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(54) **MAGNETIC CONNECTING DEVICE**

(75) Inventors: **Kim Hyun-Jun**, Yuseong-gu (KR); **Youn Dae-Young**, Seoul (KR); **Jeong Seung-Ju**, Daedeok-gu (KR); **Kim Jung Gyo**, Yuseong-gu (KR); **Kim Hyo-Nam**, Yuseong-gu (KR)

(73) Assignee: **SMART POWER SOLUTIONS, INC**, Yuseong-gu (KR)

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(57) **ABSTRACT**

The present invention relates to a magnetic connecting device, which is magnetically and electrically coupled to an external device via a communication-type magnetic connector and is configured to transfer operating power to the external device after checking the external device using communication when the external device is coupled to the connecting device, thus ensuring convenience and safety in use. The magnetic connecting device includes a plurality of power terminals magnetically coupled to a connector of an external device and configured to transfer power to the external device, and at least one communication terminal arranged adjacent to the plurality of power terminals and configured to come into contact with the connector of the external device and to transmit or receive data when the external device is coupled.

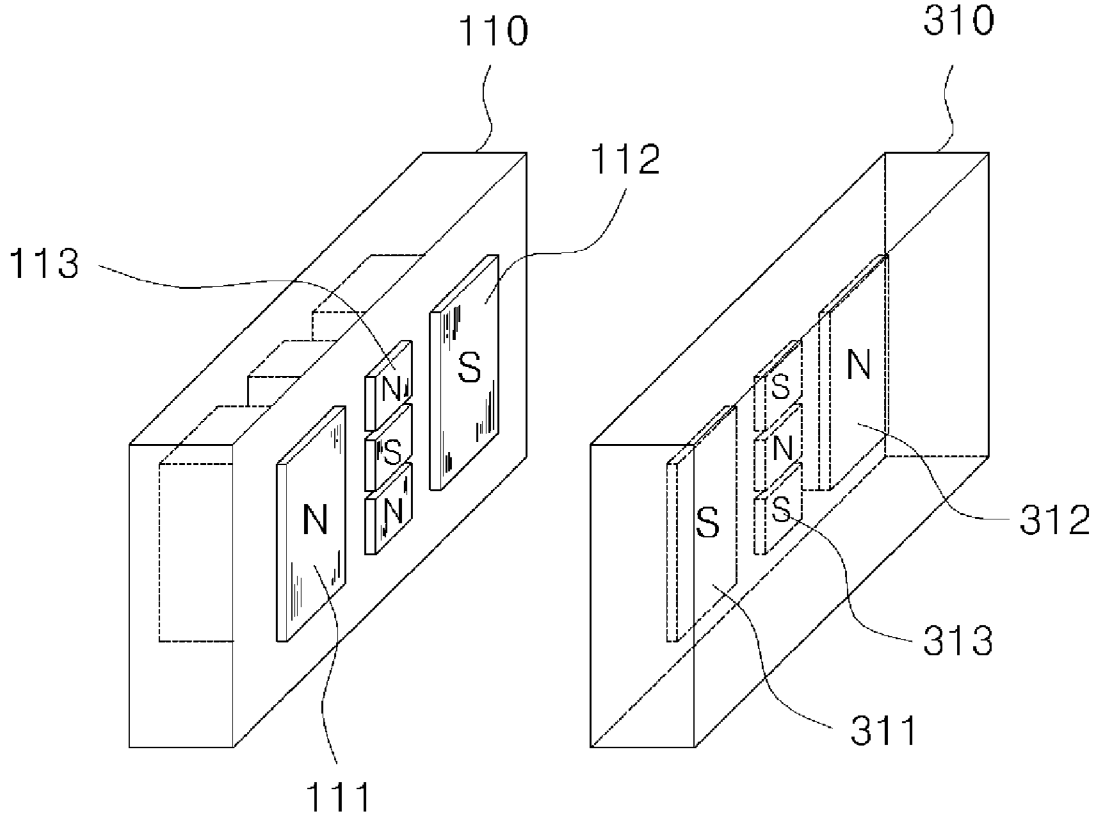


Figure 1

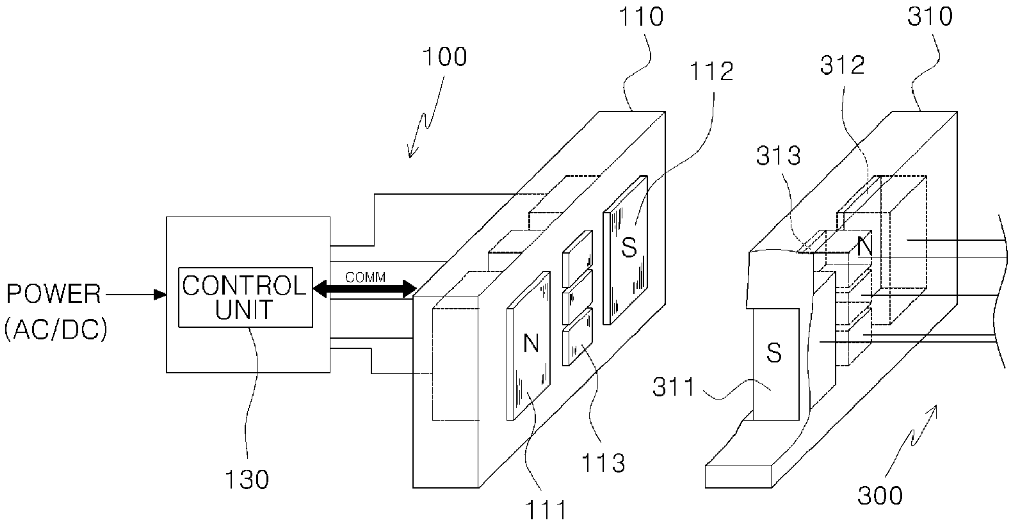


Figure 2

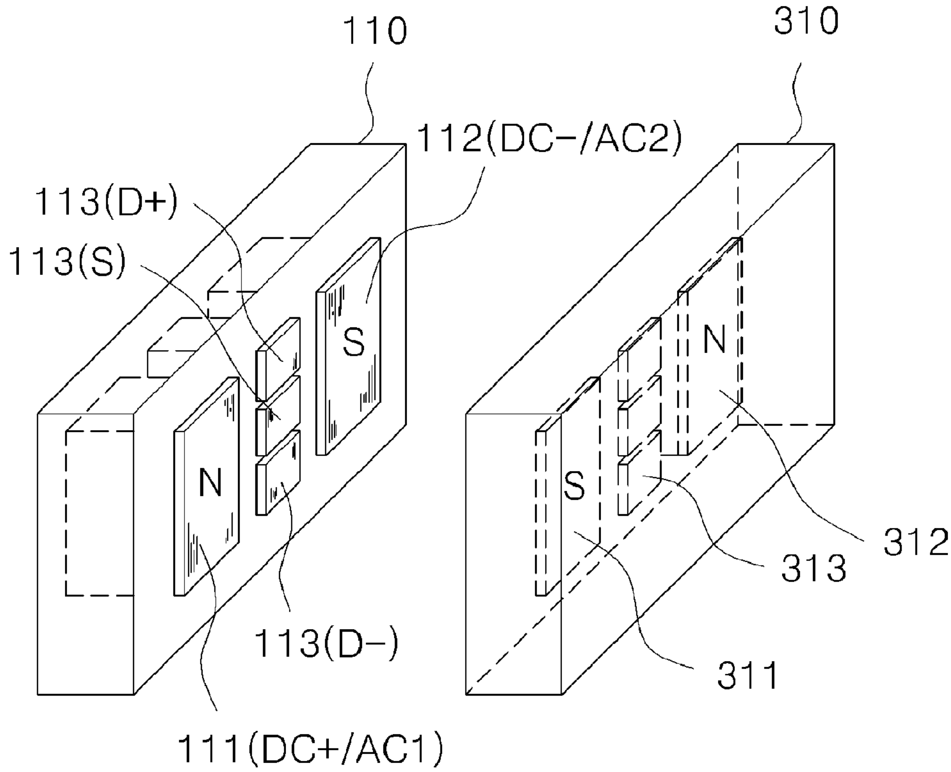


Figure 3

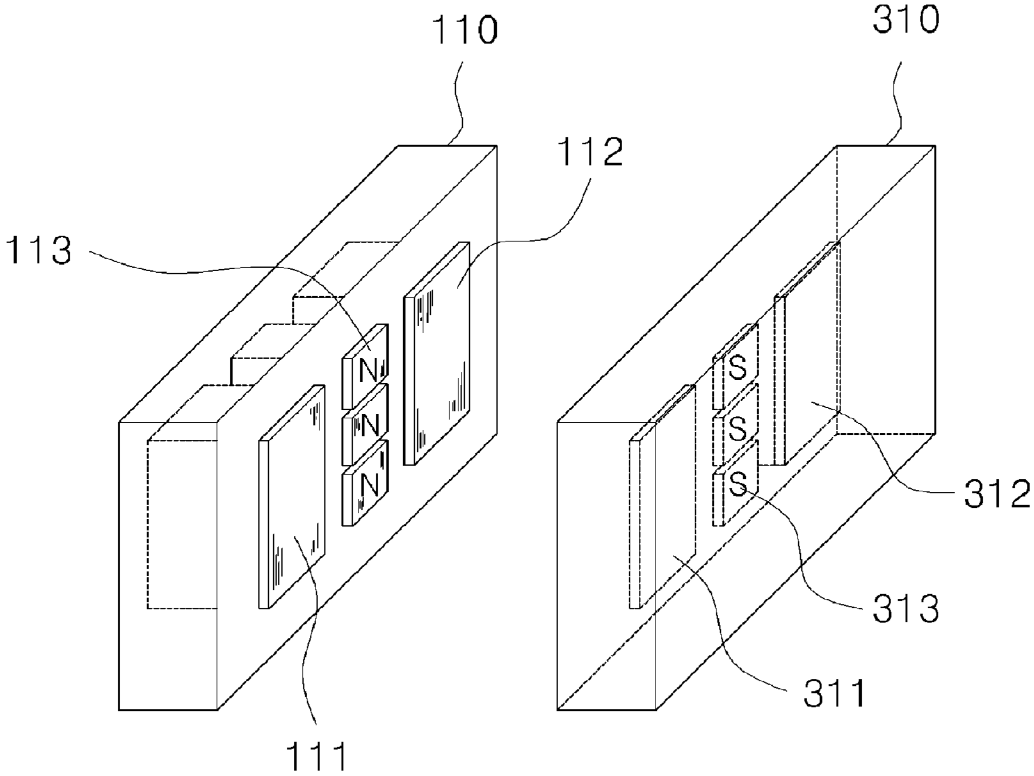


Figure 4

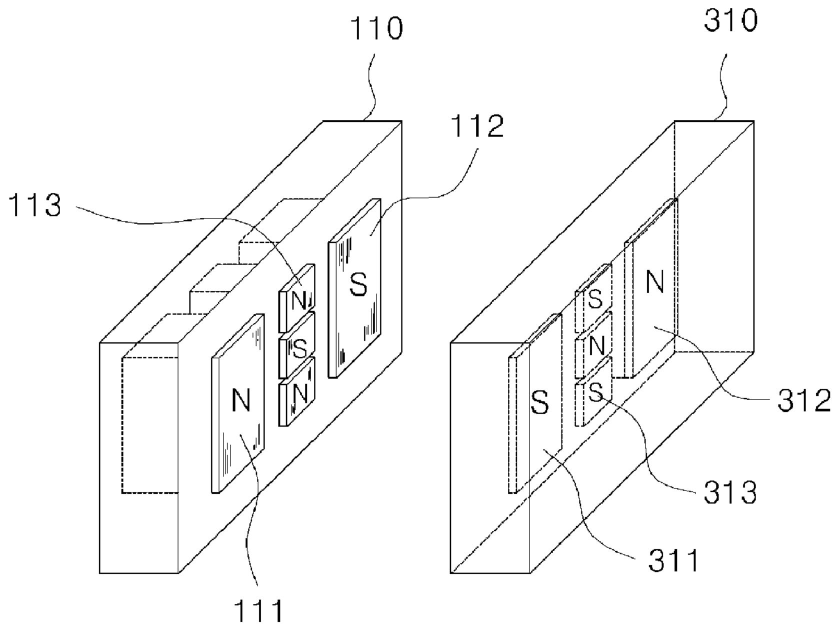


Figure 5

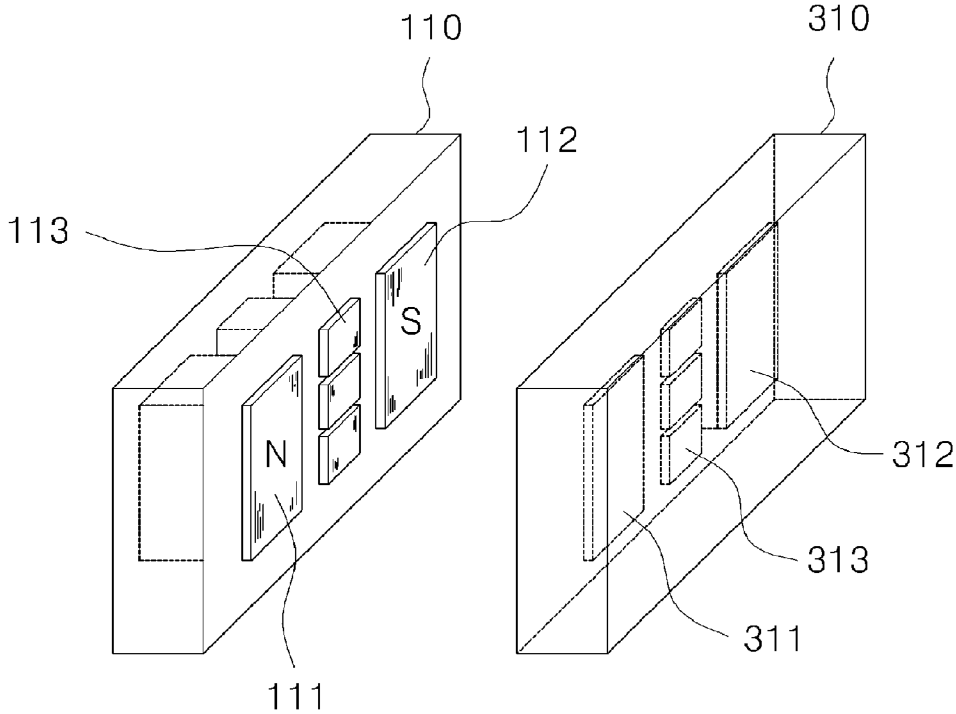


Figure 6

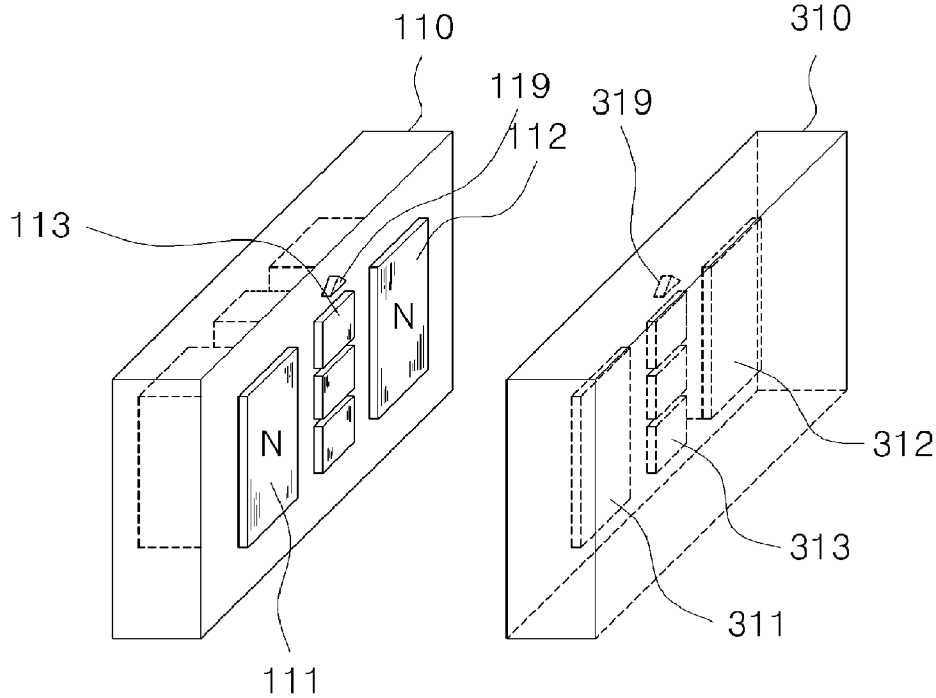


Figure 7

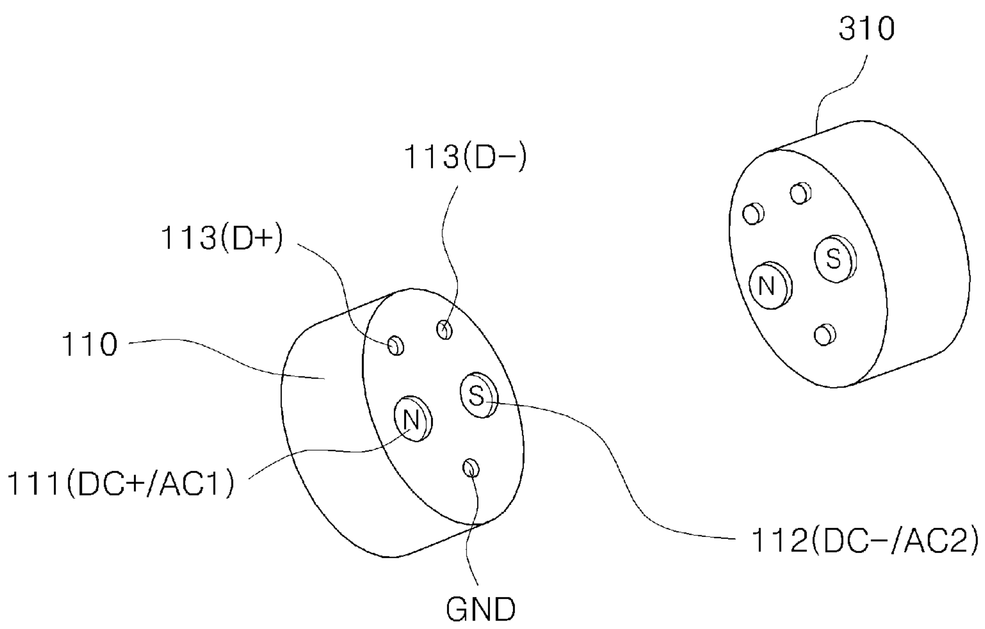


Figure 8

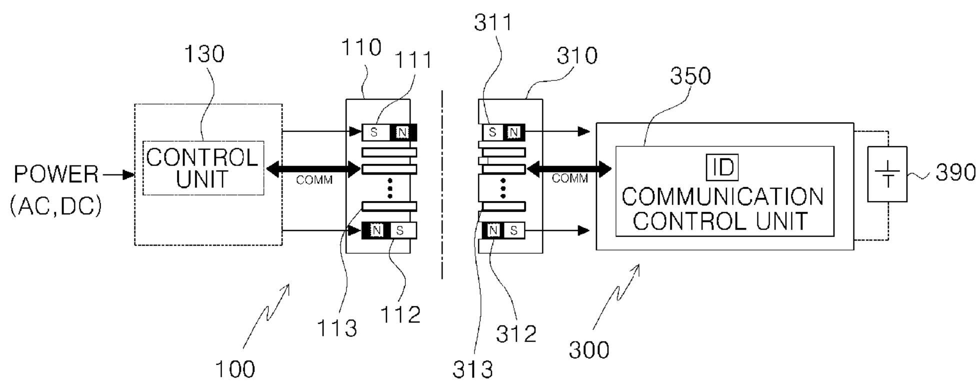


Figure 9

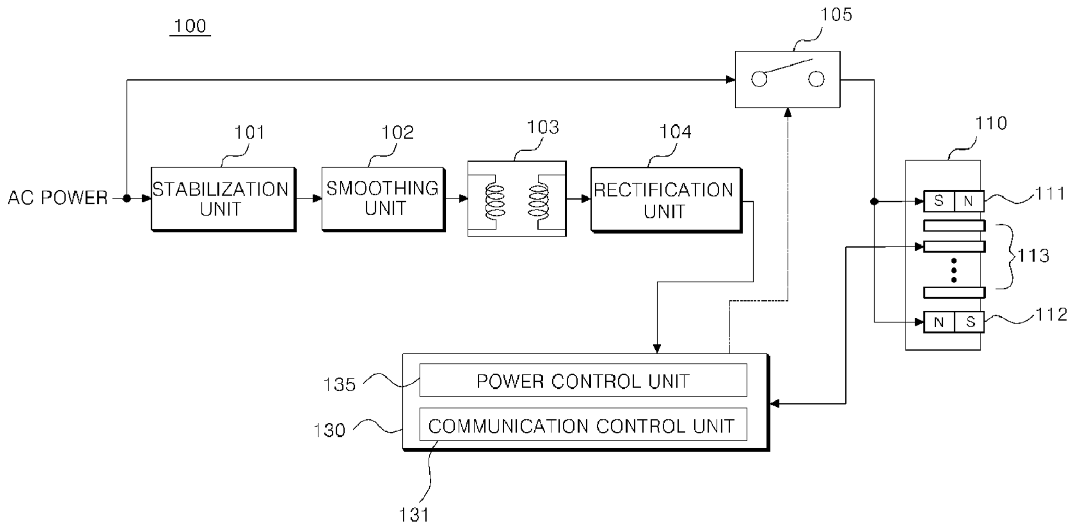


Figure 10

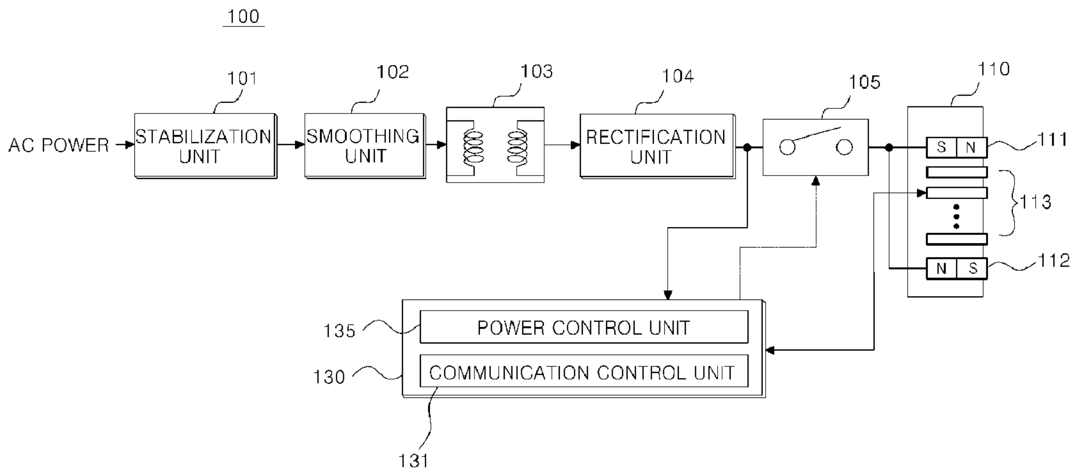


Figure 11

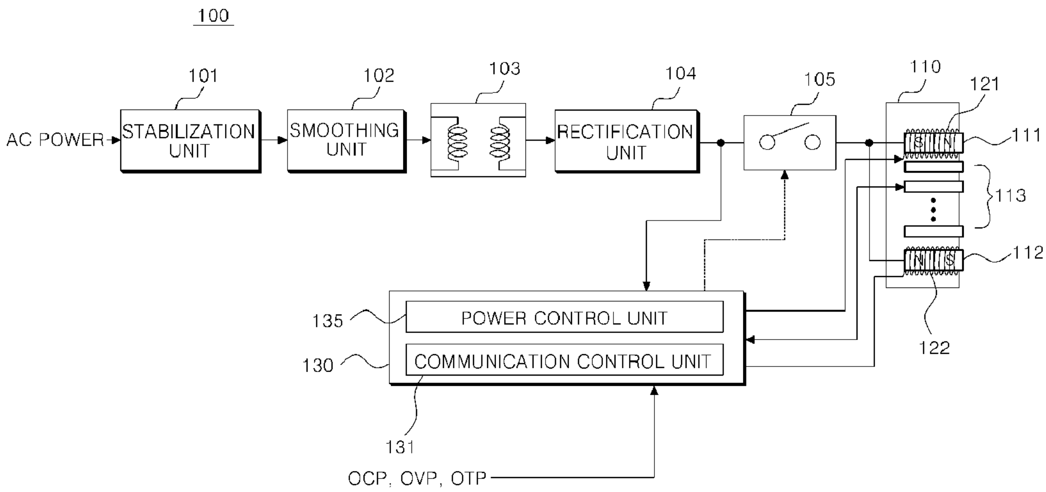
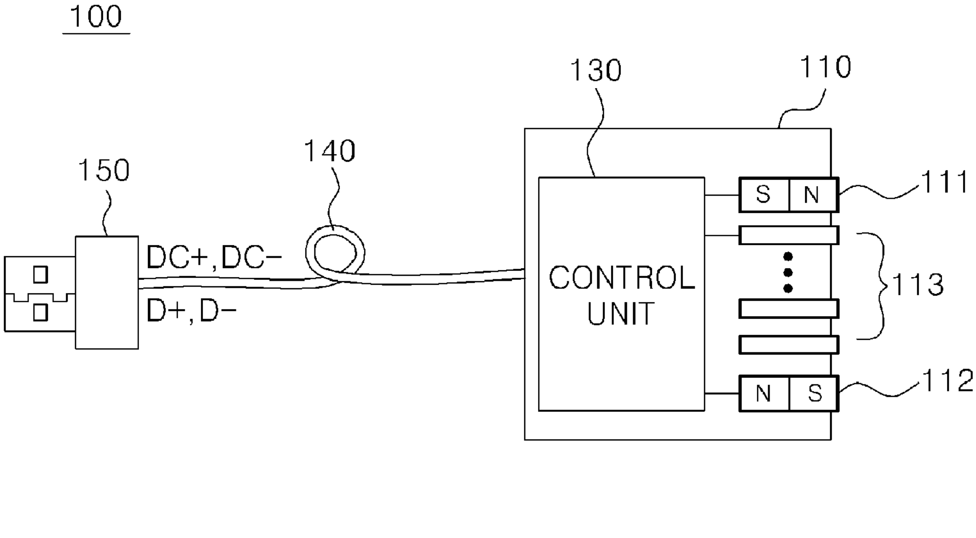


Figure 12



MAGNETIC CONNECTING DEVICE

TECHNICAL FIELD

[0001] The present invention relates to a magnetic connecting device having a communication-type power magnetic connector.

BACKGROUND ART

[0002] Generally, mobile terminals such as mobile phones, smart phones, and Personal Digital Assistants (PDAs) have been universally used thanks to their excellent mobility and convenient portability. Accordingly, wired chargers for charging the batteries of mobile terminals have been manufactured to have different shapes in conformity with the shapes or standards of manufactured batteries. Due to a recent tendency to improve the functionality of mobile terminals and to pursue lightweight mobile terminals in conformity with consumers' requirements, mobile terminals having various shapes and chargers having various shapes that are suitable for the mobile terminals have been manufactured even in the same manufacturing company.

[0003] Recently, with the development of technology, new chargers have been popularized. In order to solve the problems of existing charging methods using such chargers, a wireless (contactless) charging method for charging batteries using magnetic induction without making electrical contact has been used.

[0004] A wireless power transmission device (inductive charger) that uses such a wireless charging method is convenient in that power is transmitted in a wireless manner in such a way that an external device is put on or held on a charging pad to charge a battery. However, from the standpoint of energy transfer, there are problems in that energy efficiency may be deteriorated according to the size of a non-contact space between the charging pad and the charger, the design thereof may be relatively complicated, and manufacturing costs may also increase.

DISCLOSURE

Technical Problem

[0005] 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 magnetic connecting device, which is magnetically and electrically coupled to an external device via a communication-type magnetic connector and is configured to transfer operating power to the external device after checking the external device using communication when the external device is coupled, thus ensuring convenience and safety in use.

[0006] Technical objects intended to be accomplished by the present invention are not limited to the above-described object, and other objects not described herein will be clearly understood by those skilled in the art from the following description.

Technical Solution

[0007] In accordance with an aspect of the present invention to accomplish the above object, there is provided a magnetic connecting device, including a plurality of power terminals magnetically coupled to a connector of an external device and configured to transfer power to the external device; and at least one communication terminal arranged adjacent to the plurality of power terminals and configured to come into contact with the connector of the external device and to transmit or receive data when the external device is coupled.

[0008] Preferably, the power terminals may be made of magnetic materials having opposite polarities, and each of the power terminals may be made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

[0009] Preferably, the power terminals may transfer Direct Current (DC) power or Alternating Current (AC) power to the external device.

[0010] Preferably, the communication terminal may be made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

[0011] Preferably, the magnetic connecting device may further include a control unit for determining whether the external device has been connected via the communication terminal when the external device is coupled, and thereafter controlling whether to supply power to the external device via the power terminals. The control unit may compare identification information read from the external device with preset identification information when the external device is coupled, and then determine whether to supply power to the external device.

[0012] Preferably, the control unit may include a communication control unit for requesting identification information from the external device when the external device is coupled, and comparing the identification information read from the external device with preset identification information; and a power control unit for controlling a switch unit based on results of the comparison by the communication control unit, thus controlling whether to supply power to the external device. The switch unit may be disposed between a DC output terminal and the power terminals.

[0013] In accordance with another aspect of the present invention to accomplish the above object, there is provided a magnetic connecting device, including a plurality of power terminals coupled to a connector of an external device and configured to transfer power to the external device; and at least one communication terminal arranged adjacent to the plurality of power terminals and magnetically coupled to the connector of the external device, the communication terminal being configured to transmit or receive data when the external device is coupled.

[0014] Preferably, the power terminals may be made of magnetic materials having opposite polarities, and each of the power terminals may be made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

[0015] Preferably, the power terminals may transfer Direct Current (DC) power or Alternating Current (AC) power to the external device.

[0016] Preferably, the communication terminal may be made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

[0017] In accordance with a further aspect of the present invention to accomplish the above object, there is provided a magnetic connecting device, including a plurality of power terminals magnetically coupled to a connector of a power supply and configured to receive power from the power supply; and at least one communication terminal arranged adjacent to the plurality of power terminals and configured to come into contact with the connector of the power supply and to transmit or receive data when the power supply is coupled.

[0018] In accordance with yet another aspect of the present invention to accomplish the above object, there is provided a magnetic connecting device, including a plurality of power terminals coupled to a connector of a power supply and configured to receive power from the power supply; and at least one communication terminal arranged adjacent to the plurality of power terminals and magnetically coupled to the connector of the power supply, the communication terminal being configured to transmit or receive data when the power supply is coupled.

[0019] Preferably, the magnetic connecting device may further include a communication control unit for transferring pre-stored identification information to the power supply if identification information is requested via the communication terminal when the power supply is coupled.

[0020] In accordance with still another aspect of the present invention to accomplish the above object, there is provided a magnetic connecting device, including a plurality of power terminals magnetically coupled to a connector of an external device and configured to transfer power to the external device; at least one communication terminal arranged adjacent to the plurality of power terminals and coupled to the connector of the external device, the communication terminal being configured to transmit or receive data when the external device is coupled; and a control unit configured to check identification of the external device via the communication terminal when the external device is coupled, and thereafter to control whether to supply power to the external device via the power terminals.

[0021] Preferably, the power terminals may have coils wound therearound; and the control unit may supply currents to the coils if the identification information of the external device is different from preset identification information, thus compulsorily disconnecting the connector of the external device.

[0022] In accordance with still another aspect of the present invention to accomplish the above object, there is provided a magnetic connecting device, including a main connector including a plurality of power terminals that are magnetically coupled to a connector of an external device and configured to transfer power to the external device, and at least one communication terminal that is arranged between the power terminals and is configured to come into contact with the connector of the external device and to transmit or receive data when the external device is coupled; and a Universal Serial Bus (USB) connector extended from a first end of the main connector via a cable and configured to transmit externally input Direct Current (DC) power to the main connector.

Advantageous Effects

[0023] As described above, the magnetic connector of the present invention is advantageous in that it has various applicable forms in such a way as to hold or put the magnetic connector on a predetermined location or to implement the independent coupling form of the magnetic connector itself. Accordingly, the magnetic connector can be more simply and inexpensively implemented than typical wireless power transmission devices, and has a very convenient structure from the standpoint of convenience of use. Further, the present invention is advantageous in that, from the standpoint of energy transfer, a power transfer form that does not cause deterioration of efficiency can be implemented.

DESCRIPTION OF DRAWINGS

[0024] 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:

[0025] FIG. **1** is a conceptual diagram showing a magnetic connecting device according to the present invention;

[0026] FIGS. **2** to **7** are diagrams showing the external appearance of a main connector according to embodiments of the present invention;

[0027] FIG. **8** is a diagram showing a magnetic connecting device according to an embodiment of the present invention;

[0028] FIG. **9** is a diagram showing the detailed construction of a power supply to which a magnetic connector is applied according to an embodiment of the present invention;

[0029] FIG. **10** is a diagram showing the detailed construction of a power supply to which the magnetic connector is applied according to another embodiment of the present invention;

[0030] FIG. **11** is a diagram showing the detailed construction of a power supply to which the magnetic connector is applied according to a further embodiment of the present invention; and

[0031] FIG. **12** is a diagram showing the detailed construction of a power supply to which the magnetic connector is applied according to yet another embodiment of the present invention.

BEST MODE

[0032] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the attached drawings. The same reference numerals are used throughout the different drawings to designate the same or similar components. If in the specification, detailed descriptions of well-known functions or configurations may unnecessarily make the gist of the present invention obscure, the detailed descriptions will be omitted.

[0033] FIG. **1** is a conceptual diagram showing a magnetic connecting device according to the present invention, wherein the magnetic connecting device can be individually applied to a power supply **100** and an external device **300**. The power supply **100** may be an adaptor for outputting input Direct Current (DC) power or converting externally input commercial Alternating Current (AC) power into DC power and supplying the DC power to the external device **300** connected thereto. The external device **300** may be any of small-capacity devices supplied with DC power, such as mobile terminals (a mobile phone, a PDA, a smart phone, or the like), notebook computers, or computer peripherals, or various types of devices supplied with high AC power or DC power, such as Uninterruptible Power Supply (UPS) devices, electric vehicles, electric bicycles, or electric scooters.

[0034] The power supply **100** and the external device **300** can be electrically connected to each other via their own magnetic connectors **110** and **310**. Hereinafter, for convenience of description, the connector **110** of the power supply **100** is called a main connector, and the connector **310** of the external device **300** is called an external connector.

[0035] As shown in the drawing, the main connector **110** of the power supply **100** and the external connector **310** of the external device **300** may be formed to have the same structure or formed in a concavo-convex shape in which the connectors **110** and **310** structurally correspond to each other. When the main connector **110** and the external connector **310** are configured to have the same structure, first ends of the outer sides of power terminals **111** and **112** and a first end of the outer side of at least one communication terminal **113** may be located on the same horizontal plane. The main connector **110** of the power supply **100** and the external connector **310** of the external device **300** may be formed to physically match each other.

[0036] The power supply **100** includes the main connector **110** and a control unit **130**, and the main connector **110** may include the first power terminal **111**, the second power terminal **112**, and the communication terminal **113**.

[0037] The external device **300** includes the external connector **310**, which may include a first power terminal **311**, a second power terminal **312**, and at least one communication terminal **313**. The plurality of power terminals **311** and **312** are magnetically coupled to the power terminals **111** and **112** of the power supply **100**, respectively, and receive power from the power supply **100**. The communication terminal **313** may be implemented as one or more terminals that are arranged adjacent to the plurality of power terminals **311** and **312**, are coupled to the communication terminal **113** of the power supply **100**, and are used to transmit or receive data when the power supply **100** is coupled to the external device **300**. In FIG. **1**, although three communication terminals **113** are shown, the number of communication terminals **113** can be increased or decreased depending on the circumstances, and the arrangement locations and shapes of the communication terminals **113** may also be changed.

[0038] In the above description, when the power supply **100** and the external device **300** are electrically connected to each other, the control unit **130** of the power supply **100** and the external device **300** can be configured to perform preset communication. Before power from the power supply **100** is supplied to the external device **300**, the external device **300** is driven in response to a communication signal transmitted from the power supply **100** and is then capable of communicating with the power supply **100**.

[0039] The first power terminal **111** of the power supply **100** is magnetically coupled to the first power terminal **311** of the external device **300**, and transfers supplied power DC+ or AC1 to the external device **300** when the external device **300** is coupled to the power supply **100**. The second power terminal **112** is installed to be spaced apart from the first power terminal **111**, and transfers supplied power DC− or AC2 to the second power terminal **312** of the external device **300** when the external device **300** is coupled to the power supply **100**. In this case, each of the first power terminal **111** and the second power terminal **112** may be made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material, and may be formed to have opposite polarities so as to obtain directionality with the external connector **310** of the external device **300**. For example, when the first power terminal **111** has an N polarity, the second power terminal **112** has an S polarity.

[0040] The communication terminals **113** are arranged either adjacent to the power terminals **111** and **112** or between the power terminals **111** and **112**, and are configured to come into contact with the communication terminals **313** of the external device **300** and to transmit or receive data when the external device **300** is coupled to the power supply **100**. Such a communication terminal **113** may be made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material. The communication terminals **113** may include at least one of data terminals D+ and D−, a signal terminal S, and a ground terminal GND.

[0041] The control unit **130** can determine whether the external device **300** has been connected, via the communication terminals **113**, when the external device **300** is coupled to the power supply **100**, and can thereafter control whether to supply power to the external device **300** via the power terminals **111** and **112**. That is, the control unit **130** compares identification information read from the external device **300** with preset identification information when the external device **300** is coupled to the power supply **100**, and then determines whether to supply power.

[0042] Meanwhile, the power supply **100** may further include auxiliary magnets installed around the first power terminal **111** and/or the second power terminal **112**, and configured to intensify the magnetic force of the first power terminal **111** and/or the second power terminal **112**.

[0043] When the auxiliary magnets are installed around the power terminals **111** and **112** in this way, each of the power terminals **111** and **112** may also be made of a non-magnetic material rather than a magnet.

[0044] FIGS. **2** to **7** are diagrams showing various structures of the main connector and the external connector, wherein the main connector **110** can be formed to have a rectangular section, as shown in FIG. **2**, or a circular section, as shown in FIG. **7**. The communication terminals **113** are arranged between the plurality of power terminals **111** and **112** in FIGS. **2** to **6**, and the communication terminals **113** are arranged around the power terminals **111** and **112** in FIG. **7**.

[0045] Further, the main connector **110** and the external connector **310** may be formed in the shape of plates on which the power terminals **111** and **112**, and **311** and **312**, and the communication terminals **113** and **313** are individually formed, rather than the shape of typical connectors.

[0046] FIG. **2** illustrates the case where each of the first power terminal **111** and the second power terminal **112** of the main connector **110** is made of a permanent magnet, a ferromagnetic material, or a paramagnetic material, and where each communication terminal **113** is made of a nonmagnetic material or a paramagnetic material. As shown in FIG. **2**, the terminals **111** to **113** of the main connector **110** can slightly protrude from the surface of the main connector **110**, and first ends of the terminals **111** to **113** can be located on the same horizontal plane. Further, the individual terminals **311** to **313** of the external connector **310** can be slightly depressed from the surface of the external connector **310**. In this case, the protrusion height of the main connector **110** may be equal to or greater than the depression depth of the external connector **310**.

[0047] FIG. **3** illustrates the case where each of the first power terminal **111** and the second power terminal **112** of the main connector **110** is made of a nonmagnetic material or a paramagnetic material, and each communication terminal **113** is made of a permanent magnet, a ferromagnetic material, or a paramagnetic material.

[0048] FIG. **4** illustrates the case where all of the first power terminal **111**, the second power terminal **112**, and the communication terminals **113** of the main connector **110** are made of at least one of a permanent magnet, a ferromagnetic material, and a paramagnetic material. The magnet described in the present invention denotes one of a permanent magnet, a ferromagnetic material, and a paramagnetic material. In this way, when all terminals **111** to **113** are made of magnets, it is more profitable to divide the polarities of the magnets into N polarity and S polarity in half and simultaneously form N-polarity magnets and S-polarity magnets without alternately forming N-polarity magnets and S-polarity magnets, from the standpoint of magnetic force and directionality.

[0049] In this case, the individual terminals **311** to **313** of the external connector **310** magnetically coupled to the main connector **110** may be formed to have magnetic polarities that are opposite those of the individual terminals **111** to **113** of the main connector **110**, as shown in FIGS. **2** to **4**.

[0050] Further, as shown in FIG. **5**, the external connector **310** may be made of a ferromagnetic material or a paramagnetic material, rather than a permanent magnet. That is, each of the connectors **311** to **313** of the external connector **310** may be made of a ferromagnetic material or a paramagnetic material even when the terminals **111** to **113** of the main connector **110** are permanent magnets. It is important that at least one of the terminals **111** to **113** of the main connector **110** and the terminals **311** to **313** of the external connector **310** needs only to be a permanent magnet.

[0051] FIG. **6** illustrates the case where a projection **119** is formed at a predetermined position of the main connector **110** to maintain mounting directionality between the main connector **110** and the external connector **310**. A depression **319** is formed at a location of the external connector **310**, corresponding to that of the projection **119**. The projection **119** and the depression **319** can be formed to have various shapes or formed in a plural number depending on the circumstances. When the projection **119** and the depression **319** are respectively formed at the main connector **110** and the external connector **310**, all terminals **111** to **113** of the main connector **110** may be formed to have the same polarity (N polarity or S polarity). In this case, the external connector **310** may be made of a ferromagnetic material or a paramagnetic material, as well as a permanent magnet.

[0052] FIG. **7** illustrates the case where the main connector is formed to have a circular section. Even in this case, the first power terminal **111** and the second power terminal **112** are formed in opposite polarities.

[0053] In the above description, a method for communication between the power supply **100** and the external device **300** may be at least one of Serial Communication Interface (SCI) communication, Controller Area Network (CAN) communication, and Power Line Communication (PLC). The SCI communication may include Electrically Erasable Programmable Read-Only Memory (EEPROM) communication, RS232, RS422, RS485, and I^2C communication methods, etc. The structures of the connectors **110** and **310**, the number of terminals **111** to **113**, the arrangement shape of the terminals, etc. may be determined according to the communication method between the power supply **100** and the external device **300**.

[0054] That is, it is apparent that the main connector **110** may have a sectional shape corresponding to at least one of a plate, a rectangle, a polygon, a circle, and an ellipse depending on the circumstances, and that the size of the main connector **110** may change in various manners. The external connector **310** of the external device **300** will necessarily have a shape corresponding to that of the main connector **110** of the power supply **100**.

[0055] Meanwhile, in the present invention, the main connector **110** and the external connector **310** are shown to be implemented in a surface contact manner. However, in order to improve the contact performance and design tolerance of each terminal, predetermined elastic bodies (not shown) can be installed inside the first power terminal **111**, the second power terminal **112**, and the communication terminals **113**. Such an elastic body may be a spring, rubber, or the like.

[0056] It is apparent that elastic bodies can be installed in the terminals **311**, **312**, and **313** of the external connector **310**, and elastic bodies can also be installed in both the connectors **110** and **310**. When an elastic body is installed in the main connector **110**, the individual terminals **111**, **112**, and **113** may be formed to protrude outwardly, and the individual terminals **311**, **312**, and **313** of the external connector **310** may be formed to be slightly depressed inwardly.

[0057] FIG. **8** is a diagram showing a magnetic connecting device according to an embodiment of the present invention, wherein the magnetic connecting device can be individually connected to the power supply **100** and to the external device **300**.

[0058] The power supply **100** includes a main connector **110** and a control unit **130**. The main connector **110** may include a first power terminal **111**, a second power terminal **112**, and at least one communication terminal **113**.

[0059] The external device **300** includes an external connector **310** and a communication control unit **350**. The external connector **310** may include a first power terminal **311**, a second power terminal **312**, and at least one communication terminal **313**. The plurality of power terminals **311** and **312** are coupled to the main connector **110** of the power supply **100** and configured to receive power from the power supply **100**. The communication terminal **313** may be implemented as one or more communication terminals that are arranged adjacent to the plurality of power terminals **311** and **312**, are magnetically coupled to the connector **110** of the power supply **100**, and are configured to transmit or receive data when the power supply **100** is coupled to the external device **300**. The communication control unit **350** is configured such that if identification information is requested via the communication terminals **313** when the power supply **100** is coupled to the external device **300**, pre-stored identification information is transferred to the power supply **100**.

[0060] That is, when the power supply **100** is electrically connected to the external device **300**, the control unit **130** of the power supply **100** and the communication control unit **350** of the external device **300** are configured to perform preset communication. Before power from the power supply **100** is supplied to the external device **300**, the communication control unit **350** of the external device **300** is driven by an internal battery **390** and is then capable of communicating with the power supply **100**. In this case, when no battery is included in the external device **300**, the external device **300** is driven in response to a communication signal received from the power supply **100** and is then capable of communicating with the power supply **100**.

[0061] Hereinafter, the present invention based on the power supply **100** and the main connector **110** thereof will be described.

[0062] The first power terminal **111** of the power supply **100** is magnetically coupled to the external connector **310** of the external device **300**, and is configured to transfer supplied power DC+ or AC1 to the external device **300** when the external device **300** is coupled to the power supply **100**. The second power terminal **112** is installed to be spaced apart from the first power terminal **111** by a predetermined interval, and is configured to transfer supplied power DC− or AC2 to the external device **300** when the external device **300** is coupled to the power supply **100**.

[0063] The communication terminals **113** are arranged either adjacent to the plurality of power terminals **111** and **112** or between the power terminals **111** and **112**, and are configured to come into contact with the external connector **310** of the external device **300** and to transmit or receive data when the external device **300** is coupled to the power supply **100**. Each of the communication terminals **113** may be made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material. The communication terminals **113** may include at least one of data terminals D+ and D−, a signal terminal S, and a ground terminal GND.

[0064] The control unit **130** determines whether the external device **300** has been connected via the communication terminals **113** when the external device **300** is coupled to the power supply **100**, and thereafter controls whether to supply power to the external device **300** via the power terminals **111** and **112**. That is, the control unit **130** compares the identification information read from the external device **300** with preset identification information when the external device **300** is coupled to the power supply **100**, and then determines whether to supply power. The identification information may be product information, a unique number, etc.

[0065] Therefore, the control unit **130** allows the power to be output via the first power terminal **111** and the second power terminal **112** only when the external device **300** is connected to the power supply **100**. The principal reason for forming configuration in this way is that safety can be guaranteed against accidents such as electric shocks when impurities come into contact with the main connector **110**.

[0066] FIG. **9** is a diagram showing the detailed structure of a power supply to which a magnetic connector is applied according to an embodiment of the present invention. In the drawing, the power supply **100** includes a stabilization unit **101**, a smoothing unit **102**, a transformation unit **103**, a rectification unit **104**, a switch unit **105**, a main connector **110**, and a control unit **130**. The power supply **100** may be connected to the external device **300**, as shown in FIG. **8**.

[0067] The stabilization unit **101** is configured to boost an externally input commercial AC voltage, for example, a voltage of AC 110V or AC 220V, about 1.414 times, or to stabilize the input AC voltage.

[0068] The smoothing unit **102** smoothes the voltage output from the stabilization unit **101** and then outputs a voltage close to a DC voltage. That is, the smoothing unit **102** minimizes ripple components contained in the voltage output from the stabilization unit **101**, thus reducing ripple noise.

[0069] The transformation unit **103** drops the voltage output from the smoothing unit **102** to a required voltage level, and outputs a resulting voltage. The transformation unit **103** includes a primary coil and a secondary coil. The number of windings of the primary coil and the number of windings of the secondary coil are suitably adjusted, thus enabling noise at an output terminal to be reduced.

[0070] The rectification unit **104** rectifies the voltage output from the secondary coil of the transformation unit **103**, and outputs a DC voltage to the main connector **110**. Since the voltage generated on the secondary side of the transformation unit **103** is close to a square wave, the rectification unit **104** rectifies the voltage, thus enabling the voltage output via the main connector **110** to be converted into a DC voltage. The rectification unit **104** minimizes ripple noise using an inductor coil, thus causing the output voltage to be closer to the DC voltage.

[0071] The switch unit **105** is installed between the rectification unit **104**, which is a DC output stage, and the power terminals of the main connector **110**, and is switched in response to a predetermined control signal to output the power input from the rectification unit **104** to the power terminals of the main connector **110**. Of course, the switch unit **105** may be switched in response to the control signal, but may be configured to be switched on/off according to the selection of a user.

[0072] The main connector **110** is magnetically coupled to the external connector **310** of the external device **300**, and is configured to transmit/receive data to/from the external connector **310** of the external device **300** and to transfer power to the external connector **310**. The main connector **110** is configured to include the first power terminal **111**, the second power terminal **112**, and at least one communication terminal **113**. That is, the main connector **110** includes the first power terminal **111** which is magnetically coupled to the external connector **310** of the external device **300** and is configured to transfer supplied power to the external device **300** when the external device **300** is coupled to the power supply **100**, the second power terminal **112** which is installed to be spaced apart from the first power terminal **111** by a predetermined interval and is configured to transfer supplied power to the external device **300** when the external device **300** is coupled to the power supply **100**, and the communication terminal **113** which is arranged between the power terminals **111** and **112** and is configured to come into contact with the external connector **310** of the external device **300** and to transmit or receive data when the external device **300** is coupled to the power supply **100**. Here, the first power terminal **111** and the second power terminal **112** can be formed as magnets having opposite polarities so as to realize directionality with the external connector **310** of the external device **300**. The communication terminal **113** can also be formed as a magnet depending on the circumstances.

[0073] The control unit **130** checks the identification information of the external device **300** via the communication terminal **113** when the external device **300** is coupled to the power supply **100**, and thereafter controls whether to supply power to the external device **300** via the power terminals **111** and **112**. In detail, as shown in the drawing, the control unit **130** may include a communication control unit **131** and a power control unit **135**. That is, the communication control unit **131** requests identification information from the external device **300** when the external device **300** is coupled to the main connector **110**, and compares the identification information, read from the communication control unit **350** of the external device **300** in compliance with a request command, with preset identification information. The power control unit **135** controls the switch unit **105** on the basis of the results of the comparison by the communication control unit **131**, thus determining whether to supply power to the external device **300**. Therefore, the control unit **130** allows the power to be output via the first power terminal **111** and the second power terminal **112** only when the set external device **300** is connected to the power supply **100**.

[0074] In this way, the present invention is configured such that when the power supply **100** and the external device **300** are magnetically connected to each other, the control unit **130** of the power supply **100** and the communication control unit

350 of the external device **300** perform preset communication before power is supplied to the external device **300**. Before power from the power supply **100** is supplied to the external device **300**, the communication control unit **350** of the external device **300** may be driven by an internal battery **390** or a signal input via the communication terminals **113**, thereby communicating with the power supply **100**.

[0075] FIG. **10** is a diagram showing the detailed structure of a power supply to which the magnetic connector is applied according to another embodiment of the present invention. The power supply **100** may include a stabilization unit **101**, a smoothing unit **102**, a transformation unit **103**, a rectification unit **104**, a switch unit **105**, a main connector **110**, and a control unit **130**. The power supply **100** may be connected to the external device **300**, as shown in FIG. **8**.

[0076] Unlike the structure of FIG. **9**, the structure of FIG. **10** is greatly characterized in that AC power rather than DC power is applied to the main connector **110**, and a brief description will be given based on this structure.

[0077] That is, the rectification unit **104** rectifies a voltage output from the secondary coil of the transformation unit **103** and then outputs the rectified voltage to the control unit **130**.

[0078] The switch unit **105** is disposed between an AC input terminal and the main connector **110**, and is switched in response to a predetermined control signal to output the externally input AC power to the main connector **110**.

[0079] The main connector **110** is magnetically coupled to the external connector **310** of the external device **300**, and is configured to transmit or receive data to or from the external connector **310** of the external device **300** and to transfer operating power to the external connector **310**. The main connector **110** includes a first power terminal **111**, a second power terminal **112**, and at least one communication terminal **113**.

[0080] The control unit **130** checks the identification information of the external device **300** via the communication terminal **113** when the external device **300** is coupled to the power supply **100**, and thereafter controls whether to supply power to the external device **300** via the power terminals **111** and **112**. In detail, as shown in the drawing, the control unit **130** may include a communication control unit **131** and a power control unit **135**. That is, the communication control unit **131** requests identification information from the external device **300** when the external device **300** is coupled to the main connector **110**, and compares the identification information read from the communication control unit **350** of the external device **300** in compliance with a request command with preset identification information. The power control unit **135** controls the switch unit **105** on the basis of the results of the comparison by the communication control unit **131**, thus determining whether to supply power to the external device **300**. Therefore, the control unit **130** allows the input AC power to be output via the first power terminal **111** and the second power terminal **112** only when the set external device **300** is connected to the power supply **100**.

[0081] FIG. **11** is a diagram showing the detailed structure of a power supply to which the magnetic connector is applied according to a further embodiment of the present invention. The power supply **100** may include a stabilization unit **101**, a smoothing unit **102**, a transformation unit **103**, a rectification unit **104**, a switch unit **105**, a main connector **110**, coils **121** and **122**, and a control unit **130**. The power supply **100** may be connected to the external device **300**, as shown in FIG. **8**.

[0082] FIG. **11** illustrates the structure in which coils are respectively wound around the power terminals **111** and **112**, unlike the structure of FIG. **9**, thus enabling the coils to have polarities identical or opposite to those of the power terminals depending on the direction of currents that is externally applied.

[0083] That is, the main connector **110** is magnetically coupled to the external connector **310** of the external device **300**, and is configured to transmit or receive data to or from the external connector **310** of the external device **300** and to transfer operating power to the external connector **310**. The main connector **110** includes a first power terminal **111**, a second power terminal **112**, and at least one communication terminal **113**.

[0084] The control unit **130** checks the identification information of the external device **300** via the communication terminal **113** when the external device **300** is coupled to the power supply **100**, and thereafter controls whether to supply power to the external device **300** via the power terminals **111** and **112**. In detail, as shown in the drawing, the control unit **130** may include a communication control unit **131** and a power control unit **135**. That is, the communication control unit **131** requests identification information from the external device **300** when the external device **300** is coupled to the main connector **110**, and compares the identification information read from the communication control unit **350** of the external device **300** in compliance with a request command with preset identification information. If the identification information of the external device **300** is identical to the preset (pre-stored) identification information as the result of the comparison by the communication control unit **131**, the power control unit **135** turns on the switch unit **105**, thus enabling operating power to be supplied to the external device **300**.

[0085] If the identification information of the external device **300** is different from the pre-stored identification information, the power control unit **135** applies currents to the coils **121** and **122** respectively wound around the power terminals **111** and **112** to magnetize the power terminals **111** and **112** of the main connector **110** in the same polarities as those of the power terminals **311** and **312** of the external device **300** while turning off the switching unit **105**, thus compulsorily disconnecting the external connector **310** of the external device **300**. That is, the coils **121** and **122** are wound around the power terminals **111** and **112** and generate magnetic fields depending on the applied currents, and thus operate as electromagnets for weakening the magnetic force of the power terminals **111** and **112**. The currents are applied to the coils **121** and **122** so that magnetic fields are generated in the direction in which the magnetic force of the power terminals **111** and **112** is weakened.

[0086] Meanwhile, even in the case where a signal for over-current protection (OCP), over-voltage protection (OVP) or an over-temperature protection (OTP) is externally input, the control unit **130** applies currents to the coils **121** and **122** respectively wound around the power terminals **111** and **112**, so that the power terminals **111** and **112** of the main connector **110** are magnetized in the same polarities as those of the power terminals **311** and **312** of the external device **300**, thus compulsorily disconnecting the external connector **310** of the external device **300**.

[0087] Therefore, the control unit **130** enables input DC power or AC power to be output via the first power terminal **111** and the second power terminal **112** only when the set external device **300** is connected to the power supply **100**. In the main connectors **110** of FIGS. **9** and **10**, the power terminals **111** and **112** and the communication terminal **113** may be formed as at least one of magnets and electromagnets.

[0088] FIG. **12** is a conceptual diagram showing a power supply to which the magnetic connector is applied according to yet another embodiment of the present invention. The power supply **100** includes a main connector **110**, a control unit **130**, and a Universal Serial Bus (USB) connector **150**. The power supply **100** may be connected to the external device **300**, as shown in FIG. **8**.

[0089] The main connector **110** includes a plurality of power terminals **111** and **112** which are magnetically coupled to the external connector **310** of the external device **300** and are configured to transfer power to the external device **300**, and at least one communication terminal **113** which is arranged between the power terminals **111** and **112** and is configured to come into contact with the external connector **310** of the external device **300** and to transmit or receive data when the external device **300** is coupled to the main connector **110**.

[0090] The control unit **130** checks the identification information of the external device **300** via the communication terminal **113** when the external device **300** is coupled to the main connector **110**, and then controls whether to supply power to the external device **300** via the power terminals **111** and **112**. In this case, the control unit **130** is shown to be included in and integrated into the main connector **110**, but may be installed outside the main connector **110** if necessary.

[0091] The USB connector **150** is extended from one end of the main connector **110** via a cable **140**, and is configured to transfer DC power DC+ and DC− and data D+ and D−, which are input from an external system (for example, from a computer), to the main connector **110**.

[0092] Thus, in the power supply **100** of FIG. **12**, when the main connector **110** is coupled to the external connector **310** of the external device **300**, DC power input from the computer, an adaptor, or the like is transferred to the external device **300** via the USB connector **150** and the main connector **110**. As the power supply **100** is manufactured as a USB connector-type portable device, convenience of use can be improved.

[0093] Various applicable forms can be implemented in such a way as to hold the main connector configured in this way at a specific location, to place the external device on the main connector, or to simply couple the main connector to the external connector of the external device. These forms enable the connecting device to be more simply and inexpensively implemented than typical wireless power transmission devices, and to be very simply and conveniently used. Further, from the standpoint of energy transfer, the connecting device has a power transfer form that does not cause the deterioration of efficiency.

[0094] The present invention has been described based on preferred embodiments, and those skilled in the art will be able to implement other embodiments differing from those of the detailed description of the present invention without departing from the essential technical scope of the present invention. Here, the essential technical scope of the present invention will be disclosed in the claims, and differences falling within the scope of the claims and equivalents thereof should be interpreted as being included in the present invention.

MODE FOR INVENTION

Industrial Applicability

[0095] As described above, the magnetic connector of the present invention is advantageous in that it has various applicable forms in such a way as to hold or put the magnetic connector on a predetermined location or to implement the independent coupling form of the magnetic connector itself. Accordingly, the magnetic connector can be more simply and inexpensively implemented than typical wireless power transmission devices, and has a very convenient structure from the standpoint of convenience of use. Further, the present invention is advantageous in that, from the standpoint of energy transfer, a power transfer form that does not cause deterioration of efficiency can be implemented.

1. A magnetic connecting device, comprising:

a plurality of power terminals magnetically coupled to a connector of an external device and configured to transfer power to the external device; and

at least one communication terminal arranged adjacent to the plurality of power terminals and configured to come into contact with the connector of the external device and to transmit or receive data when the external device is coupled.

2. The magnetic connecting device according to claim **1**, wherein the power terminals are made of magnetic materials having opposite polarities.

3. The magnetic connecting device according to claim **1**, wherein each of the power terminals is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

4. The magnetic connecting device according to claim **1**, wherein the power terminals are implemented as electromagnets around which coils are respectively wound.

5. The magnetic connecting device according to claim **1**, wherein the power terminals transfer Direct Current (DC) power or Alternating Current (AC) power to the external device.

6. The magnetic connecting device according to claim **1**, wherein the communication terminal is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

7. The magnetic connecting device according to claim **1**, wherein first ends of outer sides of the power terminals and a first end of an outer side of the communication terminal are located on an identical horizontal plane.

8. The magnetic connecting device according to claim **1**, further comprising a control unit for determining whether the external device has been connected via the communication terminal when the external device is coupled, and thereafter controlling whether to supply power to the external device via the power terminals.

9. The magnetic connecting device according to claim **8**, wherein the control unit compares identification information read from the external device with preset identification information when the external device is coupled, and then determines whether to supply power to the external device.

10. The magnetic connecting device according to claim **8**, wherein the control unit comprises:

a communication control unit for requesting identification information from the external device when the external device is coupled, and comparing the identification information read from the external device with preset identification information; and a power control unit for controlling a switch unit based on results of the comparison by the communication control unit, thus controlling whether to supply power to the external device.

11. The magnetic connecting device according to claim **10**, wherein the switch unit is disposed between a DC output terminal and the power terminals.

12. The magnetic connecting device according to claim **10**, wherein the switch unit is disposed between an AC output terminal and the power terminals.

13. The magnetic connecting device according to claim **1**, wherein the communication terminal and the external device communicate with each other using at least one of Serial Communication Interface (SCI) communication, Controller Area Network (CAN) communication, and Power Line Communication (PLC) methods.

14. A magnetic connecting device, comprising:

a plurality of power terminals coupled to a connector of an external device and configured to transfer power to the external device; and

at least one communication terminal arranged adjacent to the plurality of power terminals and magnetically coupled to the connector of the external device, the communication terminal being configured to transmit or receive data when the external device is coupled.

15. The magnetic connecting device according to claim **14**, wherein the communication terminal is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

16. The magnetic connecting device according to claim **14**, wherein the communication terminal is arranged between the power terminals.

17. The magnetic connecting device according to claim **14**, wherein the power terminals are made of magnetic materials having opposite polarities.

18. The magnetic connecting device according to claim **14**, further comprising a control unit for determining whether the external device has been connected via the communication terminal when the external device is coupled, and thereafter controlling whether to supply power to the external device via the power terminals.

19. The magnetic connecting device according to claim **18**, wherein the control unit compares identification information read from the external device with preset identification information when the external device is coupled, and then determines whether to supply power to the external device.

20. A magnetic connecting device, comprising:

a plurality of power terminals magnetically coupled to a connector of a power supply and configured to receive power from the power supply; and

at least one communication terminal arranged adjacent to the plurality of power terminals and configured to come into contact with the connector of the power supply and to transmit or receive data when the power supply is coupled.

21. The magnetic connecting device according to claim **20**, wherein the power terminals are made of magnetic materials having opposite polarities.

22. The magnetic connecting device according to claim **20**, wherein each of the power terminals is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

23. The magnetic connecting device according to claim **20**, wherein the power terminals receive Direct Current (DC) power or Alternating Current (AC) power from the power supply.

24. The magnetic connecting device according to claim **20**, wherein the communication terminal is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

25. The magnetic connecting device according to claim **20**, wherein first ends of outer sides of the power terminals and a first end of an outer side of the communication terminal are located on an identical horizontal plane.

26. The magnetic connecting device according to claim **20**, further comprising a communication control unit for transferring pre-stored identification information to the power supply if identification information is requested via the communication terminal when the power supply is coupled.

27. A magnetic connecting device, comprising:

a plurality of power terminals coupled to a connector of a power supply and configured to receive power from the power supply; and

at least one communication terminal arranged adjacent to the plurality of power terminals and magnetically coupled to the connector of the power supply, the communication terminal being configured to transmit or receive data when the power supply is coupled.

28. The magnetic connecting device according to claim **27**, wherein the communication terminal is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

29. The magnetic connecting device according to claim **27**, wherein the communication terminal is arranged between the power terminals.

30. The magnetic connecting device according to claim **27**, wherein the power terminals are made of magnetic materials having opposite polarities.

31. The magnetic connecting device according to claim **27**, further comprising a communication control unit for transferring pre-stored identification information to the power supply if identification information is requested via the communication terminal when the power supply is coupled.

32. A magnetic connecting device, comprising:

a plurality of power terminals magnetically coupled to a connector of an external device and configured to transfer power to the external device;

at least one communication terminal arranged adjacent to the plurality of power terminals and coupled to the connector of the external device, the communication terminal being configured to transmit or receive data when the external device is coupled; and

a control unit configured to check identification of the external device via the communication terminal when the external device is coupled, and thereafter to control whether to supply power to the external device via the power terminals.

33. The magnetic connecting device according to claim **32**, wherein each of the power terminals is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

34. The magnetic connecting device according to claim **32**, wherein:

the power terminals have coils wound therearound; and

the control unit supplies currents to the coils if the identification information of the external device is different from preset identification information, thus compulsorily disconnecting the connector of the external device.

35. The magnetic connecting device according to claim **32**, wherein the communication terminal is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

36. A magnetic connecting device, comprising:

a main connector including a plurality of power terminals that are magnetically coupled to a connector of an external device and configured to transfer power to the external device, and at least one communication terminal that is arranged between the power terminals and is configured to come into contact with the connector of the external device and to transmit or receive data when the external device is coupled; and

a Universal Serial Bus (USB) connector extended from a first end of the main connector via a cable and configured to transmit externally input Direct Current (DC) power to the main connector.

37. The magnetic connecting device according to claim **36**, further comprising a control unit for determining whether the external device has been connected via the communication terminal when the external device is coupled, and thereafter controlling whether to supply power to the external device via the power terminals.

38. The magnetic connecting device according to claim **36**, wherein the control unit is integrated into the main connector.

39. The magnetic connecting device according to claim **36**, wherein each of the power terminals is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic material.

40. The magnetic connecting device according to claim **36**, wherein the communication terminal is made of any one of a permanent magnet, a ferromagnetic material, and a paramagnetic magnet.

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