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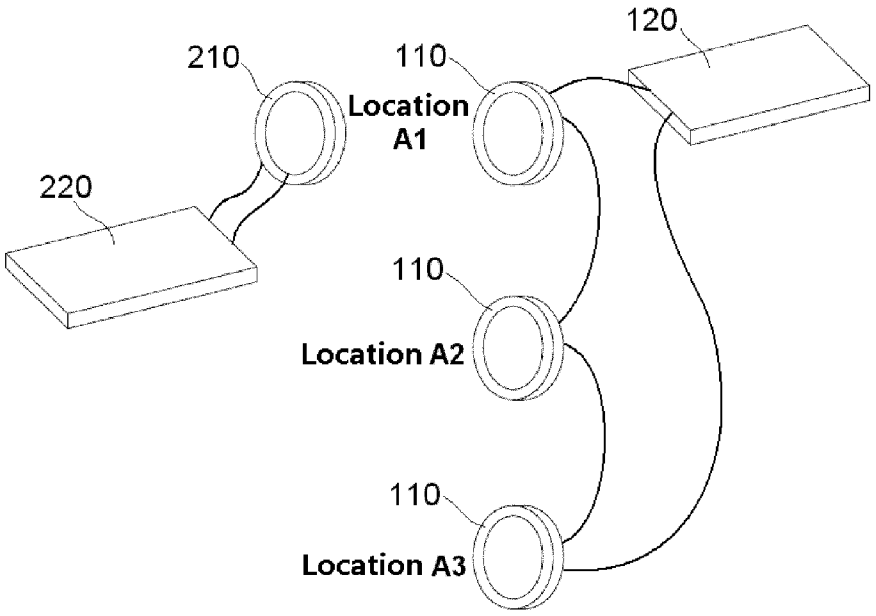

Fig.2

(57) Abstract: A wireless powering device including: a plurality of transmitting coils (110) adapted to be mounted at a plurality of different locations (A1, A2, A3) of an electrical apparatus, respectively; and a single transmitting circuit board (120) to which the plurality of transmitting coils (110) are electrically connected in series. When a carrier loaded with the receiving coil (210) and a load is placed at one location of the plurality of different locations, the receiving coil and the transmitting coil at the one location will be electromagnetically coupled with each other. Therefore, it does not need to check the location of the receiving coil and the load.

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Wireless Powering Device and Electrical Apparatus

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Chinese Patent Application No.201710541610.6 filed on July 5, 2018 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

At least one embodiment of the present disclosure relates to a wireless powering device and an electrical apparatus comprising the wireless powering device.

Description of the Related Art

In recent years, emergence of wireless power supply technology has brought great convenience to a power supply of moving parts in an electrical apparatus. The wireless power supply technology may completely avoid many problems caused by physical wear, for example, problems related to safety, service life and maintenance of the electrical apparatus. Moreover, the wireless power supply technology may greatly enhance the freedom degree in the structural design of the electrical apparatus, and increase the aesthetic and functional features of the electrical apparatus, especially consumer electrical equipment, such as household appliances.

In the relevant art, a wireless power supply device comprises a transmitting module and a receiving module, and the transmitting module must correspond to the receiving module one to one. At present, the most common wireless power supply technology is based on electromagnetic coupling. Generally, the wireless power supply device based on the electromagnetic coupling comprises a transmitting coil and a receiving coil. The transmitting coil must correspond to the receiving coil one to one. When the transmitting coil and the receiving coil are moved to close to each other, they will be electromagnetically coupled to each other.

However, in practical applications, there is often a situation in which a load may be placed at any one of a plurality of different locations of the electrical apparatus. For example, in a refrigerator, a carrier may be placed at any suitable location of the plurality of different locations according to a height of an object to be loaded on the carrier. In order to

supply power to a load (for example, a lamp, or a fan) mounted on the carrier, it needs to provide a transmitting module at each of the plurality of different locations. In this way, all transmitting modules may be in work at any time, which will lead to energy waste.

SUMMARY OF THE INVENTION

The present disclosure has been made to overcome or alleviate at least one aspect of the above mentioned disadvantages.

According to an aspect of the present disclosure, there is provided a wireless powering device, comprising: a plurality of transmitting coils adapted to be mounted at a plurality of different locations of an electrical apparatus, respectively; and a single transmitting circuit board to which the plurality of transmitting coils are electrically connected in series.

According to an exemplary embodiment of the present disclosure, the wireless powering device further comprises: a receiving coil adapted to be mounted at one location of the plurality of different locations of the electrical apparatus; and a single receiving circuit board to which the receiving coil is electrically connected. The receiving coil is adapted to electromagnetically couple with the transmitting coil mounted at the one location after the receiving coil is mounted at the one location.

According to another exemplary embodiment of the present disclosure, the receiving coil is adapted to be mounted on a carrier of the electrical apparatus, and the carrier is adapted to be mounted at one location of the plurality of different locations of the electrical apparatus. The receiving coil is adapted to electromagnetically couple with the transmitting coil mounted at the one location after the carrier loaded with the receiving coil is mounted at the one location.

According to another exemplary embodiment of the present disclosure, the receiving coil is movably mounted on the electrical apparatus, so that the receiving coil is movable within a coverage of an electromagnetic field of the plurality of transmitting coils.

According to another exemplary embodiment of the present disclosure, the transmitting coil is formed by winding a wire, and the transmitting coil comprises a component separate from the transmitting circuit board.

According to another exemplary embodiment of the present disclosure, the plurality of transmitting coils are connected in series with each other by welding or pressing; or the plurality of transmitting coils are connected in series with each other by wires or electrical connectors.

According to another exemplary embodiment of the present disclosure, the transmitting coil is formed by winding a wire, and the transmitting coil comprises a component fixed and integrated on the transmitting circuit board.

According to another exemplary embodiment of the present disclosure, the plurality of transmitting coils are connected in series with each other by conductive traces printed on the

transmitting circuit board.

According to another exemplary embodiment of the present disclosure, the transmitting coil comprises a coil printed on the transmitting circuit board.

According to another exemplary embodiment of the present disclosure, the plurality of transmitting coils are connected in series with each other by conductive traces printed on the transmitting circuit board.

According to another exemplary embodiment of the present disclosure, the receiving coil is formed by winding a wire, and the receiving coil comprises a component separate from the receiving circuit board.

According to another exemplary embodiment of the present disclosure, the receiving coil is formed by winding a wire, and the receiving coil comprises a component fixed and integrated on the receiving circuit board.

According to another exemplary embodiment of the present disclosure, the receiving coil comprises a coil printed on the receiving circuit board.

According to another exemplary embodiment of the present disclosure, the plurality of transmitting coils are arranged in a common plane.

According to another exemplary embodiment of the present disclosure, the plurality of transmitting coils are arranged in different planes.

According to another exemplary embodiment of the present disclosure, adjacent transmitting coils of the plurality of transmitting coils have the same current direction.

According to another exemplary embodiment of the present disclosure, adjacent transmitting coils of the plurality of transmitting coils have opposite current directions.

According to another aspect of the present disclosure, there is provided an electrical apparatus, comprising: a carrier adapted to be mounted at any one of a plurality of different locations of the electrical apparatus; a load mounted on the carrier; and the above wireless powering device configured to supply power to the load.

In the above exemplary embodiments of the present disclosure, the transmitting coil may be mounted at each of the plurality of different locations of the electrical apparatus. Therefore, when the carrier loaded with the receiving coil and the load is placed at one location of the plurality of different locations, the receiving coil and the transmitting coil at the one location will be electromagnetically coupled with each other. Therefore, in the present disclosure, it does not need to check the location of the receiving coil and the load. In addition, it does not need to provide a plurality of independent circuit boards for the plurality of transmitting coils, which greatly improves the hardware utilization, simplifies the complexity of the wireless powering device, and reduces the cost.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present disclosure will become more apparent by describing in detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

Fig.1 shows a typical refrigerator;

Fig.2 is an illustrative view of a wireless powering device according to an embodiment of the present disclosure;

Fig.3 is an illustrative view of a wireless powering device according to another embodiment of the present disclosure; and

Fig.4 is an illustrative view of a wireless powering device according to a further embodiment of the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE IVENTION

Exemplary embodiments of the present disclosure will be described hereinafter in detail with reference to the attached drawings, wherein the like reference numerals refer to the like elements. The present disclosure may, however, be embodied in many different forms and should not be construed as being limited to the embodiment set forth herein; rather, these embodiments are provided so that the present disclosure will be thorough and complete, and will fully convey the concept of the disclosure to those skilled in the art.

In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

According to a general concept of the present disclosure, there is provided a wireless powering device, comprising: a plurality of transmitting coils adapted to be mounted at a plurality of different locations of an electrical apparatus, respectively; and a single transmitting circuit board to which the plurality of transmitting coils are electrically connected in series.

Fig.1 shows a typical refrigerator. For the sake of illustration, the present disclosure is illustrated and described by an example of the refrigerator shown in Fig. 1, but the present disclosure is not limited to the illustrated embodiment, for example, an electrical apparatus in the present disclosure may be any other electrical apparatus, such as a washing machine, an air conditioner, etc.

As shown in Fig.1, in an embodiment, a carrier (or referred as a tray) 11 is provided in the refrigerator. The carrier 11 may be plated at any one of a plurality of different locations A1, A2, A3 of the refrigerator according to a height of an object to be loaded on the carrier

11. A load (not shown) is mounted on the carrier 11, and the load may comprise a lamp, a display, a fan, etc. When the carrier 11 is placed at one location of the plurality of different locations A1, A2, A3, the wireless powering device will power the load mounted on the carrier 11.

Fig.2 is an illustrative view of a wireless powering device according to an embodiment of the present disclosure.

Hereafter, it will describe the wireless powering device according to the embodiment of the present disclosure with reference to Fig.2.

As shown in Fig.2, in an embodiment, the wireless powering device mainly comprises a plurality of transmitting coils 110, a single transmitting circuit board 120, a single receiving coil 210, and a single receiving circuit board 220.

As shown in Figs.1-2, in an embodiment, the plurality of transmitting coils 110 are located at a plurality of different locations A1, A2, A3 of the electrical apparatus, respectively. The plurality of transmitting coils 110 are electrically connected in series to the single transmitting circuit board 120. The single receiving coil 210 is mounted on the carrier 11 of the electrical apparatus. The receiving coil 210 is electrically connected to the receiving circuit board 220.

As shown in Figs.1-2, in an embodiment, after the carrier 11 loaded with the receiving coil 210 is mounted at one location of the plurality of different locations A1, A2, A3 of the electrical apparatus, the receiving coil 210 mounted on the carrier 11 is electromagnetically coupled with the transmitting coil 110 mounted at the one location to supply power for the load mounted on the carrier 11.

As shown in Fig. 2, in an embodiment, the transmitting coil 110 is formed by winding a wire, and the transmitting coil 110 comprises a component separate from the transmitting circuit board 120.

As shown in Fig. 2, in an embodiment, the plurality of transmitting coils 110 are connected in series with each other by welding or pressing. But the present disclosure is not limited to this, for example, the plurality of transmitting coils 110 may be connected in series with each other by wires or electrical connectors.

Similarly, as shown in Fig.2, in an embodiment, the receiving coil 210 is formed by winding a wire, and the receiving coil 210 comprises a component separate from the receiving circuit board 220.

As shown in Fig. 2, in an embodiment, the plurality of transmitting coils 110 are arranged in a common vertical plane. But the present disclosure is not limited to this, for example, the plurality of transmitting coils 110 may be arranged in different planes.

In an exemplary embodiment of the present disclosure, adjacent transmitting coils 110 of the plurality of transmitting coils 110 have the same current direction. But the present disclosure is not limited to this, for example, adjacent transmitting coils 110 of the plurality

of transmitting coils 110 may have opposite current directions.

In an exemplary embodiment of the present disclosure, the receiving coil 210 is movably mounted on the electrical apparatus, so that the receiving coil 210 is movable within a coverage of an electromagnetic field of the plurality of transmitting coils 110.

Fig.3 is an illustrative view of a wireless powering device according to another embodiment of the present disclosure. Hereafter, it will describe the wireless powering device according to the another embodiment of the present disclosure with reference to Fig.3.

As shown in Fig.3, in an embodiment, the wireless powering device mainly comprises a plurality of transmitting coils 110, a single transmitting circuit board 120, a single receiving coil 210, and a single receiving circuit board 220.

As shown in Figs.1 and 3, in an embodiment, the plurality of transmitting coils 110 are located at a plurality of different locations A1, A2, A3 of the electrical apparatus, respectively. The plurality of transmitting coils 110 are electrically connected in series to the single transmitting circuit board 120. The single receiving coil 210 is mounted on the carrier 11 of the electrical apparatus and electrically connected to the receiving circuit board 220.

As shown in Figs.1 and 3, in an embodiment, after the carrier 11 loaded with the receiving coil 210 is mounted at one location of the plurality of different locations A1, A2, A3 of the electrical apparatus, the receiving coil 210 mounted on the carrier 11 is electromagnetically coupled with the transmitting coil 110 mounted at the one location to supply power for the load mounted on the carrier 11.

As shown in Fig.3, in an embodiment, the transmitting coil 110 is formed by winding a wire, and the transmitting coil 110 comprises a component fixed and integrated on the transmitting circuit board 120.

As shown in Fig.3, in an embodiment, the plurality of transmitting coils 110 are connected in series with each other by conductive traces printed on the transmitting circuit board 120.

As shown in Fig.3, in an embodiment, the receiving coil 210 is formed by winding a wire, and the receiving coil 210 comprises a component separate from the receiving circuit board 220.

As shown in Fig.3, in an embodiment, the plurality of transmitting coils 110 are arranged in a row in a vertical direction on a surface of the transmitting circuit board 120. But the present disclosure is not limited to this, for example, the plurality of transmitting coils 110 may be irregularly arranged on the surface of the transmitting circuit board 120.

In an exemplary embodiment of the present disclosure, adjacent transmitting coils 110 of the plurality of transmitting coils 110 have the same current direction. But the present disclosure is not limited to this, for example, adjacent transmitting coils 110 of the plurality of transmitting coils 110 may have opposite current directions.

In an exemplary embodiment of the present disclosure, the receiving coil 210 is movably mounted on the electrical apparatus, so that the receiving coil 210 is movable within a coverage of an electromagnetic field of the plurality of transmitting coils 110.

Fig.4 is an illustrative view of a wireless powering device according to a further embodiment of the present disclosure. Hereafter, it will describe the wireless powering device according to the further embodiment of the present disclosure with reference to Fig.4.

As shown in Fig.4, in an embodiment, the wireless powering device mainly comprises a plurality of transmitting coils 110, a single transmitting circuit board 120, a single receiving coil 210, and a single receiving circuit board 220.

As shown in Figs.1 and 4, in an embodiment, the plurality of transmitting coils 110 are located at a plurality of different locations A1, A2, A3 of the electrical apparatus, respectively. The plurality of transmitting coils 110 are electrically connected in series to the single transmitting circuit board 120. The single receiving coil 210 is mounted on the carrier 11 of the electrical apparatus and electrically connected to the receiving circuit board 220.

As shown in Figs.1 and 4, in an embodiment, after the carrier 11 loaded with the receiving coil 210 is mounted at one location of the plurality of different locations A1, A2, A3 of the electrical apparatus, the receiving coil 210 mounted on the carrier 11 is electromagnetically coupled with the transmitting coil 110 mounted at the one location to supply power for the load mounted on the carrier 11.

As shown in Fig.4, in an embodiment, the transmitting coil 110 comprises a coil printed on the transmitting circuit board 120.

As shown in Fig.4, in an embodiment, the plurality of transmitting coils 110 are connected in series with each other by conductive traces printed on the transmitting circuit board 120.

Similarly, as shown in Fig.4, in an embodiment, the receiving coil 210 comprises a coil printed on the receiving circuit board 220.

As shown in Fig.4, in an embodiment, the plurality of transmitting coils 110 are arranged in a row in a vertical direction on a surface of the transmitting circuit board 120. But the present disclosure is not limited to this, for example, the plurality of transmitting coils 110 may be irregularly arranged on the surface of the transmitting circuit board 120.

In an exemplary embodiment of the present disclosure, adjacent transmitting coils 110 of the plurality of transmitting coils 110 have the same current direction. But the present disclosure is not limited to this, for example, adjacent transmitting coils 110 of the plurality of transmitting coils 110 may have opposite current directions.

In an exemplary embodiment of the present disclosure, the receiving coil 210 is movably mounted on the electrical apparatus, so that the receiving coil 210 is movable within a coverage of an electromagnetic field of the plurality of transmitting coils 110.

According to another exemplary embodiment of the present disclosure, there is further

disclosed an electrical apparatus. As shown in Fig.1, the electrical apparatus mainly comprises a carrier 11, a load, and the above wireless powering device as mentioned in any one of the above embodiments.

As shown in Fig.1, the carrier 11 may be mounted at any one of a plurality of different locations A1, A2, A3 of the electrical apparatus. The load is mounted on the carrier 11, and may be mounted at any one of the plurality of different locations A1, A2, A3 of the electrical apparatus together with the carrier 11.

As shown in Figs.1-4, in an embodiment, after the carrier 11 loaded with the receiving coil 210 is mounted at one location of the plurality of different locations A1, A2, A3 of the electrical apparatus, the receiving coil 210 is electromagnetically coupled with the transmitting coil 110 mounted at the one location to supply power for the load mounted on the carrier 11.

It should be appreciated for those skilled in this art that the above embodiments are intended to be illustrated, and not restrictive. For example, many modifications may be made to the above embodiments by those skilled in this art, and various features described in different embodiments may be freely combined with each other without conflicting in configuration or principle.

Although several exemplary embodiments have been shown and described, it would be appreciated by those skilled in the art that various changes or modifications may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

As used herein, an element recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural of said elements or steps, unless such exclusion is explicitly stated. Furthermore, references to "one embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Moreover, unless explicitly stated to the contrary, embodiments "comprising" or "having" an element or a plurality of elements having a particular property may include additional such elements not having that property.

What is claimed is,

1. A wireless powering device, comprising:

a plurality of transmitting coils (110) adapted to be mounted at a plurality of different locations (A1, A2, A3) of an electrical apparatus, respectively; and

a single transmitting circuit board (120) to which the plurality of transmitting coils (110) are electrically connected in series.

2. The wireless powering device according to claim 1, further comprising:

a receiving coil (210) adapted to be mounted at one location of the plurality of different locations (A1, A2, A3) of the electrical apparatus; and

a single receiving circuit board (220) to which the receiving coil (210) is electrically connected,

wherein the receiving coil (210) mounted at the one location is adapted to electromagnetically couple with the transmitting coil (110) mounted at the one location.

3. The wireless powering device according to claim 2,

wherein the receiving coil (210) is adapted to be mounted on a carrier (11) of the electrical apparatus, and the carrier (11) is adapted to be mounted at one location of the plurality of different locations (A1, A2, A3) of the electrical apparatus;

wherein the receiving coil (210) is adapted to electromagnetically couple with the transmitting coil (110) mounted at the one location in response to the carrier (11) loaded with the receiving coil (210) being mounted at the one location.

4. The wireless powering device according to claim 2 or 3,

wherein the receiving coil (210) is movably mounted on the electrical apparatus, so that the receiving coil (210) is movable within a coverage of an electromagnetic field of the plurality of transmitting coils (110).

5. The wireless powering device according to any one of claims 2-4,

wherein the transmitting coil (110) is formed by winding a wire, and the transmitting coil (110) comprises a component separate from the transmitting circuit board (120).

6. The wireless powering device according to claim 5,

wherein the plurality of transmitting coils (110) are connected in series with each other by welding or pressing; or

wherein the plurality of transmitting coils (110) are connected in series with each other by wires or electrical connectors.

7. The wireless powering device according to claim 2,

wherein the transmitting coil (110) is formed by winding a wire, and the transmitting coil (110) comprises a component fixed and integrated on the transmitting circuit board (120).

8. The wireless powering device according to claim 7 or 8,

wherein the plurality of transmitting coils (110) are connected in series with each other by conductive traces printed on the transmitting circuit board (120).

9. The wireless powering device according to claim 2,

wherein the transmitting coil (110) comprises a coil printed on the transmitting circuit board (120).

10. The wireless powering device according to claim 9,

wherein the plurality of transmitting coils (110) are connected in series with each other by conductive traces printed on the transmitting circuit board (120).

11. The wireless powering device according to any one of claims 1-10,

wherein the receiving coil (210) is formed by winding a wire, and the receiving coil (210) comprises a component separate from the receiving circuit board (220).

12. The wireless powering device according to any one of claims 1-10,

wherein the receiving coil (210) is formed by winding a wire, and the receiving coil (210) comprises a component fixed and integrated on the receiving circuit board (220).

13. The wireless powering device according to any one of claims 1-10, wherein the receiving coil (210) comprises a coil printed on the receiving circuit board (220).

14. The wireless powering device according to any one of claims 1-13, wherein the plurality of transmitting coils (110) are arranged in a common plane.

15. The wireless powering device according to any one of claims 1-13, wherein the plurality of transmitting coils (110) are arranged in different planes.

16. The wireless powering device according to any one of claims 1-15, wherein adjacent transmitting coils (110) of the plurality of transmitting coils (110) have the same current direction.

17. The wireless powering device according to any one of claims 1-15, wherein adjacent transmitting coils (110) of the plurality of transmitting coils (110) have opposite current directions.

18. An electrical apparatus, comprising:

a carrier (11) adapted to be mounted at any one of a plurality of different locations (A1, A2, A3) of the electrical apparatus;

a load mounted on the carrier (11); and

the wireless powering device, according to any one of claims 3-17, configured to supply power to the load.

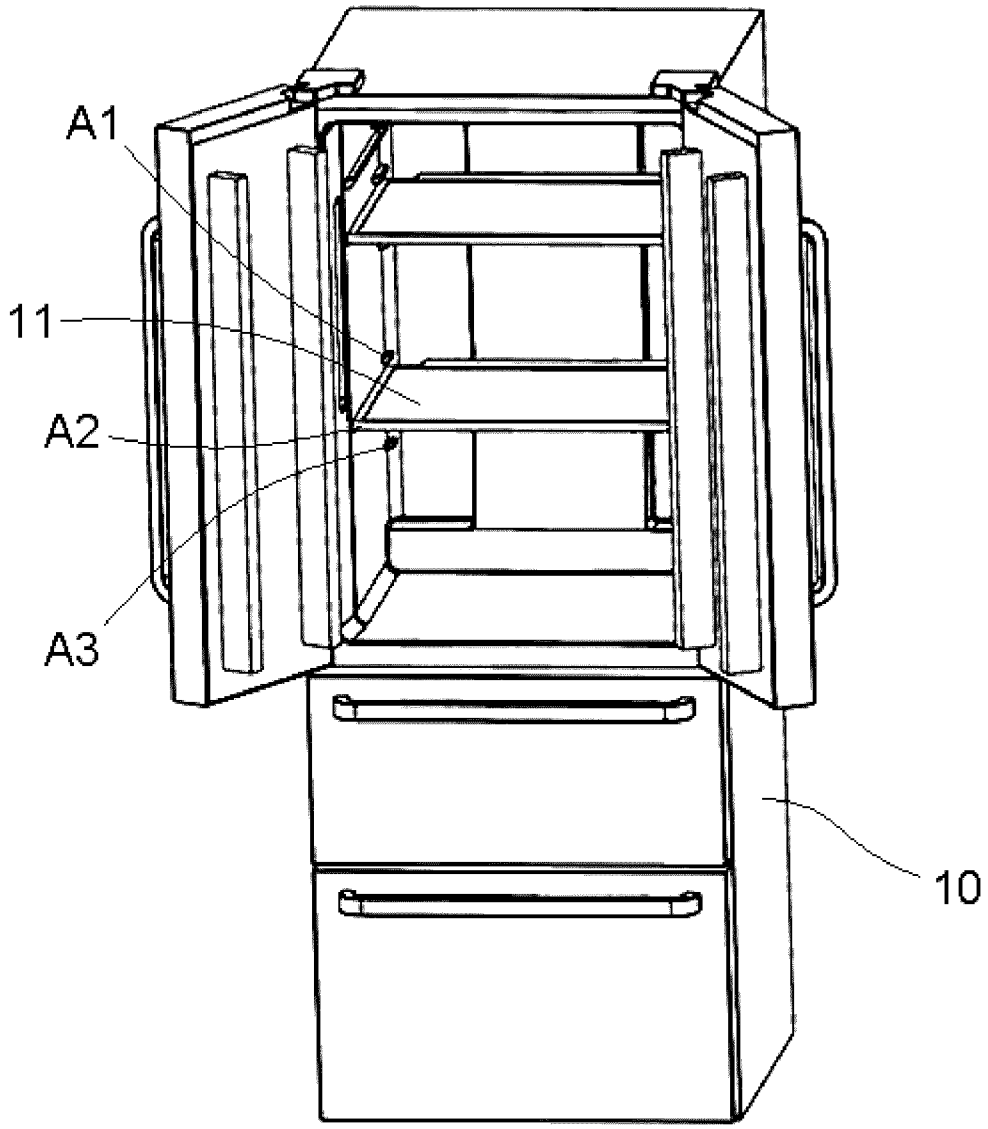

Fig.1

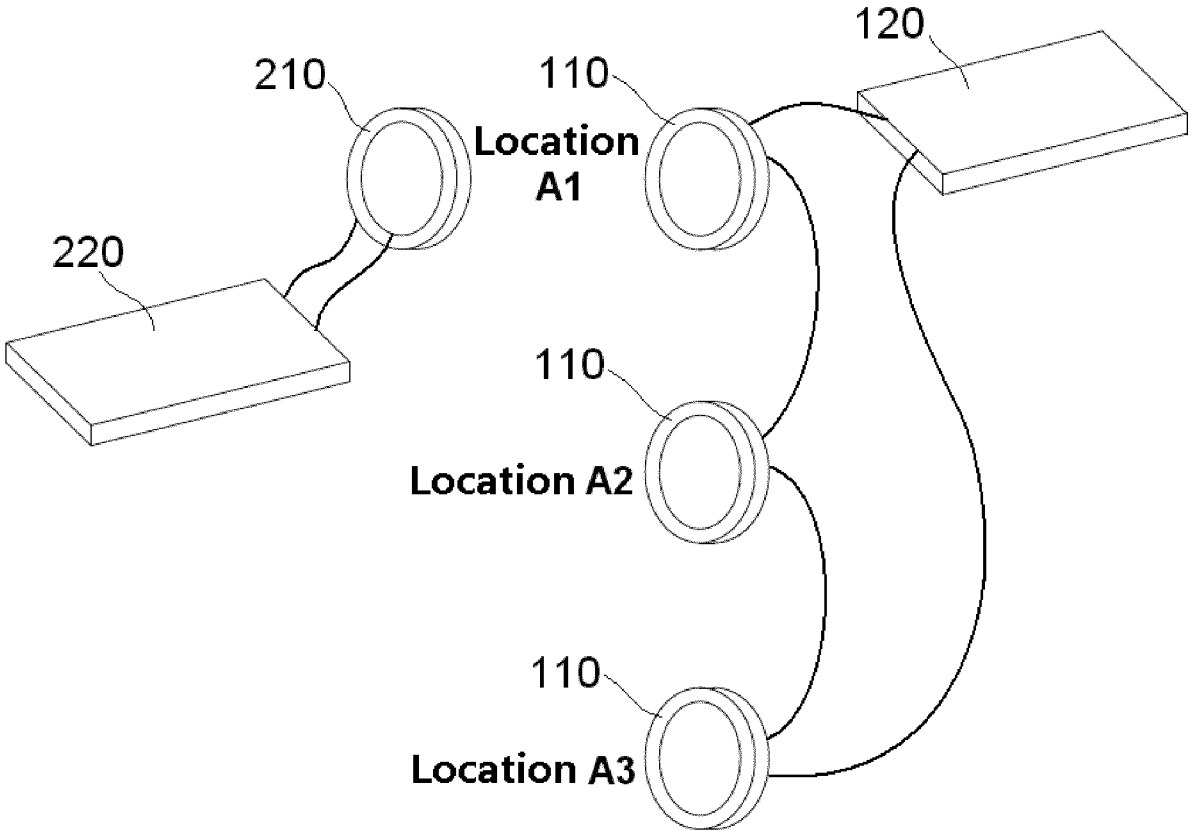

Fig.2

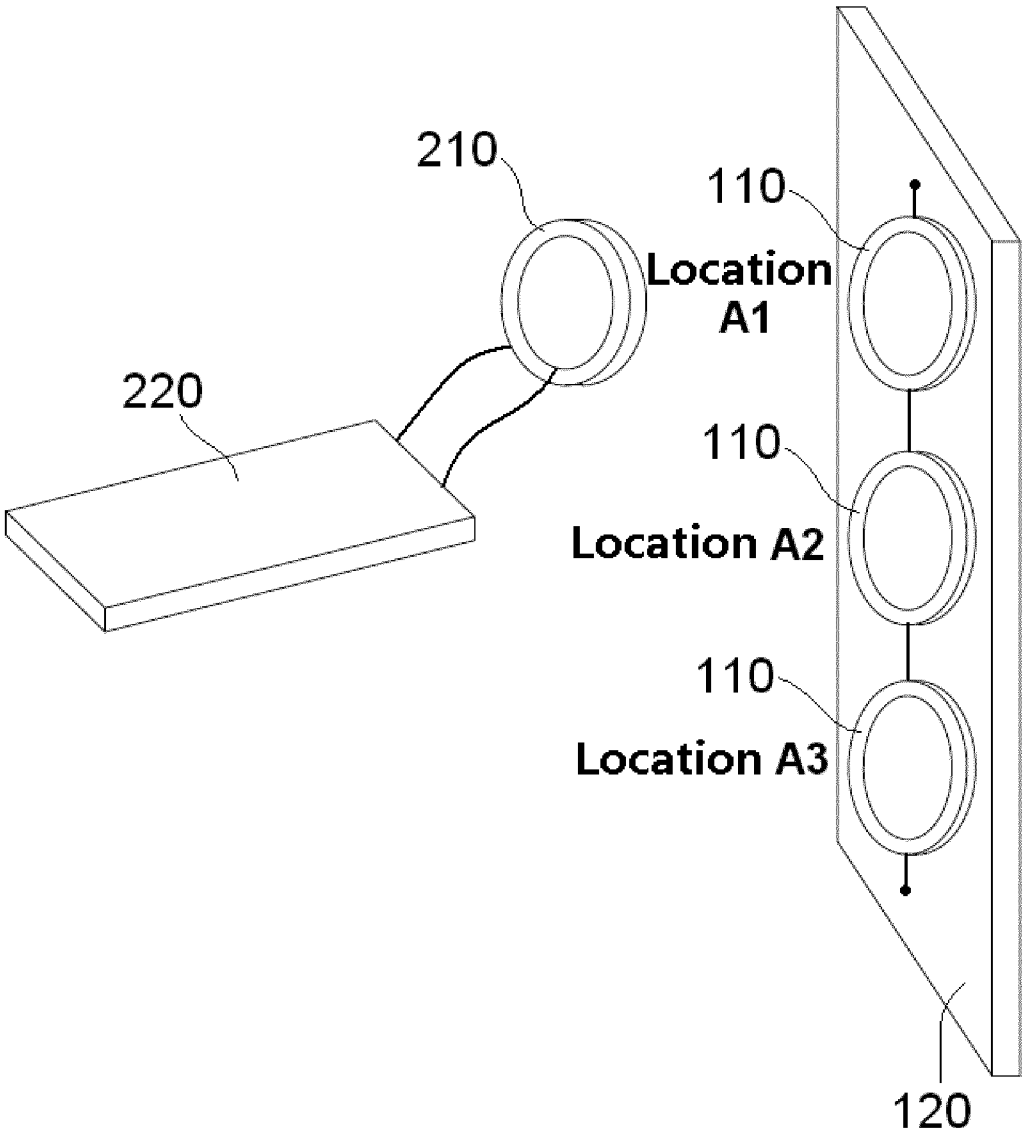

Fig.3

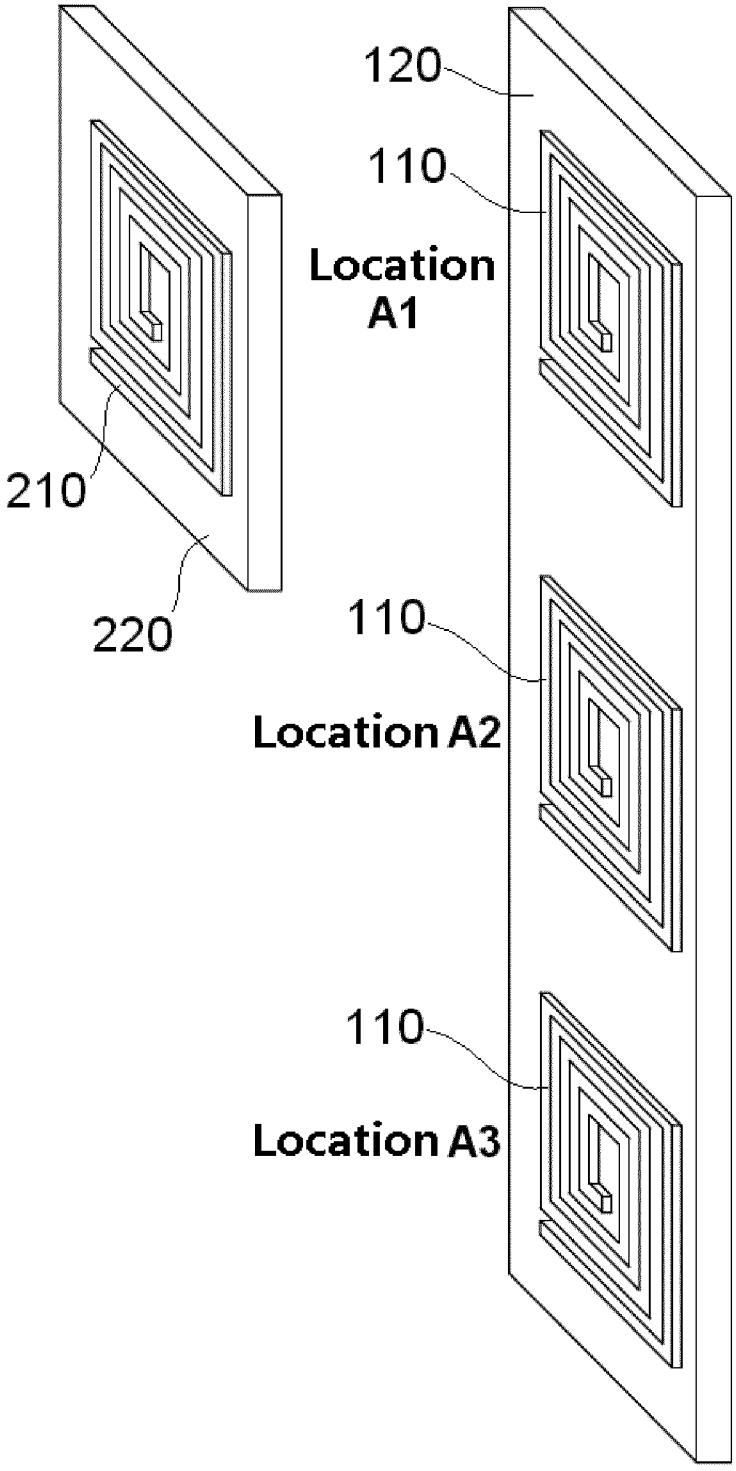

Fig.4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/068096

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02J50/10 H02J50/40 H01F38/14
ADD. H01F5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H02J H01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/043836 A1 (HUI SHU-YUEN RON [HK]) 21 February 2013 (2013-02-21) paragraph [0008] - paragraph [0115]; figures 1-51	1-18
X	DE 10 2015 006277 A1 (DAIMLER AG [DE]) 3 December 2015 (2015-12-03)	1-17
A	paragraph [0009] - paragraph [0062]; figures 1-6	18
X	US 2016/285318 A1 (MANIKTALA SANJAYA [US]) 29 September 2016 (2016-09-29) paragraph [0009] - paragraph [0030]; figures 1-8	1-18

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
5 September 2018	30/10/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Holz, Matthias

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/068096

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017/103130 A1 (TYCO ELECTRONICS CO LTD [CN]; TYCO ELECTRONICS LTD UK [GB]) 22 June 2017 (2017-06-22) page 2, line 1 - page 11, line 13; figures 1-6	1-18

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013043836 A1	21-02-2013	AU 2003229145 A1	22-12-2003
		EP 1547222 A1	29-06-2005
		EP 2479866 A2	25-07-2012
		EP 2685594 A1	15-01-2014
		US 2005189910 A1	01-09-2005
		US 2007090790 A1	26-04-2007
		US 2009251102 A1	08-10-2009
		US 2011109265 A1	12-05-2011
		US 2012194126 A1	02-08-2012
		US 2013043836 A1	21-02-2013
		WO 03105308 A1	18-12-2003
DE 102015006277 A1	03-12-2015	NONE	
US 2016285318 A1	29-09-2016	NONE	
WO 2017103130 A1	22-06-2017	CN 106887906 A	23-06-2017
		WO 2017103130 A1	22-06-2017