract, Fig. 1). The secondary charging device 19 is electrically coupled to a sensing device 38 which provides to a radio transceiver 35 a feedback signal indicative of a charging parameter of the secondary charging device 19, such as indicative of a charging voltage. The radio transceiver 35 preferably comprises an encoder/decoder to encode a signal for radio transmission through antenna 37 of radio transceiver 35. The radio signal from antenna 37 is received wirelessly by antenna 52 of transceiver 39 providing feedback to primary controller 11. The primary controller 11 then uses the feedback control signal, such as to regulate a parameter of the charging process, a charging signal voltage, and/or a cycling rate, and thereby improving the efficiency of the overall charging process and the energy transfer to the battery 21 (Fig. 3).

Kubota et al. (US 7208915) published 2007-04-24, foreign priority date 2004-09-30 disclosed constant current battery charger includes voltage monitor (Fig. 1).

Extensions of Time

Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that *ex parte* reexamination

proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extensions of time in ex parte reexamination proceedings are provided for in 37 CFR 1.550(c).

Waiver of Right to File Patent Owner Statement

In a reexamination proceeding, Patent Owner may waive the right under 37 C.F.R. 1.530 to file a Patent Owner Statement. The document needs to contain a statement that Patent Owner waives the right under 37 C.F.R. 1.530 to file a Patent Owner Statement and proof of service in the manner provided by 37 C.F.R. 1.248, if the request for reexamination was made by a third party requester, see 37 C.F.R. 1.550(f). The Patent Owner may consider using the following statement in a document waiving the right to file a Patent Owner Statement:

Patent Owner waives the right under 37 C.F.R. 1.530 to file a Patent Owner Statement.

Amendment in Reexamination Proceedings

Patent owner is notified that any proposed amendment to the specification and/or claims in this reexamination proceeding must comply with 37 CFR 1.530(d)-(j), must be formally presented pursuant to 37 CFR § 1.52(a) and (b), and must contain any fees required by 37 CFR § 1.20(c). See MPEP § 2250(IV) for examples to assist in the preparation of proper proposed amendments in reexamination proceedings.

Submissions

If the patent owner fails to file a timely and appropriate response to any Office action or any written statement of an interview required under 37 CFR § 1.560(b), the *ex parte* reexamination proceeding will be terminated, and the Director will proceed to issue a certificate under 37 CFR § 1.570 in accordance with the last Office action.

Service of Papers

After the filing of a request for reexamination by a third party requester, any document filed by either the patent owner or the third party requester must be served on the other party (or parties where two or more third party requester proceedings are merged) in the reexamination proceeding in the manner provided in 37 CFR 1.248. See 37 CFR 1.550(f).

Notification of Concurrent Proceedings

The patent owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving Patent No. US 8,013,568B2 throughout the course of this reexamination proceeding. The third party requester is also reminded of the ability to similarly apprise the Office of any such activity or proceeding throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282 and 2286.

All correspondence relating to this ex parte reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
 Central Reexamination Unit
 Commissioner for Patents
 United States Patent & Trademark Office
 P.O. Box 1450
 Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
 Central Reexamination Unit

By hand: Customer Service Window
 Randolph Building
 401 Dulany Street
 Alexandria, VA 22314

Any inquiry concerning this communication should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

/ANJAN K DEB/
Primary Examiner, Art Unit 3992

Conferees:

/MAJID A BANANKHAH/
Reexamination Specialist, Art Unit 3992

/H.B.P/
SPRS, Art Unit 3992