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# (12) EX PARTE REEXAMINATION CERTIFICATE (229th)

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(54) **CONTACT-LESS CHARGEABLE BATTERY AND CHARGING DEVICE, BATTERY CHARGING SET, AND CHARGING CONTROL METHOD THEREOF**

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CPC ..... ***H02J 7/00304*** (2020.01); ***H02J 5/00*** (2013.01); ***H02J 7/0044*** (2013.01); ***H02J 7/00308*** (2020.01); ***H02J 50/10*** (2016.02); ***H02J 50/80*** (2016.02); ***H02J 50/90*** (2016.02)

(58) **Field of Classification Search**
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See application file for complete search history.

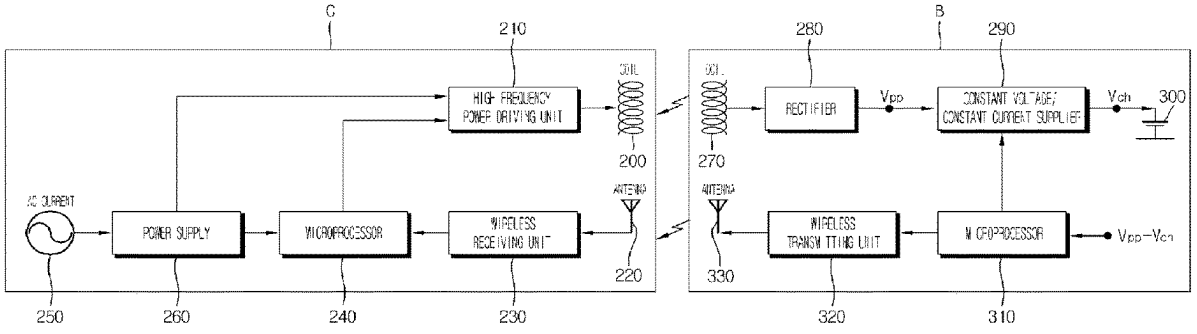
(56) **References Cited**

To view the complete listing of prior art documents cited during the supplemental examination proceeding and the resulting reexamination proceeding for Control Number 96/000,355, please refer to the USPTO's Patent Electronic System.

*Primary Examiner* — Anjan K Deb

(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.



# EX PARTE REEXAMINATION CERTIFICATE

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

**Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.**

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

Claim **2** is cancelled.

Claims **1**, **3**, **4**, **7-13**, **15-19**, **21** and **23** are determined to be patentable as amended.

Claims **5**, **6**, **14**, **20**, **22** and **24**, dependent on an amended claim, are determined to be patentable.

New claims **25-58** are added and determined to be patentable.

**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 *that includes a secondary coil* to which a high frequency AC current is induced by means of a magnetic field generated from *a primary coil of* 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**]** *that includes first and second voltage detectors respectively detecting first and second voltages at both ends of the constant voltage/constant current supplier and a microprocessor monitoring the detected* 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,

*wherein the monitoring result includes a wireless feedback control signal to induce the change of intensity of the magnetic field by adjusting a power applied to the primary coil of the external contact-less charging device based on relative positions of the contact-less chargeable battery and the external contact-less charging device*.

**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;**]** *and*

a voltage comparator for comparing *the* first and second voltages detected by the first and second voltage detectors and **[**outputs**]** *outputting* a voltage comparison result; and **[**a**]** *the* microprocessor **[**for outputting a**]** *outputs the* 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**]** *the* magnetic field generated by the *external* 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**]** *microprocessor receives an end time point signal indicating* 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.

**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**]** *a microprocessor* monitoring voltages at both ends of the constant voltage/constant current supplier and *wirelessly* 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,

*wherein the change of intensity of the magnetic field is based on relative positions of the contact-less charging circuit module and the external contact-less charging device*.

**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**]** *the* 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**]** *further comprising*:

an antenna;

first and second voltage detectors for respectively detecting *first and second* voltages at front and rear ends of the constant voltage/constant current supplier; *and*

a voltage comparator for comparing *the* first and second voltages detected by the first and second voltage detectors and **[**outputs**]** *outputting* a voltage comparison result**[**;**]** , and

**[**a**]** *wherein the* microprocessor **[**for outputting a**]** *outputs the* monitoring result according to the voltage comparison result**[**to the wireless transmitting unit**]** *using the antenna*.

10. The contact-less charging circuit module according to claim 9, wherein [a] *the* magnetic field generated by the *external* 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] *microprocessor receives* a time point *indicating* when the induction of high frequency AC current ends, and then [outputting] *outputs* the end time point to the microprocessor, and

wherein the monitoring result is *wirelessly* 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] 7, wherein the monitoring result is a charging power adjustment request signal.

12. 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.

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] *microprocessor wirelessly* 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] *the* charging power transmitted to the *contact-less chargeable* battery is adjusted,

*wherein the adjustment to the power of the high frequency AC current applied to the magnetic field generating unit is based on relative positions of the contact-less chargeable battery and the contact-less charging device.*

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] *further comprising*:

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.] *coupled to the microprocessor and used to receive the monitoring result.*

16. The contact-less [chargeable battery] *charging device* according to claim 15, further comprising a [constant voltage supplier for converting] *power supply receiving* 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] *microprocessor* adjusts [a] *the* charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or [the] *a* number of pulses.

18. The contact-less charging device according to claim 16, wherein the [constant voltage supplier] *power supply* 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] *supplier that receives* 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] *microprocessor* receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.

21. A battery charging set including a contact-less chargeable battery and a contact-less charging device,

wherein the *contact-less chargeable* 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] *a first microprocessor* monitoring voltages at both ends of the constant voltage/constant current supplier and *wirelessly* 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 *contact-less* charging device includes:

a magnetic field generating unit for receiving an AC current and forming [a] *the* 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] *second microprocessor*, while a high frequency AC current is not applied to the magnetic field generating unit, *wirelessly* 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 *from the contact-less charging device* to the *contact-less chargeable* battery is adjusted, *wherein the adjustment to the power of the high frequency AC current applied to the magnetic field generating unit is based on relative positions of the contact-less chargeable battery and the contact-less charging device.*

**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 *wirelessly* 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,

*wherein the adjusting the power of the high frequency AC current applied to the primary coil is based on relative positions of the contact-less chargeable battery and the contact-less charging device.*

*25. The contact-less chargeable battery according to claim 1, wherein the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.*

*26. The contact-less chargeable battery according to claim 1, wherein the 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.*

*27. 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.*

*28. 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.*

*29. 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.*

*30. The contact-less charging circuit module according to claim 7, wherein the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.*

*31. The contact-less charging circuit module according to claim 7, wherein the 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.*

*32. 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.*

*33. 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.*

*34. 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.*

*35. The contact-less chargeable battery according to claim 13, wherein the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.*

*36. 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.*

*37. 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.*

*38. 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.*

*39. The battery charging set according to claim 21, wherein the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.*

*40. The battery charging set according to claim 21, wherein the microprocessor controls, through wireless feedback control of charging 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.*

*41. 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.*

*42. 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.*

*43. 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.

44. 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.

45. 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.

46. 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.

47. 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.

48. 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 that includes a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil of an external contact-less charging device;

a rectifier 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 receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode, 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; and

an overvoltage monitoring unit that includes first and second voltage detectors respectively detecting voltages at both ends of the constant voltage/constant current supplier, and a microprocessor monitoring the detected 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,

wherein the microprocessor transmits the monitoring result to induce the change of intensity of the magnetic field by adjusting a power applied to the primary coil of the external contact-less charging device to solve an overvoltage state according to relative positions of the primary coil and the secondary coil.

49. The contact-less charging circuit module according to claim 48, wherein a magnetic flux of the magnetic field generated from the external contact-less charging device is linked to the secondary coil of the high frequency AC current inducing unit.

50. The contact-less charging circuit module according to claim 48, wherein:

the overvoltage monitoring unit further comprises:

a wireless transmitting unit wirelessly propagating the monitoring result through an antenna; and

a voltage comparator for comparing the first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result, and

the microprocessor outputs the monitoring result according to the voltage comparison result to the wireless transmitting unit.

51. The contact-less charging circuit module according to claim 50, wherein the magnetic field generated by the contact-less charging device is generated intermittently,

wherein the overvoltage monitoring unit further includes a charging pause detecting unit 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.

52. The contact-less charging circuit module according to claim 48, wherein the monitoring result is a charging power adjustment request signal.

53. The contact-less charging circuit module according to claim 48, 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. 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 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 that includes: a microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier, and a wireless transmitting unit 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,

wherein the change of intensity of the magnetic field is based on relative positions of the contact-less charging circuit module and the external contact-less charging device.

55. 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 including a secondary coil to which a high frequency AC current is

induced by means of a magnetic field generated from a primary coil in 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 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 that includes: a microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier, and a wireless transmitting unit 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,

wherein the secondary coil is movable relative to the primary coil during the charging of the battery cell by the contact-less charging circuit module, and

wherein the monitoring result includes an adjustment request signal being transmitted repeatedly during the battery charging process for adjusting the intensity of the magnetic field.

56. 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 including a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil in 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 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 detecting first and second voltages at both ends of the constant voltage/constant current supplier, monitoring the detected 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,

wherein the monitoring result includes an adjustment request signal being transmitted repeatedly during the battery charging process for adjusting a power applied to the primary coil of the external contact-less charging device based on relative positions of the contact-less chargeable battery and the external contact-less charging device.

57. 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 that includes: a wireless receiving unit receiving the monitoring result from the contact-less chargeable battery by means of wireless communication, and a microprocessor 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 the charging power transmitted to the contact-less chargeable battery is adjusted,

wherein the adjustment to the power of the high frequency AC current applied to the magnetic field generating unit is based on relative positions of the contact-less chargeable battery and the contact-less charging device.

58. 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 that includes a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil of 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 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 that includes a microprocessor, the microprocessor 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,

wherein the change of intensity of the magnetic field includes a change of intensity of the magnetic field by adjusting a power applied to the primary coil of the external contact-less charging device based on relative positions of the contact-less charging circuit module and the external contact-less charging device.

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