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(54) Title: POWER PEDESTAL, GROUND FAULT INDICATION SYSTEM, AND PRINTED CIRCUIT BOARD ASSEMBLY THEREFOR

(57) Abstract: A printed circuit board assembly is for a ground fault indication system of a power pedestal. The power pedestal includes a housing. The ground fault indication system has a number of ground fault input devices each structured to be coupled to the housing. The printed circuit board assembly includes an enclosure, a number of terminals each coupled to the enclosure, at least one of the number of terminals being structured to be electrically connected with one of the number of ground fault input devices, and a printed circuit board enclosed by the enclosure and electrically connected to the number of terminals. The printed circuit board has an indication apparatus structured to provide an indication of circuit status.

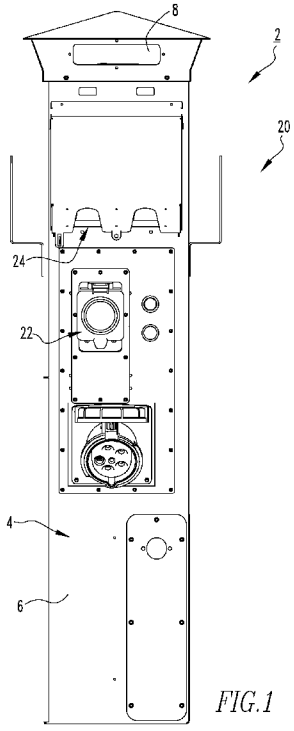


FIG.1

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[Continued on next page]

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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POWER PEDESTAL, GROUND FAULT INDICATION SYSTEM, AND PRINTED CIRCUIT BOARD ASSEMBLY THEREFOR

BACKGROUND

Field

The disclosed concept relates generally to power pedestals. The disclosed concept also relates to ground fault indication systems for power pedestals. The disclosed concept further relates to printed circuit board assemblies for ground fault indication systems.

Background Information

Electrical components (*e.g.,* without limitation, receptacles, relays, circuit breakers, electrical meters, transformers, light fixtures, telephones, telephone and/or internet service lines, and television cables) used outdoors are typically housed within an enclosure, such as, for example, a power pedestal, to protect the electrical components from the environment and to prevent electrical faults caused by moisture. Power pedestals generally comprise an upstanding housing, the base of which is disposed on a suitable foundation (*e.g.,* platform), and is structured to receive, for example and without limitation, power cables, telephone lines, television cables, internet service lines, and water service lines. The housing is made from a weather-resistant material, such as a suitable plastic or metal (*e.g.,* without limitation, stainless steel), and is designed to enclose the power cables, lines and other cables, and the electrical components, receptacles and connectors which are electrically connected to the lines, in order to shield and protect them from the environment. Accordingly, power pedestals are well suited for use in environments such as marinas and recreational vehicle (RV) parks, where they must remain outdoors exposed to environmental elements as they serve to provide plug-in power and/or connectivity (*e.g.,* without limitation, telephone service; Internet service; cable television; water service), for example, for boats and RVs and other vehicles.

Power pedestals commonly include many components (*e.g.,* timers, control relays, and/or terminal relays) that function together to provide indications to users of various circuit states (*e.g.,* safe state, tripped notifying state) of the power pedestal. Assembling and maintaining the many components requires significant labor and cost.

It is therefore desirable to provide an improved power pedestal, ground fault indication system, and printed circuit board assembly therefor.

SUMMARY

These needs and others are met by embodiments of the invention, which are directed to an improved power pedestal, ground fault indication system, and printed circuit board assembly therefor.

As one aspect of the disclosed concept, a printed circuit board assembly is provided for a ground fault indication system of a power pedestal. The power pedestal includes a housing. The ground fault indication system has a number of ground fault input devices each structured to be coupled to the housing. The printed circuit board assembly includes an enclosure, a number of terminals each coupled to the enclosure, at least one of the number of terminals being structured to be electrically connected with one of the number of ground fault input devices, and a printed circuit board enclosed by the enclosure and electrically connected to the number of terminals. The printed circuit board has an indication apparatus structured to provide an indication of circuit status.

As another aspect of the disclosed concept, a ground fault indication system for a power pedestal is provided. The power pedestal has a housing. The ground fault indication system comprises a number of ground fault input devices each structured to be coupled to the housing, and a printed circuit board assembly comprising a printed circuit board having an indication apparatus. The printed circuit board is electrically connected to each of the ground fault input devices in order to receive an input of circuit status therefrom, and in response, generate an indication of the circuit status with the indication apparatus.

As another aspect of the disclosed concept, a power pedestal including a housing and the aforementioned ground fault indication system is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

A full understanding of the disclosed concept can be gained from the following description of the preferred embodiments when read in conjunction with the accompanying drawings in which:

FIG. 1 is a front elevation view of a power pedestal and ground fault indication system therefor, in accordance with one non-limiting embodiment of the disclosed concept;

FIG. 2 is a right side elevation view of the power pedestal and ground fault indication system therefor of FIG. 1;

FIG. 3 is another right side elevation view of the power pedestal and ground fault indication system therefor of FIG. 1, shown with a portion of the housing removed in order to see hidden structures;

FIG. 4 is a top view of the power pedestal and ground fault indication system therefor of FIG. 3;

FIGS. 5, 6, and 7 are isometric, top, and exploded isometric views, respectively, of a printed circuit board assembly for the power pedestal and ground fault indication system therefor of FIG. 4; and

FIGS. 8 and 9 are isometric and top views, respectively, of a printed circuit board for the printed circuit board assembly of FIGS. 5 and 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As employed herein, the singular form of "a", "an", and "the" include plural references unless the context clearly dictates otherwise. Still further, as used herein, the term "number" shall mean one or an integer greater than one (e.g., a plurality).

As employed herein, the term "coupled" shall mean that two or more parts are joined together directly or joined through one or more intermediate parts. Furthermore, as employed herein, the phrase "directly coupled" shall mean that two or more parts are joined together directly, without any intermediate parts being disposed therebetween at the point or location of the connection.

FIGS. 1-4 are different views of a power pedestal 2 and ground fault indication system 20 therefor, in accordance with one non-limiting embodiment of the disclosed concept. The power pedestal 2 has a housing 4 that includes a body portion 6 and a lens 8 coupled to the body portion. In one example embodiment, and for purposes that will be more apparent below, the lens 8 is transparent. That is, the lens 8 may be structured to allow substantially all visible light to pass therethrough. The ground fault indication system 20 includes a number of ground fault input devices such as, for example and without limitation, a ground fault sensing unit 22 and a ground fault circuit breaker 24. In one example embodiment, the ground fault sensing unit 22 is a D64 Ground Fault Relay, manufactured by Eaton Intelligent Power Limited, headquartered at 30 Pembroke Road, Dublin 4, Ireland. In accordance with

the disclosed concept, the ground fault indication system 20 further includes a printed circuit board assembly 100 (partially shown in FIGS. 3 and 4) configured to aggregate circuit inputs of the power pedestal 2 and in response, generate an indication of circuit status.

FIGS. 5 and 6 show different views of the printed circuit board assembly 100. As shown, the printed circuit board assembly 100 includes an enclosure 102 and a number of terminals 104 each coupled to the enclosure 102. The enclosure 102 is preferably substantially transparent (e.g., structured to allow substantially all visible light to pass therethrough), although this is not apparent in the FIGS. for purposes of illustration. Additionally, the enclosure 102 may be made of any suitable material (e.g., without limitation, a polycarbonate material). The enclosure 102 can generally be stated as including a first enclosure member 106 and a second enclosure member 108 coupled to the first enclosure member 106. The first and second enclosure members 106,108 may be coupled by, for example and without limitation, a snap-fit mechanism and/or via coupling members (not shown).

In one example embodiment, the terminals 104 are electrically connected to the ground fault sensing unit 22 and the ground fault circuit breaker 24 in order to receive indications of circuit status within the power pedestal 2. FIG. 7 shows an exploded isometric view of the printed circuit board assembly 100. As shown, enclosed by the first and second enclosure members 106,108 is a printed circuit board 110. The printed circuit board 110 is electrically connected to the terminals 104.

Additionally, FIGS. 8 and 9 show different views of the printed circuit board 110, which is electrically connected to the ground fault sensing unit 22 and the ground fault circuit breaker 24 in order to receive an input of circuit status therefrom, and in response, generate an indication of circuit status with an indication apparatus 112. As shown, the printed circuit board 110 has a board member 111 and the indication apparatus 112 located on the board member 111. In one example embodiment, the indication apparatus 112 includes a number of light emitting diodes (four example light emitting diodes 114 are shown in FIGS. 8 and 9). It will be appreciated that the indication apparatus 112 is advantageously structured to provide the indication of circuit status.

More specifically, because the printed circuit board 110 is electrically connected to the ground fault sensing unit 22 and the ground fault circuit breaker 24,

the printed circuit board 110 takes inputs from these devices, and translates logic into either a SAFE state or a TRIPPED NOTIFYING state via the indication apparatus 112. Specifically, the indication of circuit status provided by the indication apparatus 112 may include an illumination of at least one of the light emitting diodes.

Additionally, as mentioned above, the enclosure 102 of the printed circuit board assembly 100 is preferably substantially transparent. As a result, the indication of circuit status from the light emitting diodes 114 is able to visibly pass through the enclosure 102. Furthermore, as can be appreciated from FIGS. 2 and 3, the printed circuit board assembly 100 is configured to be positioned such that visible light can readily pass from the printed circuit board assembly 100 through the lens 8. Although the lens 8 is shown as being solid in the FIGS. (e.g., for ease of illustration), it will be appreciated that the lens 8 is substantially transparent and positioned proximate the printed circuit board assembly 100. In one example embodiment the lens 8 is positioned directly in front of the printed circuit board assembly 8, with respect to the orientation of FIG. 2. As a result, the indication of circuit status (e.g., a SAFE state or a TRIPPED NOTIFYING state) from the indication apparatus 112 (FIGS. 8 and 9) is able to visibly pass through the lens 8 and to the exterior of the power pedestal 2, thus notifying operators nearby of said circuit status.

In accordance with disclosed concept, the ground fault indication system 20 of the power pedestal 2 is able to provide indications of circuit status to operators, e.g., users standing proximate the power pedestal 2 who can look at the lens 8, thus alerting them of potential problems. Moreover, the ground fault indication system 20 is able to do so via a simple component, the printed circuit board 110. This is distinct from prior art indication systems, which typically require a conglomeration of separate parts, components, and wires. For example, many prior art power pedestals require separate timers, control relays, terminal relays, and wiring associated therewith, in order to provide circuit status indications. By way of contrast, in one example embodiment the ground fault indication system 20 is advantageously able to provide indications of circuit status (e.g., a SAFE state or a TRIPPED NOTIFYING state) by being devoid of a component selected from the group consisting of a timer, a control relay, and a terminal relay. In another example embodiment, the ground fault indication system 20 is devoid of each of these components, e.g., timers, control relays, and terminal relays. As a result of this consolidation of components into the printed circuit board 110, the power pedestal 2

is significantly less expensive, and requires less labor to assemble and maintain. For example, manufacturers will generally be able to more easily assemble and perform maintenance on the power pedestal 2, as compared to prior art power pedestals, due to the more simple design and usage of the printed circuit board 110.

Accordingly, it will be appreciated that the disclosed concept provides for an improved (e.g., without limitation, easier to assemble and perform maintenance on, and less expensive) power pedestal 2, ground fault indication system 20, and printed circuit board assembly 100 therefor, in which indications of circuit status are able to be provided via a printed circuit board 110, rather than through a large number of expensive additional components.

While specific embodiments of the disclosed concept have been described in detail, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of the disclosed concept which is to be given the full breadth of the claims appended and any and all equivalents thereof.

What is claimed is:

1. A printed circuit board assembly for a ground fault indication system of a power pedestal, said power pedestal comprising a housing, said ground fault indication system comprising a number of ground fault input devices each structured to be coupled to said housing, said printed circuit board assembly comprising:

an enclosure;

a number of terminals each coupled to said enclosure, at least one of said number of terminals being structured to be electrically connected with one of said number of ground fault input devices; and

a printed circuit board enclosed by said enclosure and electrically connected to said number of terminals, said printed circuit board comprising an indication apparatus structured to provide an indication of circuit status in said power pedestal.

2. The printed circuit board assembly of claim 1 wherein said indication apparatus comprises a number of light emitting diodes.

3. The printed circuit board assembly of claim 2 wherein said number of light emitting diodes is a plurality of light emitting diodes.

4. The printed circuit board assembly of claim 1 wherein said enclosure is substantially transparent in order to allow the indication from said indication apparatus to visibly pass through said enclosure.

5. A ground fault indication system for a power pedestal, said power pedestal comprising a housing, said ground fault indication system comprising:

a number of ground fault input devices each structured to be coupled to said housing; and

a printed circuit board assembly comprising a printed circuit board having an indication apparatus, said printed circuit board being electrically connected to each of

said ground fault input devices in order to receive an input of circuit status therefrom, and in response, generate an indication of the circuit status with said indication apparatus.

6. The ground fault indication system of claim 5 wherein said indication apparatus comprises a number of light emitting diodes; and wherein the indication comprises an illumination of at least one of said number of light emitting diodes.

7. The ground fault indication system of claim 5 wherein said number of ground fault input devices comprises at least one ground fault circuit breaker.

8. The ground fault indication system of claim 5 wherein said number of ground fault input devices comprises at least one ground fault sensing unit.

9. The ground fault indication system of claim 5 wherein said ground fault indication system is devoid of a component selected from the group consisting of a timer, a control relay, and a terminal relay.

10. The ground fault indication system of claim 5 wherein said ground fault indication system is devoid of timers, control relays, and terminal relays.

11. The ground fault indication system of claim 5 wherein the circuit status comprises a safe state.

12. The ground fault indication system of claim 11 wherein the circuit status further comprises a tripped notifying state.

13. A power pedestal comprising:

a housing; and

a ground fault indication system comprising:

a number of ground fault input devices each coupled to said housing, and

a printed circuit board assembly comprising a printed circuit board having an indication apparatus, said printed circuit board being electrically connected to each of said ground fault input devices in order to receive an input of circuit status therefrom, and in response, generate an indication of the circuit status with said indication apparatus.

14. The power pedestal of claim 13 wherein said printed circuit board assembly further comprises an enclosure coupled to said printed circuit board; wherein said housing comprises a body portion and a transparent lens coupled to said body portion; and wherein said enclosure is positioned proximate said lens in order to allow the indication from said indication apparatus to visibly pass through said lens.

15. The power pedestal of claim 13 wherein said indication apparatus comprises a number of light emitting diodes; and wherein the indication comprises an illumination of at least one of said number of light emitting diodes.

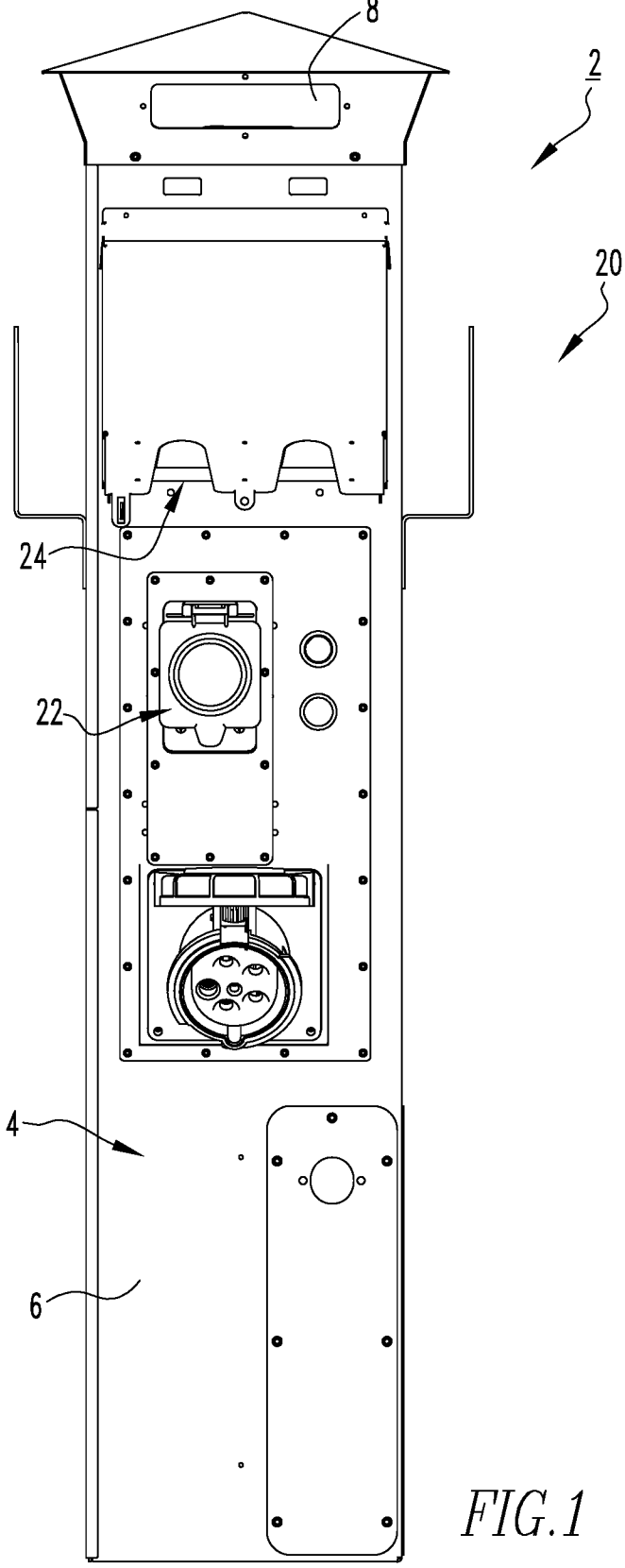


FIG.1

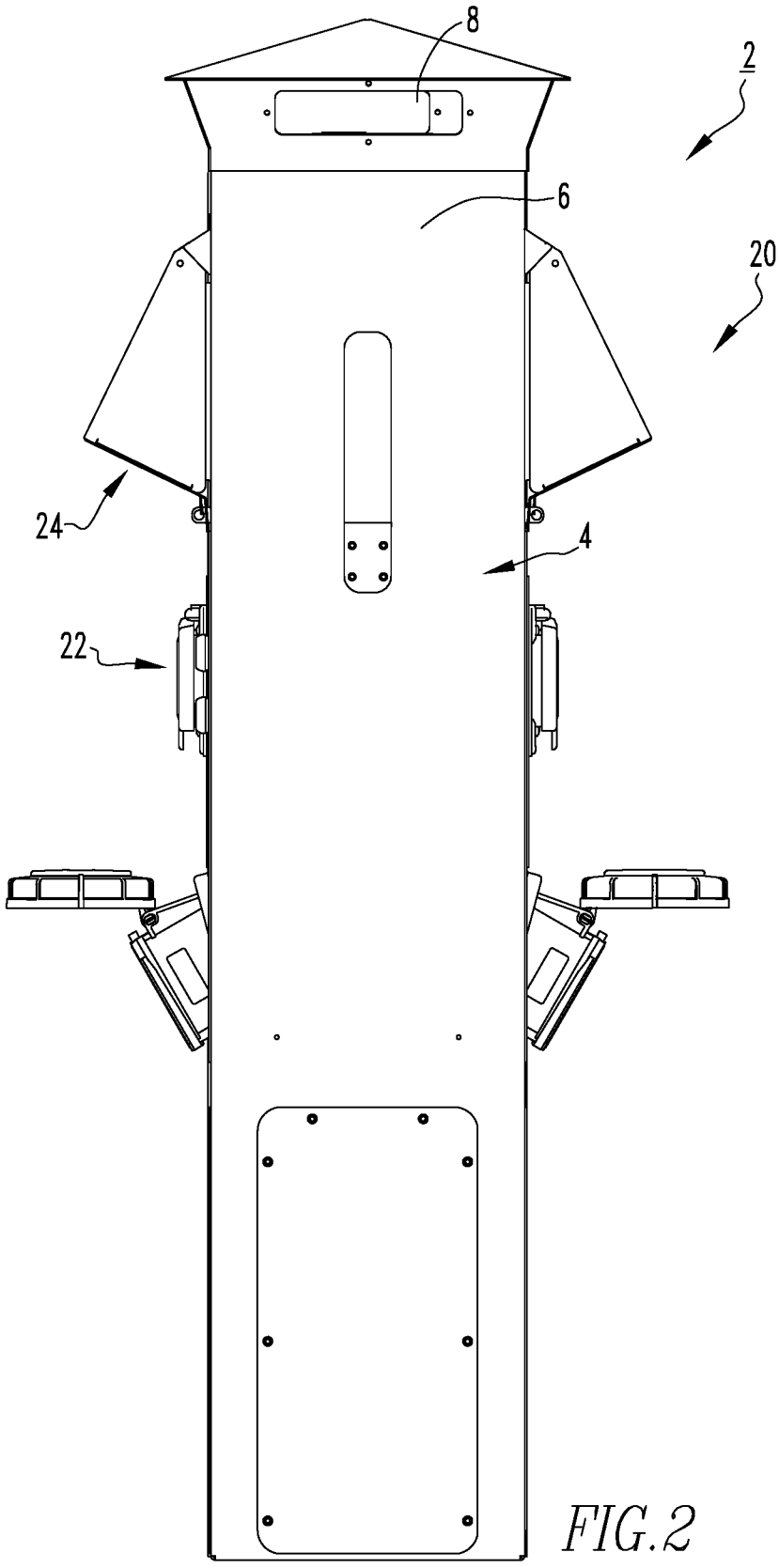


FIG.2

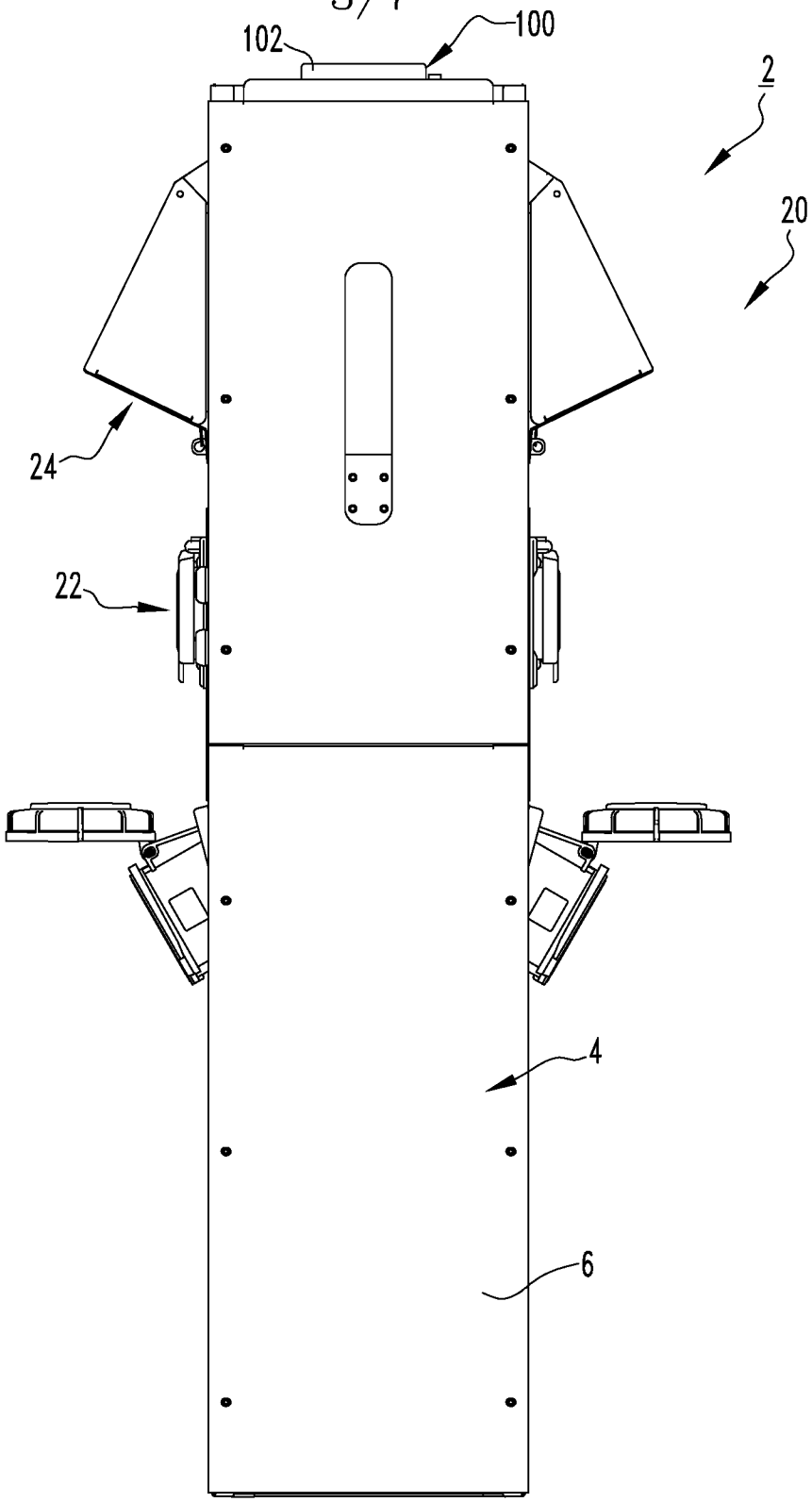


FIG.3

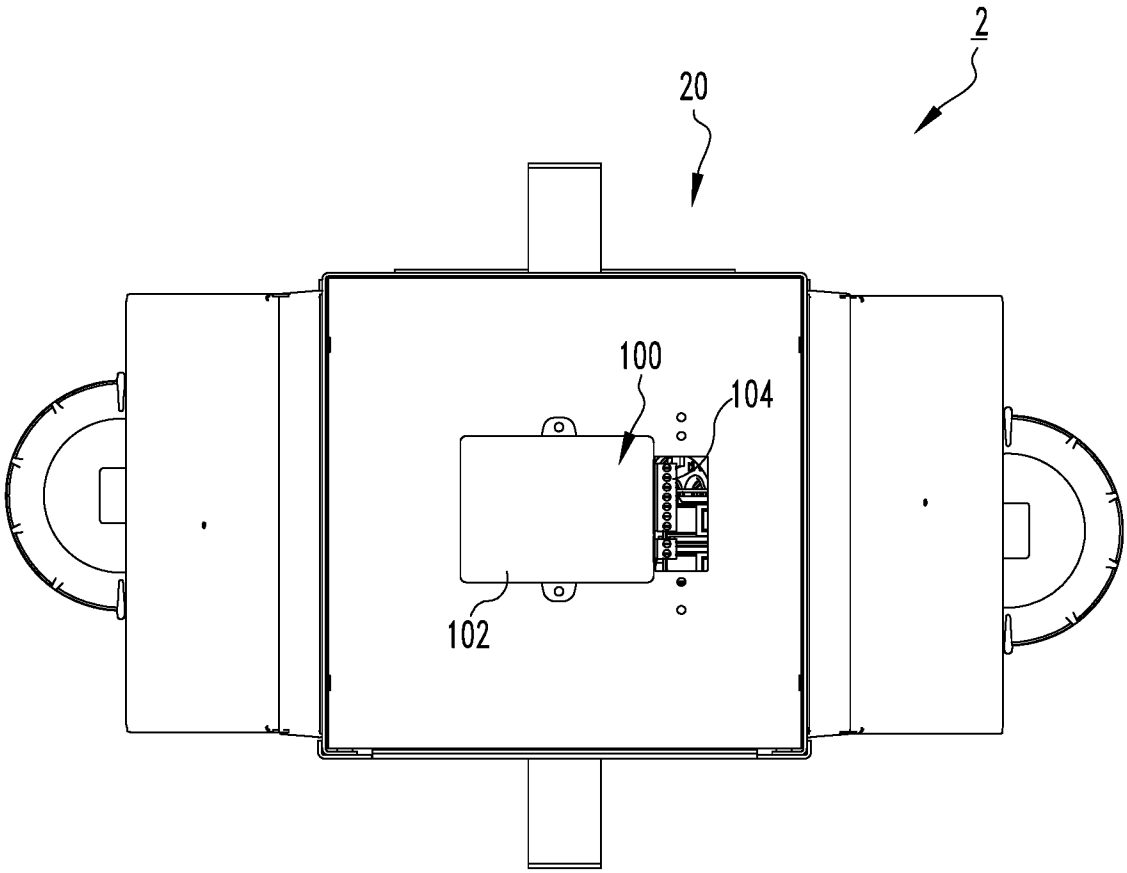


FIG.4

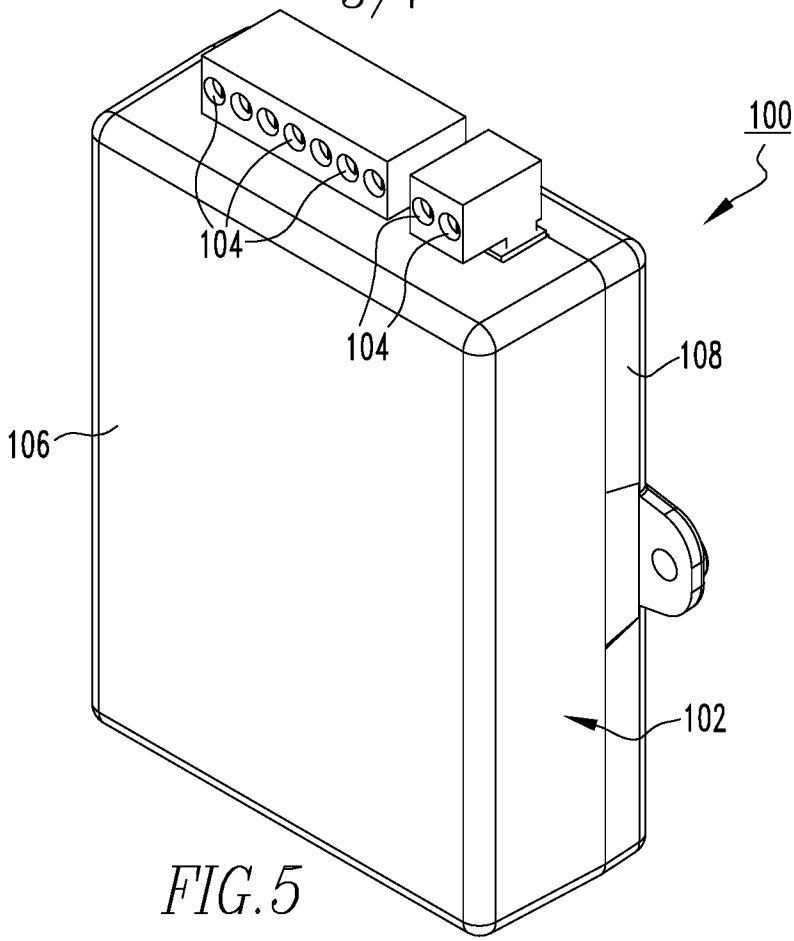


FIG.5

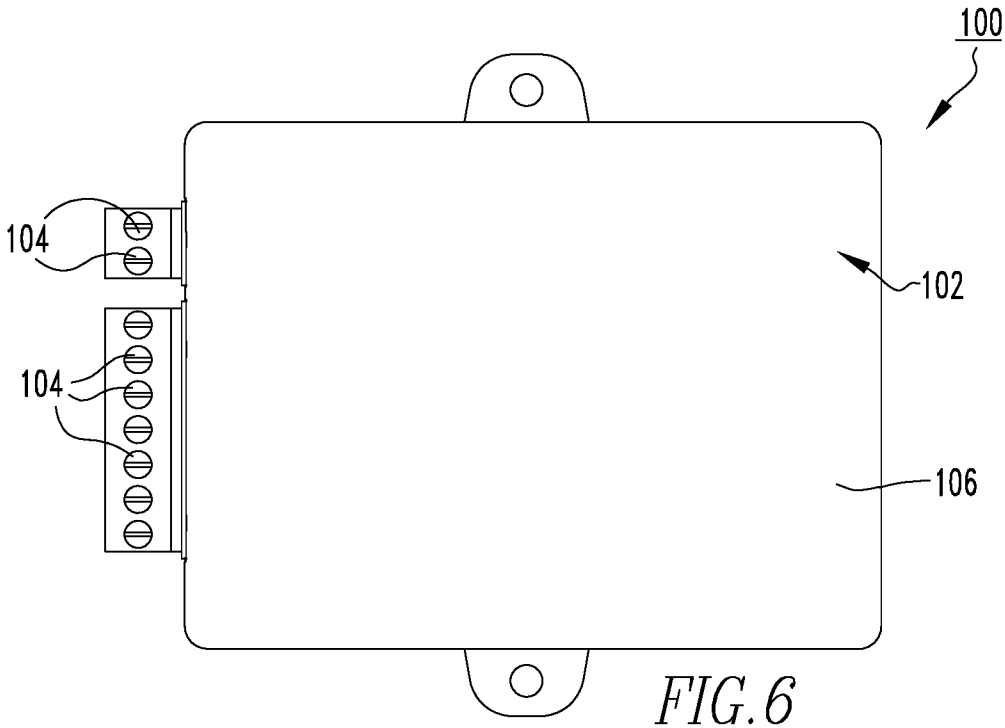


FIG.6

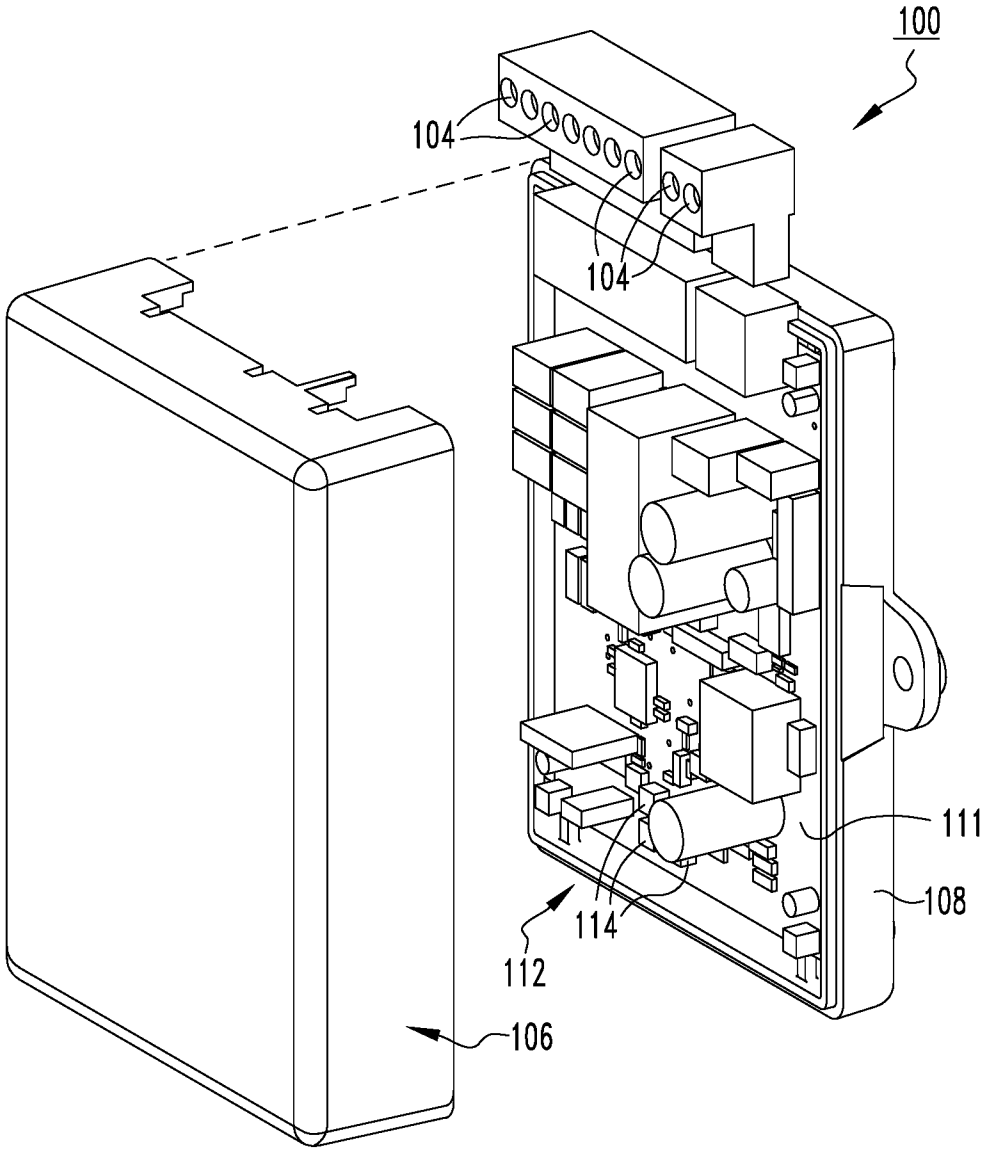


FIG. 7

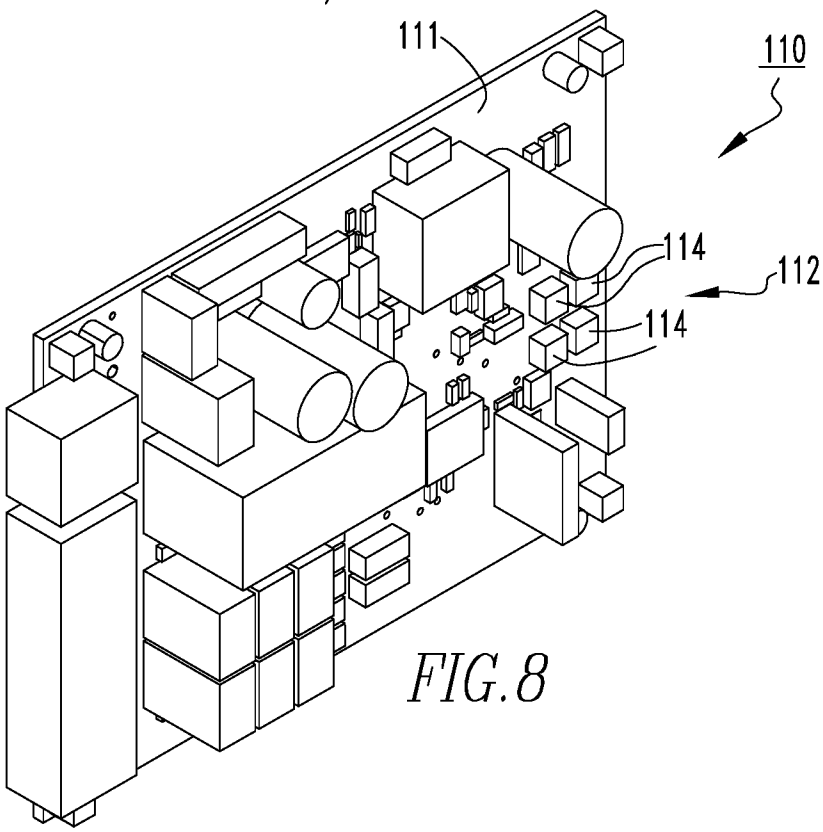


FIG.8

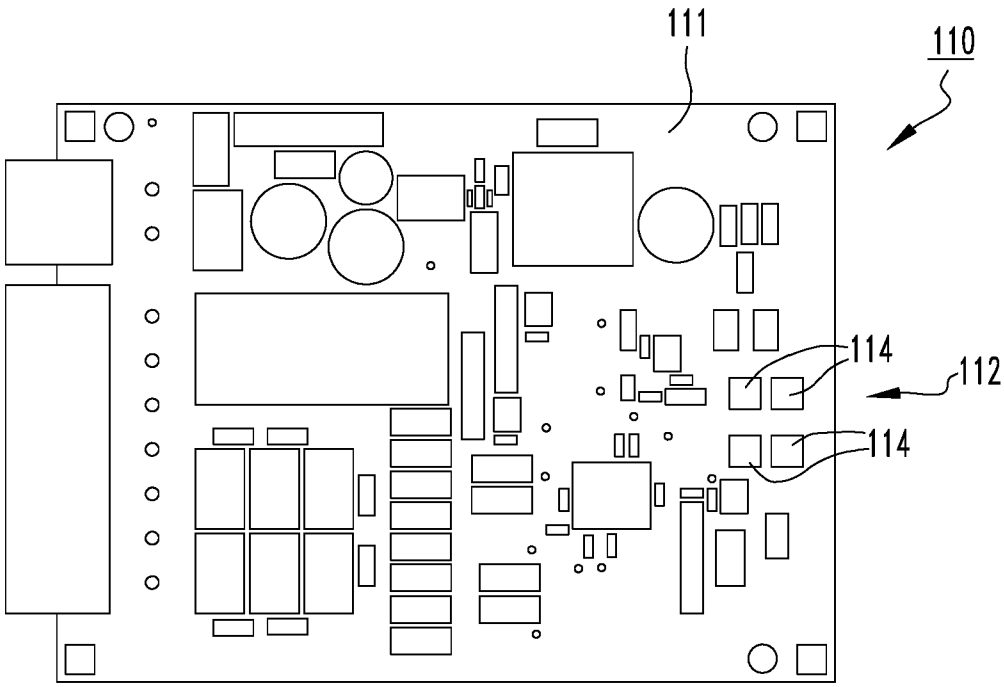


FIG.9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/025066

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02G3/04 G01R31/52 H02B1/50 H05K5/00
ADD.

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)
H02G G01R H02B H05K

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	Anonymous: "Earth-fault indicator type easi", , 2 July 2018 (2018-07-02), XP055683148, Retrieved from the Internet: URL:https://web.archive.org/web/20180702221540if_/http://www.emg-ger.com:80/index.php/en/component/jdownloads/send/8-easie/224-datasheet-easi-a-rev6e [retrieved on 2020-04-06]	1-12
Y	pages 1-4	13-15
Y	US 2017/250532 A1 (SEFF PAUL D [US] ET AL) 31 August 2017 (2017-08-31) paragraph [0037]; figure 1	13-15

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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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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 April 2020	17/04/2020

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	Hestroffer, Karine

1

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

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/025066

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 611 616 A (CHANDLER WILLIAM D [US]) 18 March 1997 (1997-03-18) figure 4 column 1, lines 28-31 column 3, lines 56-67 column 5, lines 25-33 -----	14,15

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2020/025066

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2017250532 A1	31-08-2017	CA 2964892 A1	06-05-2016
		US 2017250532 A1	31-08-2017
		WO 2016069093 A1	06-05-2016
US 5611616 A	18-03-1997	NONE	