US 20120206090A1

(19) United States
(12) Patent Application Publication
Hyun-Jun et al.
(10) Pub. No.: US 2012/0206090 A1
(43) Pub. Date: Aug. 16, 2012

(54) CHARGING DEVICE USING MAGNETS

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(21) Appl. No.: **13/278,278**

(22) Filed: **Oct. 21, 2011**

(30) **Foreign Application Priority Data**

Feb. 11, 2011 (KR) 10-2011-0012515

Publication Classification

(51) **Int. Cl.**
H02J 7/00 (2006.01)
H01R 11/30 (2006.01)

(52) **U.S. Cl.** **320/107**; 439/39

(57) **ABSTRACT**

A charging device using magnets is disclosed. The charging device using magnets includes a sleeve and a charging pad. The sleeve includes a connector connected to the charging terminal of a mobile terminal, and a plurality of magnetic terminals connected to the connector. The charging pad includes magnetic electrodes which magnetically come into contact with the respective magnetic terminals of the sleeve, and supplies charging power to the magnetic terminals using the magnetic electrodes. The magnetic electrodes of the charging pad are configured such that magnetic forces are attenuated due to magnetic fields of coils or such that repulsive forces are generated between the magnetic electrodes of the charging pad and the magnetic terminals of the sleeve which come into contact with the magnetic electrodes.

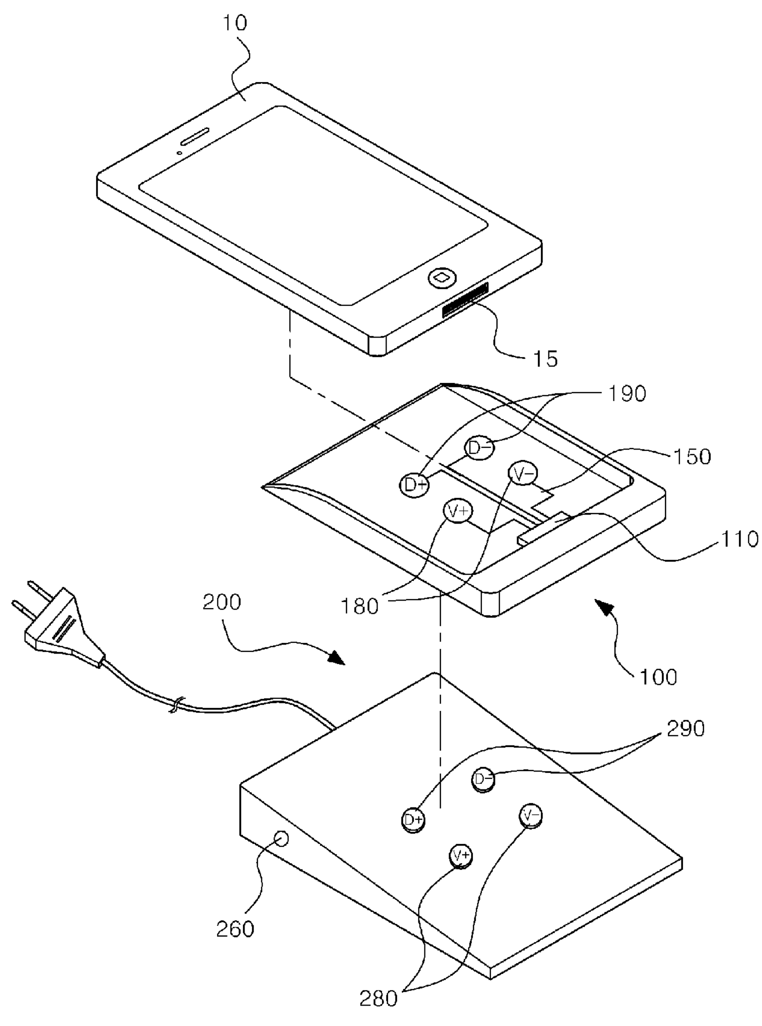


Figure 1

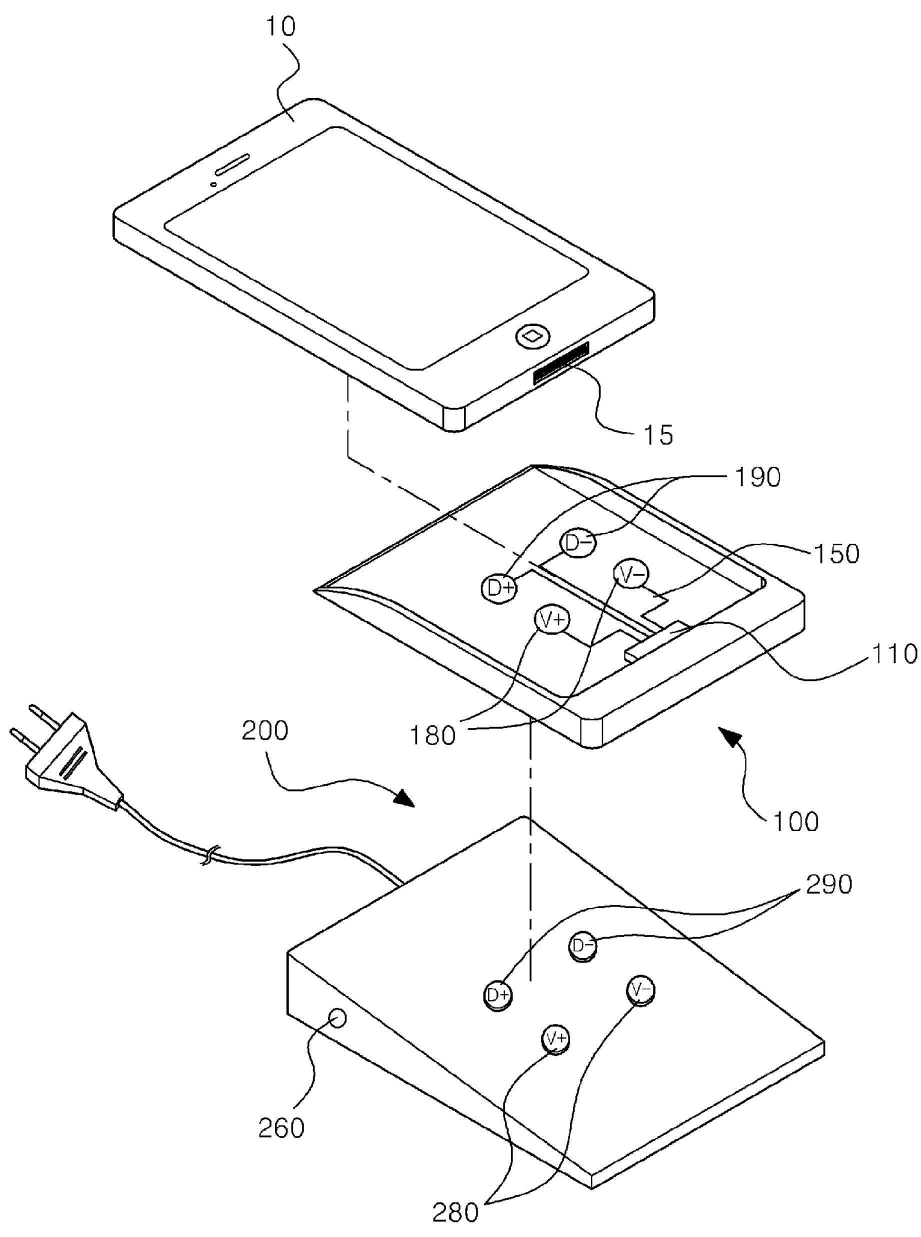


Figure 2

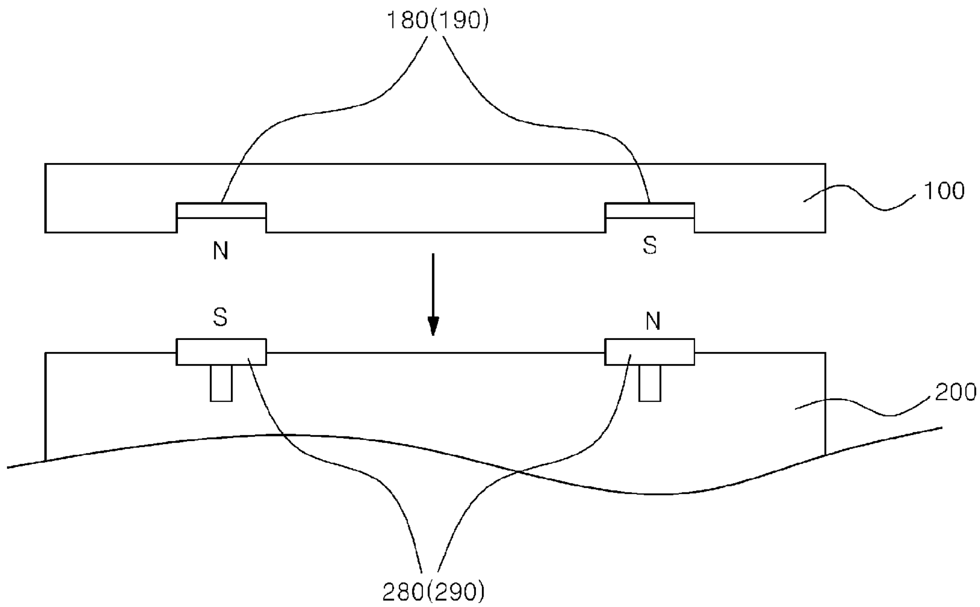


Figure 3

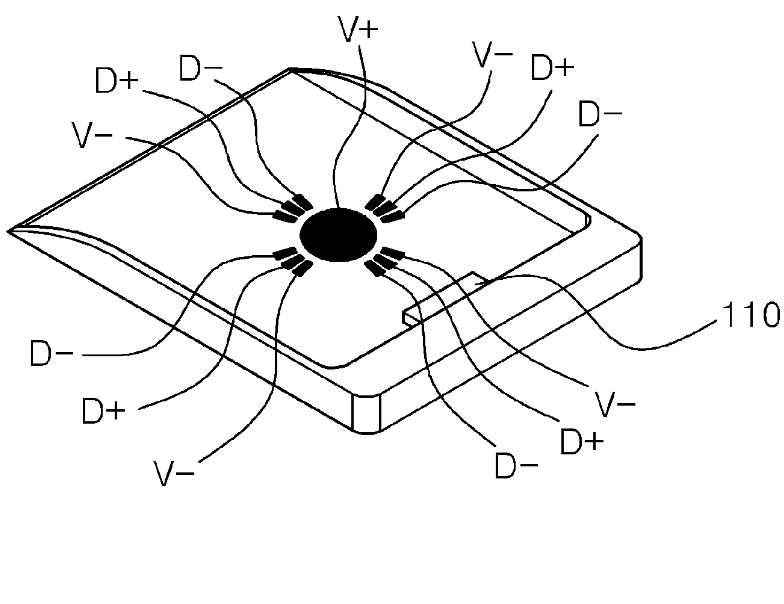
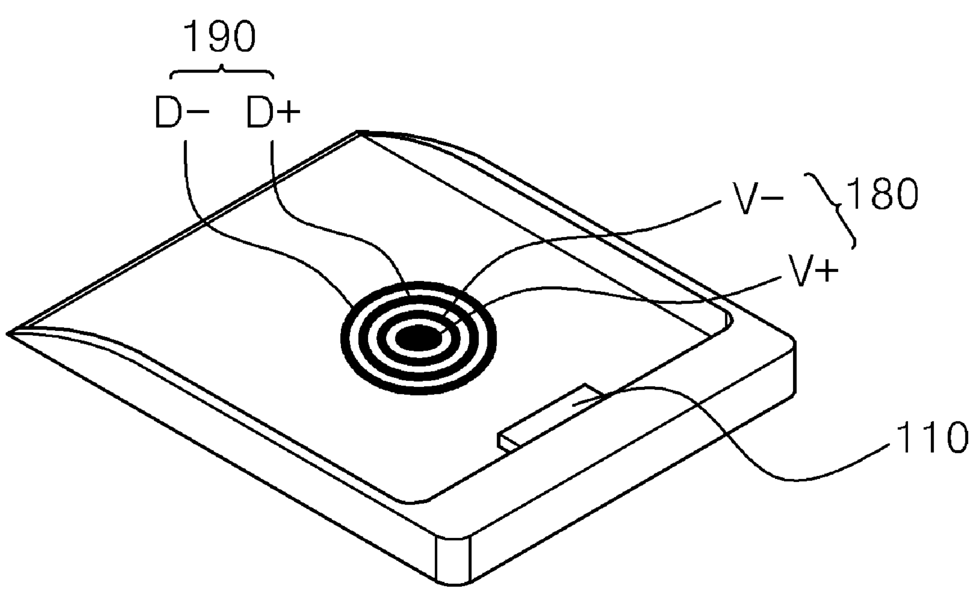


Figure 4



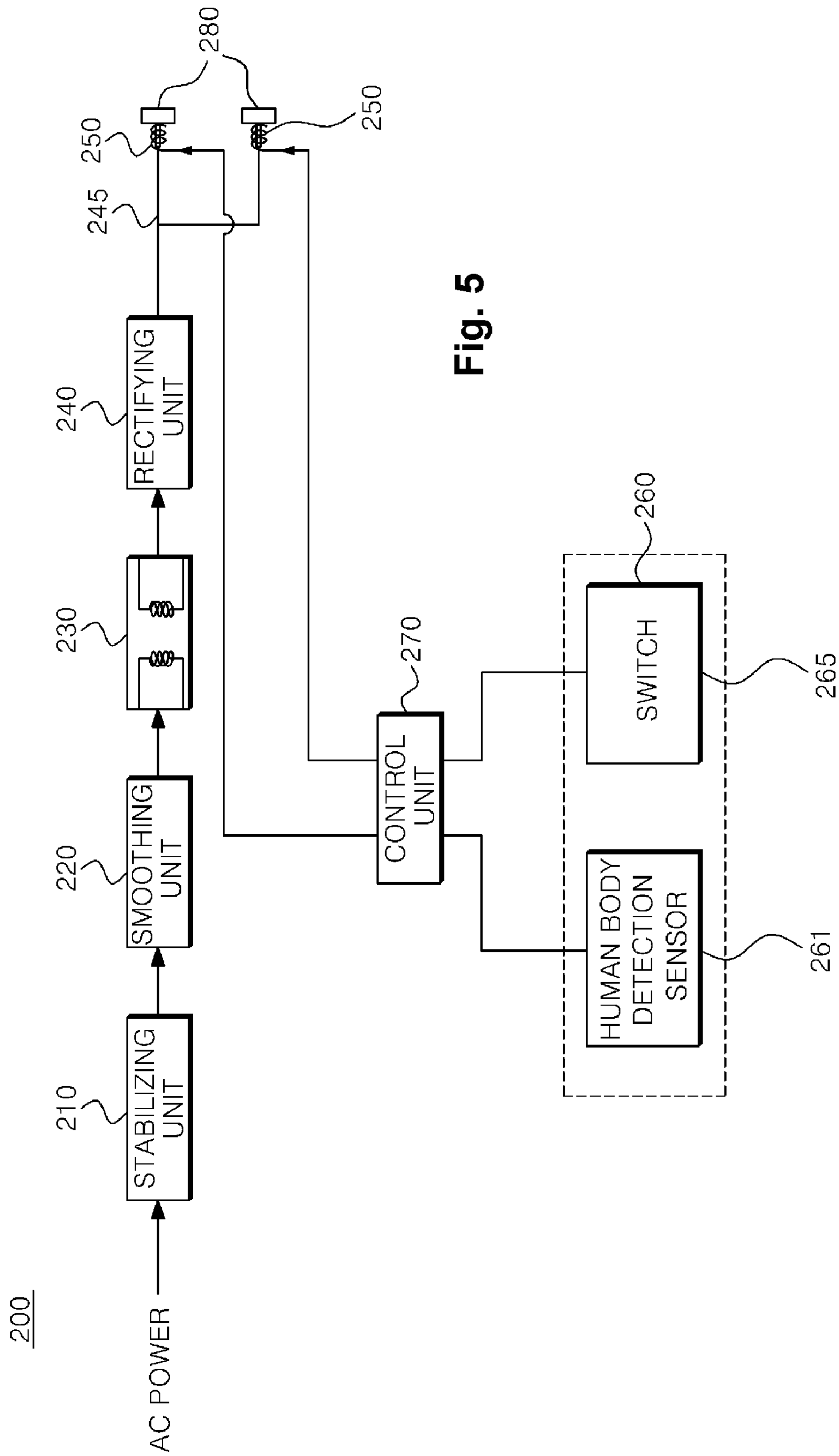

200
AC POWER
STABILIZING UNIT
210
SMOOTHING UNIT
220
230
RECTIFYING UNIT
240
245
250
250
280
CONTROL UNIT
270
SWITCH
260
265
HUMAN BODY DETECTION SENSOR
261

Fig. 5

Figure 6

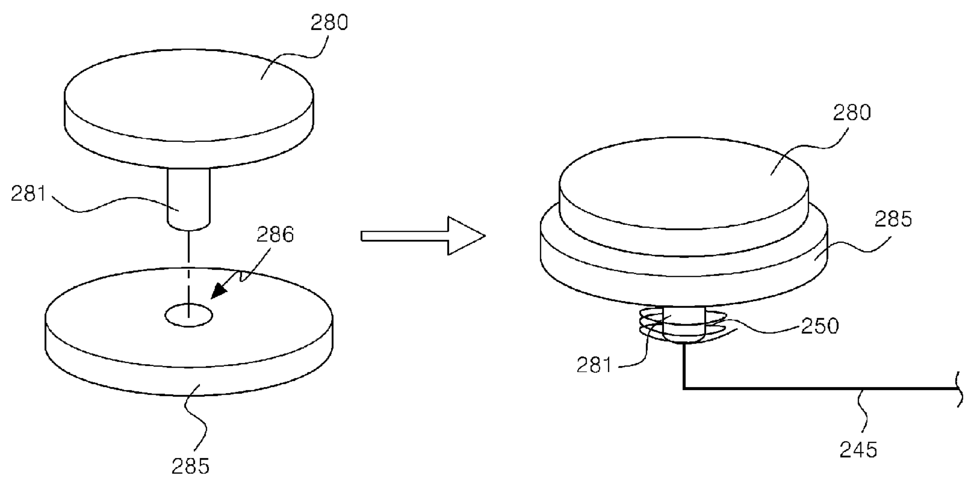
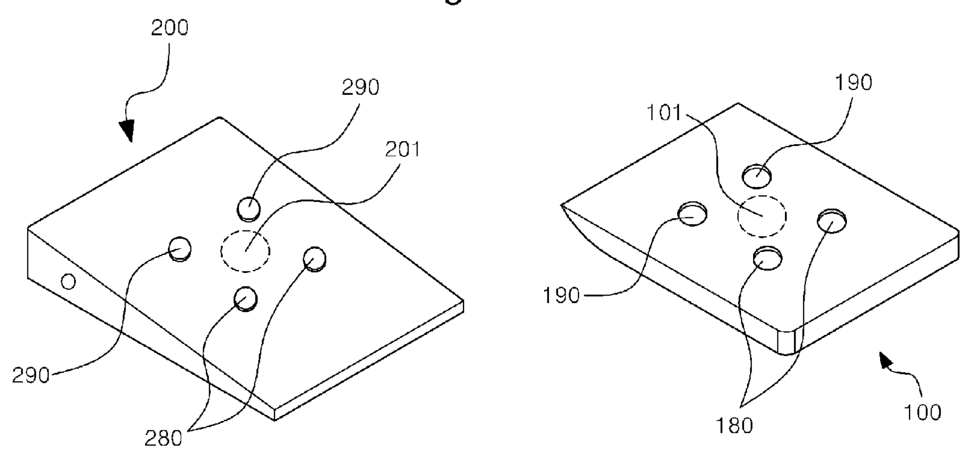


Figure 7



CHARGING DEVICE USING MAGNETS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a charging device using magnets, which is used to charge a mobile terminal using magnetic electrodes or magnetic material electrodes.

[0003] 2. Description of the Prior Art

[0004] Generally, mobile terminals, such as mobile phones, smart phones, and Personal Digital Assistants (PDAs), have been universally used due to excellent mobility and simple portability. Therefore, wired chargers for charging batteries of mobile terminals have been manufactured in different shapes depending on the shapes or standards of manufactured batteries.

[0005] Further, individual manufacturing companies manufacture various types of mobile terminals and various types of chargers which are suitable for the mobile terminals because of a tendency to improve the functions and to reduce the weights of such mobile terminals, thereby coinciding with the request of users.

[0006] Recently, with the development of technology, new types of chargers have been provided. A wireless charging method of charging a battery without electrical contact using a magnetic induction method has been used for such a new type of charger in order to solve the problems of the existing charging methods.

[0007] However, such a wireless charger has problems of complex design and high manufacturing cost.

SUMMARY OF THE INVENTION

[0008] Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a charging device using magnets which can rapidly and conveniently charge a mobile terminal using a simple-structured charging manner in which magnetic electrodes or magnetic material electrodes are used.

[0009] The objects of the present invention are not limited to the above-described object, and objects which are not mentioned can be apparently understood by those skilled in the art based on the description below.

[0010] In order to accomplish the above object, the present invention provides a charging device using magnets, including: a sleeve including a connector connected to the charging terminal of a mobile terminal, and a plurality of magnetic terminals connected to the connector; and a charging pad including magnetic electrodes which magnetically come into contact with the respective magnetic terminals of the sleeve, and supplying charging power to the magnetic terminals using the magnetic electrodes.

[0011] In detail, the charging device may further include a plurality of communication terminals provided around the magnetic terminals of the sleeve; and a plurality of communication electrodes provided on the charging pad such that the communication electrodes correspond to the respective communication terminals.

[0012] The magnetic electrodes of the charging pad may be configured such that magnetic forces are attenuated due to the magnetic fields of coils or such that repulsive forces are generated between the magnetic electrodes of the charging pad and the magnetic terminals of the sleeve which come into contact with the magnetic electrodes.

[0013] The charging pad further includes a transformation unit for dropping the level of an externally applied common Alternating Current (AC) voltage to a desired level; and a rectifying unit for rectifying voltage output from the transformation unit to Direct Current (DC) voltage, and outputting the DC voltage to the magnetic electrodes. The charging pad further includes coils wound on respective magnetic electrodes, and configured to generate magnetic fields depending on current to be applied; an input unit configured to detect an operational instruction received from the outside or an approached human body, and to output a signal corresponding thereto; and a control unit configured to apply current to the coils during a set time based on the instruction received from the input unit such that magnetic forces of the magnetic electrodes are attenuated or repulsive forces are generated between the magnetic electrodes of the charging pad and the magnetic terminals of the sleeve.

[0014] The magnetic electrodes of the charging pad and the magnetic terminals of the sleeve, which are corresponding to the respective magnetic electrodes, are formed in a protruded and depressed configuration. The charging pad may further include subsidiary magnets which are coupled to the respective magnetic electrodes and configured to increase the magnetic forces of the magnetic electrodes. In order to accomplish the above object, the present invention provides another charging device using magnets including: a sleeve including a connector connected to the charging terminal of a mobile terminal, and a plurality of magnetic terminals connected to the connector; and a charging pad including magnetic material electrodes which magnetically come into contact with the respective magnetic terminals of the sleeve, and supplying charging power to the magnetic terminals using the magnetic material electrodes.

[0015] In particular, the charging device may further include magnets coupled to the magnetic material electrodes of the charging pad, and configured to apply magnetic forces to the magnetic material electrodes.

[0016] The charging pad may further include coils wound on the respective magnetic material electrodes, and configured to generate magnetic fields depending on current to be applied; an input unit configured to detect an operational instruction received from the outside or an approached human body, and to output a signal corresponding thereto; and a control unit configured to apply current to the coils for a set time based on the instruction received from the input unit, and to perform control such that the magnetic forces of the magnetic material electrodes are attenuated or repulsive forces are generated between the magnetic material electrodes of the charging pad and the magnetic terminals of the sleeve.

[0017] As described above, the present invention uses a simple-structured charging manner in which magnetic electrodes are used, thereby having advantages of rapidly charging a mobile terminal like an existing wired charger, and conveniently charging a mobile terminal like a wireless charger using a magnetic induction manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and other objects, features, and advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0019] FIG. **1** is a view illustrating the appearance of a charging device using magnet electrodes according to an embodiment of the present invention;

[0020] FIG. **2** is a view illustrating the arrangement structure of magnetic terminals and electrodes according to the present invention;

[0021] FIGS. **3** and **4** are views illustrating the arrangement structure of terminals according to another embodiment of the present invention;

[0022] FIG. **5** is a diagram illustrating the detailed configuration of a charging pad according to an embodiment of the present invention;

[0023] FIG. **6** is a diagram illustrating the detailed structure of an electrode according to another embodiment of the present invention; and

[0024] FIG. **7** is a view illustrating the appearance of a charging device using magnetic electrodes according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0025] Embodiments of the present invention will be described in detail below with reference to attached drawings. Reference should now be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components. Further, the detailed description of wellknown functions and configurations that may obscure the gist of the present invention will be omitted.

[0026] FIG. **1** is a view illustrating the appearance of a charging device using magnet electrodes according to an embodiment of the present invention. The charging device includes a sleeve **100** and a charging pad **200**.

[0027] The sleeve **100** includes a connector **110** that is connected to the charging terminal **15** of a mobile terminal **10**. A plurality of magnetic terminals **180** (V+ and V−) and communication terminals **190** (D+ and D−), which are electrically connected to the connector **110**, are formed around the connector **110**. The mobile terminal **10** is inserted into and mounted on the sleeve **100**. When the mobile terminal **10** is mounted on the sleeve **100**, connection is made in such a way that the charging terminal **15** of the mobile terminal **10** is inserted into the connector **110** of the sleeve **100**. Here, the sleeve **100** may be formed of a polymer substrate.

[0028] The plurality of magnetic terminals **180** are formed on the upper side of the connector **110** of the sleeve **100** while they are separated from each other by predetermined intervals. Each of the magnetic terminals **180** is electrically connected to the connector **110** via wiring **150**. The communication terminals **190** are formed around the magnetic terminals **180** while they are separated from each other by predetermined intervals. The plurality of communication terminals **190** are formed around the respective magnetic terminals **180** while they are separated from each other by predetermined intervals. Each of the communication terminals **190** is electrically connected to the connector **110** via wiring **150**. When the sleeve **100** is mounted on the charging pad **200**, the mobile terminal **10** and the charging pad **200** may perform preset communication using the communication terminals **190**.

[0029] The charging pad **200** includes magnetic electrodes **280** (V+ and V−), and communication electrodes **290** (D+ and D−) that magnetically come in contact with the magnetic terminals **180** and communication terminals **190** of the sleeve **100**. The charging pad **200** is configured to supply charging power to the magnetic terminals **180** using the magnetic electrodes **280**, and to perform communication with the communication electrodes **290** through the communication terminals **190**.

[0030] Here, the magnetic electrodes **280** of the charging pad **200** and the magnetic terminals **180** of the sleeve **100**, which correspond to the magnetic electrodes **280**, may be formed in a protruded and depressed configuration, as shown in FIG. **2**. For example, the magnetic terminals **180** of the sleeve **100** may be depressed to the inside of the sleeve **100** by approximately 0.5 to 1.5 mm, and the magnetic electrodes **280** of the charging pad **200** may be protruded by approximately 0.5 to 1.5 mm. Here, the height of the protrusion of each of the magnetic electrodes **280** should be the same as or higher than the depth of the depression of each of the magnetic terminals **180**.

[0031] Further, the plurality of magnetic terminals **180** and the plurality of magnetic electrodes **280** may be formed with different polarities for the purpose of directivity of the sleeve **100**.

[0032] When any one of the magnetic terminals **180** of the sleeve **100** is the N pole, the remaining one may be the S pole, as shown in FIG. **2**. It is apparent that, if any one of the magnetic electrodes **280** of the charging pad **200** is the S pole, the remaining one may be the N pole. Although all of the magnetic terminals **180**, the communication terminals **190**, the magnetic electrodes **280**, and the communication electrodes **290** may be formed of a permanent magnet, they may be formed of any one selected from among a permanent magnet, a ferromagnetic substance, and a paramagnet material. For example, the magnetic terminals **180** and the communication terminals **190** may be formed of a permanent magnet and the magnetic electrodes **280** and the communication electrodes **290** may be formed of a paramagnet material or a ferromagnetic substance. Although not shown, the communication electrodes **290** of the charging pad **200** and the communication terminals **190** of the sleeve **100**, which correspond to the communication terminals **290**, may be formed as in FIG. **2**.

[0033] The magnetic terminals **180** and the communication terminals **190** which are formed on the sleeve **100** and the magnetic electrodes **280** and the communication electrodes **290**, corresponding to the respective magnetic terminals **180** and the communication terminals **190**, on the charging pad **200**, may be arranged using various structures as well as shown in FIG. **1**. For example, the magnetic terminals **180** (V+ and V−) and the communication terminals **190** (D+ and D−) may be arranged as in FIG. **3** or FIG. **4**. It is apparent that the magnetic electrodes **280** and the communication electrodes **290** of the charging pad **200** may be arranged in the corresponding forms as in FIG. **3** or FIG. **4**.

[0034] As shown in FIG. **3**, magnetic terminals **180** and communication terminals **190** are formed in a radiation shape. The magnetic terminals **180** (V−) and the communication terminals **190** (D+ and D−) are arranged in all directions around a center magnetic terminal **180** (V+), while the magnetic terminals **180** (V−) and the communication terminals **190** (D+ and D−) are separated from each other. Since the terminals are formed in various directions, the sleeve **100** may be conveniently placed on the charging pad **200**. That is, when the sleeve **100** is placed on the charging pad **200**, the sleeve **100** can be placed at various angles.

[0035] In FIG. **4**, the magnetic terminals **180** (V+ and V−) and the communication terminals **190** (D+ and D−) are formed in a concentric circle while they are separated from each other, and are characterized in that none of the terminals V+ to D− have directivity.

[0036] Since none of the terminals V+ to D− have directivity, it is very convenient when the sleeve **100** is placed on the charging pad **200**. That is, the sleeve **100** can be mounted on the charging pad **200** in any direction when the sleeve **100** is placed on the charging pad **200**. In addition, for the purpose of convenient mounting, the magnetic terminals **180** and the communication terminals **190** may be arranged using various structures.

[0037] FIG. **5** is a diagram illustrating the detailed configuration of the charging pad according to an embodiment of the present invention. The charging pad **200** includes a stabilizing unit **210**, a smoothing unit **220**, a transformation unit **230**, a rectifying unit **240**, coils **250**, an input unit **260**, a control unit **270**, and the magnetic electrodes **280**.

[0038] The stabilizing unit **210** is configured to raise the common Alternating Current (AC) voltage received from the outside, for example, AC 110V or AC 220V, by 1.414 times, or to stabilize the received AC voltage.

[0039] The smoothing unit **220** smoothes the voltage output from the stabilizing unit **210** and outputs a voltage that is almost Direct Current (DC) voltage. That is, the smoothing unit **220** minimizes ripples included in the voltage output from the stabilizing unit **210**, thereby reducing ripple noise.

[0040] The transformation unit **230** drops the level of the voltage output from the smoothing unit **220** to a desired voltage level and then outputs the resulting voltage. The transformation unit **230** includes a primary winding and a secondary winding. Noise that appears at the output terminal of the charging pad **200** may be decreased by appropriately adjusting the number of turns of the primary winding and the secondary winding. For example, noise that appears at the output terminal of the charging pad **200** is minimized when the number of turns of the primary winding is adjusted in the range of 83 to 90T (turns) and the number of turns of the secondary winding is adjusted in the range of 9 to 14T. The primary winding is wound with an insulating tape that is very thin. When the transformation unit **230** is configured as described above, the temperature characteristic and leakage inductance of the transformation unit **230** are improved and ripple noise is decreased.

[0041] The rectifying unit **240** rectifies voltage output from the secondary winding of the transformation unit **230**, and outputs DC voltage using the magnetic electrodes **280**.

[0042] Since the voltage generated at the secondary winding of the transformation unit **230** is near a square wave, the rectifying unit **240** rectifies the voltage and converts the voltage output from the charging pad to DC voltage. The rectifying unit **240** minimizes ripple noise using an inductor coil, thereby converting the output voltage to almost DC voltage.

[0043] The coils **250** operate as electromagnets that are wound on the respective magnetic electrodes **280**, generate magnetic fields based on current being applied, and attenuate the magnetic forces of the magnetic electrodes **280**. That is, current is applied to the coils **250** such that the magnetic forces of the magnetic electrodes **280** are attenuated.

[0044] The input unit **260** is configured to detect operational instructions received from the outside or an approaching human body, and to output a corresponding signal. The input unit **260** may include at least any one of a human body detection sensor **261** for detecting infrared rays coming from a human body and a mechanical switch **265** for outputting an operational signal based on the selection of a user.

[0045] The control unit **270** performs control in response to an instruction received from the input unit **260** such that current is applied to the coils **250** for a set time so that the magnetic forces of the magnetic electrodes **280** are attenuated or repulsive power is generated between the magnetic electrodes **280** and the magnetic terminals **180** of the sleeve **100**, which respectively come in contact with the magnetic electrodes **280**.

[0046] The coils **250** are wound on the magnetic electrodes **280** of the charging pad **200**, so that the magnetic forces of the magnetic electrodes **280** are attenuated depending on magnetic fields generated by the coils **250** or magnetic forces are generated such that repulsive power is generated between the magnetic electrodes **280** and the magnetic terminals **180** of the sleeve **100**, which respectively come into contact with the magnetic electrodes **280**.

[0047] The above-described human body detection sensor **261** and coils **250** are devices used to prevent situation in which it is difficult to separate the sleeve **100** from the charging pad **200** because the strong magnetic forces between the sleeve **100** and the charging pad **200** are too strong. Each of the magnetic electrodes **280** may further include a subsidiary magnet **285** in order to increase the magnetic forces of the respective magnetic terminal **180** and the magnetic electrode **280**, as shown in FIG. **6**.

[0048] Here, as shown in the drawing, the subsidiary magnet **285** is formed in a donut configuration in which a through hole **286** is formed in the center of a circular plate, so that the pin **281** of the electrode **280** can be inserted into the through hole and fixed therein. If the subsidiary magnet **285** has an area which is wider than that of the electrode **280**, the magnetic force of the electrode **280** can be increased. The subsidiary magnet **285** configured as described above can be applied to not only each of the magnetic electrodes **280** of the charging pad **200** but also to each of the magnetic terminals **180** of the sleeve **100**.

[0049] It is apparent that, when the subsidiary magnet **285** is provided to the electrode **280** of the charging pad **200**, the electrode **280** may be formed not of a magnet but of a magnetic material. That is, the electrode **280** installed on the charging pad **200** may be formed of a magnetic material, and the subsidiary magnet **285** can be formed to apply magnetic force to the magnetic material. When the electrode **280** is a magnetic material, the subsidiary magnet **285** and the coil **250** may be wound on the pin **281** of the electrode **280**. Since the coils **250** operate under the control of the control unit **270** as shown in FIG. **3**, the detailed description thereof will be omitted.

[0050] FIG. **7** is a view illustrating the appearance of a charging device using magnet electrodes according to another embodiment of the present invention. Unlike FIG. **1**, reinforcement magnets **101** and **201** may be further installed in the respective sleeve **100** and charging pad **200** in addition to the magnetic terminals **180** and the magnetic electrodes **280** in order to increase adhesive force of each other.

[0051] A plurality of magnetic terminals **180** are separated by predetermined intervals and arranged on the upper side of the connector **110** of the sleeve **100**. Each of the magnetic terminals **180** is electrically connected to the connector **110** using wiring.

[0052] The reinforcement magnet **101** may be provided in the sleeve **100** on the upper side of the plurality of magnetic terminals **180**. Here, it is preferable that the reinforcement magnet **101** be arranged in the middle of the plurality of magnetic terminals **180** and communication terminals **190** for the purpose of stable adhesive force.

[0053] It is apparent that a reinforcement magnet **201** corresponding to the reinforcement magnet **101** of the sleeve **100** is installed in the charging pad **200**.

[0054] There is no problem even if the reinforcement magnets **101** and **201** are not exposed to the outside but respectively are provided in the sleeve **100** and the charging pad **200**.

[0055] A procedure for mounting the above-described charging device using magnetic electrodes **280** and a procedure for performing charging using the charging device will be described below.

[0056] The mobile terminal **10** is inserted into and mounted on the sleeve **100**. Here, the charging terminal **15** of the mobile terminal **10** and the connector **110** of the sleeve **100** are coupled to each other and electrically connected to each other.

[0057] If the sleeve **100** is placed on the charging pad **200** in the above-described state, the magnetic terminals **180** are adhered to the magnetic electrodes **280** due to the magnetic forces between the magnetic electrodes **280** of the charging pad **200** and the magnetic terminals **180** of the sleeve **100**.

[0058] Here, if the poles of the magnetic terminals **180** of the sleeve **100** are the S poles, the poles of the magnetic electrodes **280** of the charging pad **200** become the N poles.

[0059] However, the plurality of magnetic electrodes **280** may be formed of poles that are different from each other for the purpose of directivity of the sleeve **100**. That is, the plurality of magnetic electrodes **280** of the charging pad **200** may be formed of poles that are different from each other, and directivity can be applied when the sleeve **100** is mounted on the charging pad **200** in such a way to differentiate the shapes or areas of the plurality of magnetic electrodes **280** formed on the charging pad **200** if necessary.

[0060] When the magnetic terminals **180** of the sleeve **100** are adhered to the respective magnetic electrodes **280** of the charging pad **200** as described above, the charging voltage of the charging pad **200** is supplied to the mobile terminal **10** mounted on the sleeve **100** using the magnetic electrodes **280** and the magnetic terminals **180**, thereby charging a battery.

[0061] Although not shown in FIG. **5** in detail, the charging pad **200** may further include an indication Light Emitting Diode (LED) which displays the charging status of a battery.

[0062] If, when charging is performed, the hand of a user approaches the charging pad **200** or an instruction indicative of the removal of the sleeve **100** is received using a predetermined switch, the control unit **270** applies current to coils **250** wound on magnetic electrodes **280**, so that the magnetic forces of the magnetic electrodes **280** are attenuated or the polarities of the magnetic electrodes **280** are changed, thereby removing the magnetic forces between the charging pad **200** and the sleeve **100**. As described above, when a human body is detected or a relevant switch is turned on, the control unit **270** performs control such that the magnetic forces of the magnetic electrodes **280** are attenuated so that a user can easily separate the sleeve **100** from the charging pad **200**. Here, when a human body is detected or a relevant switch is turned on, it is preferable that the control unit **270** apply current for a set time, for example, approximately several seconds.

[0063] As described above, the present invention uses a simple-structured charging manner in which magnetic electrodes are used, thereby rapidly charging a mobile terminal like an existing wired charger, and conveniently charging a mobile terminal like a wireless charger using a magnetic induction manner. Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A charging device using magnets, comprising:

a sleeve including a connector connected to a charging terminal of a mobile terminal, and a plurality of magnetic terminals connected to the connector; and a charging pad including magnetic electrodes which magnetically come into contact with the respective magnetic terminals of the sleeve, and supplying charging power to the magnetic terminals using the magnetic electrodes.

2. The charging device according to claim **1**, further comprising:

a plurality of communication terminals provided around the magnetic terminals of the sleeve; and a plurality of communication electrodes provided on the charging pad such that the communication electrodes correspond to the respective communication terminals.

3. The charging device according to claim **1**, wherein the magnetic electrodes of the charging pad are configured such that magnetic forces are attenuated due to magnetic fields of coils or such that repulsive forces are generated between the magnetic electrodes of the charging pad and the magnetic terminals of the sleeve which come into contact with the magnetic electrodes.

4. The charging device according to claim **1**, wherein the charging pad further comprises: a transformation unit for dropping a level of an externally applied common Alternating Current (AC) voltage to a desired level; and a rectifying unit for rectifying voltage output from the transformation unit to Direct Current (DC) voltage, and outputting the DC voltage to the magnetic electrodes.

5. The charging device according to claim **1**, wherein the charging pad further comprises: coils wound on respective magnetic electrodes, and configured to generate magnetic fields depending on current to be applied; an input unit configured to detect an operational instruction received from an outside or an approached human body, and to output a signal corresponding thereto; and a control unit configured to apply current to the coils for a set time based on the instruction received from the input unit such that magnetic forces of the magnetic electrodes are attenuated or that repulsive forces are generated between the magnetic electrodes of the charging pad and the magnetic terminals of the sleeve.

6. The charging device according to claim **5**, wherein the input unit comprises at least any one of a human body detection sensor and a mechanical switch.

7. The charging device according to claim **1**, wherein the magnetic electrodes of the charging pad and the corresponding magnetic terminals of the sleeve are formed in a protruded and depressed configuration.

8. The charging device according to claim **1**, wherein the magnetic electrodes of the charging pad are formed with different polarities.

9. The charging device according to claim **1**, wherein the charging pad further comprises subsidiary magnets which are coupled to the respective magnetic electrodes and configured to increase magnetic forces of the magnetic electrodes.

10. The charging device according to claim **1**, further comprising:

a reinforcement magnet around the magnetic electrodes of the charging pad;

and a magnet configured to correspond to the reinforcement magnet, and installed in the sleeve, thereby increasing adhesive force of the sleeve.

11. The charging device according to claim **10**, wherein the reinforcement magnet is installed in the charging pad.

12. A charging device using magnets, comprising:

a sleeve including a connector connected to a charging terminal of a mobile terminal, and a plurality of magnetic terminals connected to the connector; and a charging pad including magnetic material electrodes which magnetically come into contact with the respective magnetic terminals of the sleeve, and supplying charging power to the magnetic terminals using the magnetic material electrodes.

13. The charging device according to claim **12**, further comprising:

a plurality of communication terminals provided around the magnetic terminals of the sleeve; and a plurality of communication electrodes provided on the charging pad such that the communication electrodes correspond to the respective communication terminals.

14. The charging device according to claim **12**, further comprising magnets coupled to the magnetic material electrodes of the charging pad, and configured to apply magnetic forces to the magnetic material electrodes.

15. The charging device according to claim **12**, wherein the magnetic material electrodes of the charging pad and the corresponding magnetic terminals of the sleeve are formed in a protruded and depressed configuration.

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