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(71) Applicant: **PRONUTEC, S.A.U.**
48340 Amorebieta (Vizcaya) (ES)

(72) Inventor: **GÓMEZ BARBERO, José, Julio**
48430 Amorebieta (Vizcaya) (ES)

(74) Representative: **Carpintero Lopez, Francisco et al**
Herrero & Asociados, S.L.
Alcalá 35
28014 Madrid (ES)

(54) Measurement module for a fuse block base

(57) The present invention relates to a measurement module (100, 100', 101, 101', 100") for a fuse block base which is more versatile, useful and optimal than existing measurement modules, needing less space for cables, where said measurement module (100, 100', 101, 101', 100") is connectable to output contacts (5, 5') of a fuse block base (1), on which at least one intensity transformer is mounted to provide at least one analog current measurement signal; where the measurement module (100, 100', 101, 101', 100") additionally comprises an analog-to-digital converter (40) with at least one analog input (41) configured to receive said analog current measurement signal, and with at least one digital connection port comprising at least one digital output (110).

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Description

Field of the Invention

[0001] The invention is comprised in the technical field of electrical installations, and more specifically in installations relating to electric switchboards.

Background of the Invention

[0002] Today there is a growing trend to remotely know user electricity consumption values. To that end, it is necessary to know the values of consumed voltages and intensities, for which purpose measuring devices must be placed in the low-voltage switchboards of the corresponding electrical installation. It is also necessary to know said values of the voltage and intensity for each output of the low-voltage switchboards, which are usually established by means of three-pole fuse block bases.

[0003] European patent application EP-2259284-A2 discloses a measurement module or kit for being connected in a three-pole fuse block base. This one-piece module includes three strips connected to each of the contacts of the fuse block base, at least one current transformer. This measurement module provides data about the current consumed by a device or apparatus connected to it.

[0004] The information obtained from this measurement module or kit comprises current values, which is certainly limited because it does not allow having voltage values with a single measurement module, having to arrange additional means to determine voltage, with the time and resources this entails.

[0005] On the other hand, the information obtained by this measurement module must be sent in any case to a measurement receiving device, which can be analog, digital, or simply a receiving device that collects the information and forwards it to another device that is further away. It so happens, for example, that this measurement receiving device sends the information to a central control room.

[0006] The connection between the measurement module or kit and said measurement receiving device is by means of cables. These cables carry the measured current values in the form of an analog signal. One cable is therefore necessary for each parameter to be transported, and although in some cases some parameters can be grouped together, it involves a significant number of cables in any case to be taken from the terminals of the fuse block base to the measurement receiving device.

[0007] If this is multiplied by the number of fuse block bases that the switchboard has, the arrangement of the cables, referred to as the layout, can become a problem due to the large number of cables needed to be arranged, with the cost this entails, in addition to repair difficulties in the event of problems in one of the cables or connections and to the large space necessary for the layout of all the cables.

[0008] Combining voltage and current parameters to know the values of the power consumed by the devices connected to each output of the fuse block base is known today. The most widespread solution for obtaining the voltage value consists of connecting a connection in the switchboard general busbar. However, this solution presents mounting difficulties given that additional connections must be provided in other areas of the switchboard, in addition to other drawbacks, for example said layout only allows obtaining upstream voltage values.

Description of the Invention

[0009] The invention relates to a measurement module for a fuse block base according to claim 1. Preferred embodiments of the measurement module are defined in the dependent claims.

[0010] The present invention solves the problems mentioned in the preceding section, and is much more versatile, useful and optimal than the measurement modules existing today, needing much less space for cables.

[0011] To that end, according to the invention the module comprises at least one analog-to-digital converter with at least one digital connection port comprising at least one digital output. A single cable to a receiving device can therefore come out of the corresponding fuse block base to which this measurement module is connected.

[0012] The possibility that the measurement module comprises at least one voltage connection is also contemplated. The means necessary for taking the measurement of the current and voltage are therefore provided in a single measurement module, which facilitates said taking of measurements. To that end, it is provided with at least one conductive element for the voltage connection in addition to those of the current connections. In this case the digital connection port of the analog-to-digital converter comprises at least two digital inputs.

[0013] Placing the voltage connection next to the output terminals of the fuse block base has the following advantages: it facilitates mounting the measurement module because the connections are integrated in the actual module, whereby preventing having to make additional connections in other areas of the low-voltage switchboard to obtain said voltage measurements. Additionally, the information that can be obtained by simultaneously having voltage values upstream of the fuse, for example, in the main busbar, and downstream of the fuse, can be used in a useful manner, for example, to measure and quantify the energy lost in the fuses, or to monitor the state of the fuse, for example, to detect the moment in which the fuse blows.

[0014] A first aspect of the invention relates to a measurement module for being connected to a fuse block base, said fuse block base having at least three output contacts. The measurement module is connectable to three output contacts of a three-pole fuse block base by means of at least three conductive elements which are

connectable to the three output contacts of the fuse block base and on which at least one intensity or current transformer is mounted, preferably one for each conductive element, to provide preferably at least two analog measurement signals, one of them being a voltage measurement signal and another being a current measurement signal.

[0015] Each conductive element can consist of a conductive strip or of a cable, being easily substitutable with respect to one another, such that said conductive elements allow connecting the measurement module with different output contact typologies that fuse block bases can have. The measurement module further comprises:

- at least one analog-to-digital converter with at least one analog input configured to receive said at least one analog current measurement signal provided by said at least one intensity transformer, and with at least one digital output, preferably a single digital output.

[0016] Therefore, said at least one analog-to-digital converter collects the measurement signals of the measuring device and converts them into a digital signal. This digital signal can be transmitted through a single cable. Said cable is connectable to a receiving device, which can be installed in the actual electric switchboard, and this receiving device can send the data to a central control system.

[0017] The number of cables inside the switchboard is therefore reduced.

[0018] The possibility that the module comprises a casing containing at least said at least one intensity transformer, and on which said at least three conductive elements are mounted is contemplated, thereby allowing connecting the measurement module to the three output contacts located at one end, usually the lower end, of a three-pole fuse block base.

[0019] According to a preferred embodiment, the converter can incorporate at least one digital input in addition to said at least one digital output, such that several analog-to-digital converters of the different fuse block bases are interconnectable. Said digital input is envisaged for being used to transmit data in the form of a data bus, etc. In this preferred embodiment, each analog-to-digital converter comprises a digital input and a digital output, forming a loop, allowing the information to go from one converter to another with information from all the interconnected bases such that a single cable to the receiving device can come out of the last converter.

[0020] According to a possible embodiment, the converter is an integral part of the measurement module. Once the measurement module is connected to the fuse block base, said fuse block base is installed in the switchboard and it is only necessary to connect a single output cable of the converter.

[0021] According to another possible embodiment, the measurement module comprises at least one electrical connection point, such as a terminal block, to which said at least two analog inputs of the analog-to-digital converter are connected. This allows using, for example, the measurement modules with or without an analog-to-digital converter, or incorporating the converter *a posteriori.*

[0022] In any case, in addition to the advantages described above, the device comprises the following additional advantages:

[0023] The embodiment including the casing allows handling the module like a kit or assembly formed by a single part including the transformers, conductive elements and connection points, to facilitate mounting, as well as the converter.

[0024] It can be easily mounted in new bases and in bases previously installed in a low-voltage switchboard without having to dismount the fuse block base. For the second case, it is only necessary to disconnect the output terminals, connect the measurement module to the base and reconnect the same terminals to the module of the invention.

[0025] In addition to the current measurement through intensity transformers, it also includes a voltage measurement, so it therefore allows calculating power consumption as well as other necessary parameters for better managing the grid.

[0026] The strips are fixed such that certain movement thereof is allowed in order to be adapted to the range of measurements that the connections of the base may have, e.g., due to deformations caused by the prior mounting. This is done by fixing the strips to a flexible area of the casing.

[0027] The kit allows being able to continue using the protective terminal cover of the standard base, also referred to as connection cover. The same cover is fixed to the casing of the measurement kit, such that the output terminals continue to be protected.

[0028] The kit is usable in bases in both the upper and lower output positions.

[0029] According to another possible embodiment, the converter can be placed in any part of the measurement module. This converter incorporates an electrical connection point connected by means of cables to the electrical output connection point of the measurement module.

[0030] A second aspect of the invention also relates to a fuse block base with a measurement module as it has been defined above.

Brief Description of the Drawings

[0031] To complement the description that is being made and for the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description, in which the following has been depicted with an illustrative and non-limiting character:

Figure 1 shows a conventional three-pole fuse block base of the state of the art with the cover removed.
Figure 2 shows a detailed view of an end of the fuse block base of the state of the art depicted in Figure 1, in which the three output contacts are shown.
Figure 3 shows a perspective view of a measurement module of the state of the art.
Figure 4 shows a perspective view of a first embodiment of the measurement module of the present invention.
Figure 5 shows the measurement module of Figure 4 mounted on the fuse block base.
Figure 6 shows two measurement modules according to the first embodiment of the invention mounted in "loop" or series.
Figure 7 shows the measurement modules of Figure 6 mounted on two fuse block bases.
Figures 8 and 9 show a perspective view of a second embodiment of the measurement module of the present invention.
Figure 10 shows a perspective view of a variant of the second embodiment of the measurement module depicted in Figures 8 and 9, where the conductive elements consist of cables instead of strips, said variant relating to the conductive elements being applicable to any of the measurement modules according to the present invention.
Figure 11 shows a detailed view of an end of an embodiment variant of the fuse block base depicted in Figure 2, where the output contacts are V-shaped, being envisaged for being connected to the conductive elements of the variant of the measurement module depicted in Figure 10.
Figure 12 shows the measurement module of the any of Figures 8 to 10 already mounted on a fuse block base.
Figure 13 shows two measurement modules according to the second embodiment of the invention mounted in "loop" or series.
Figure 14 shows a perspective view of a third embodiment of the measurement module of the present invention.
Figure 15 shows the measurement module of Figure 14 mounted on the fuse block base.
Figure 16 schematically shows two possible configurations for connecting the different fuse block bases to with measurement receiving devices, a "loop" or series mounting having been depicted in view a), and a parallel mounting having been depicted in view b).

Preferred Embodiment of the Invention

[0032] As illustrated in Figures 1 and 2, a three-pole fuse block base (1) of the state of the art comprises, in a known manner, three pairs of contacts (2), each pair of contacts (2) being electrically connected to a conductive strip, which has not been depicted, of the low-voltage switchboard of the corresponding electrical installation. There is one pair of contacts (2) for each electrical phase. A fuse (3) is coupled in each pair of contacts (2). The non-depicted conductive strip is connected to the fuse block base in its rear portion, i.e., in an area opposite the fuses (3).

[0033] These fuses (3) are generally mounted in a cover hinged to a casing (4) of the fuse block base (1) where the pairs of contacts (2) are located, such that when the cover is closed on the fuse block base (1), the fuses (3) are coupled in their respective pairs of contacts (2) closing the electrical circuit. When the cover is opened, the fuses (3) are disconnected from the contacts (2). The fuse block base (1) furthermore has output contacts (5, 5') to which the corresponding electric cables are fixed. These cables reach the equipment to be powered.

[0034] There are also fuse block bases (1) that do not have this hinged cover, and in which the fuses (3) are exposed.

[0035] Figure 3 shows a measurement module (10) of the state of the art comprising a casing (11) in which three conductive elements (20) are mounted, and the corresponding intensity transformer, not shown in the figure, is mounted in each of them. This measurement module (10) also has an electrical connection point (30) connected to the conductive elements (20) and to the secondary of the transformers for the output of the current and/or voltage connections.

[0036] Once mounted in the fuse block base (1), the measurement module (10) provides current measurements through the intensity transformers, as well as voltage measurements through the electrical connection points (30). The power consumption, as well as other parameters necessary for better managing the grid, can then be calculated with these two parameters.

[0037] According to the invention, the measurement module comprises at least one voltage connection which can be established in different ways, and among such ways it is contemplated that the module comprises a conductive element in addition to the conductive elements (20, 20') of the current connections, so it is contemplated that the module comprises a metal flange clamping the end of each conductive element (20, 20'), whether it is a bare cable (20'), as will be explained below, or a strip (20), specifically in the area of attachment between each conductive element (20, 20') and each output contact (5, 5'). It is also contemplated that each flange has a sharpened element contacting the conductive element (20, 20'), perforating the plastic covering in the event that it is a cable (20').

[0038] It is also contemplated that the voltage connection is established by means of a conductor in electrical contact with the output contacts (5, 5'), directly on them or on the conductive elements (20, 20') which are connected to said output contacts (5, 5'), or on any intermediate element that is used to assure the electrical contact between the output contacts (5, 5'), and the conductive elements (20, 20').

[0039] Said cable with the voltage connection internally located in the measurement module is then taken to the electrical connection point (30, 30', 30"), or to any other independent connector.

[0040] Figure 4 shows a first preferred embodiment of the measurement module (100) of the present invention. The possibility that this measurement module (100) has an analog-to-digital converter integrated therein, the at least two analog inputs of which are connected to said at least two current and/or voltage connections of the module, is contemplated. The analog-to-digital converter provides at least one digital output (110), preferably a single digital output (110). The output of this measurement module (100) to the exterior therefore does not need the corresponding electrical connection point providing the analog voltage and/or current signals measured by the measurement module (100), but rather it has a single digital output (110) to which a single cable (111) carrying the necessary information to a measurement receiving device (60, 70) is connectable, as seen in Figure 16.

[0041] Figure 5 shows this measurement module (100) already mounted on a fuse block base (1). So instead of having to transport six or nine cables for each fuse block base (1), only one cable (111) in which all the information is transported to the measurement receiving device (60) is necessary.

[0042] This first embodiment of the measurement module (100) can also have at least one digital input (120); it can therefore collect information from other measurement modules (100).

[0043] Figure 6 shows a first measurement module (100) and a second measurement module (101) according to the first embodiment of the invention; these measurement modules (100, 101) are connected to one another through a connection cable (112). A single cable (111) transporting the information from the two fuse block bases (1) in which these measurement modules (100, 101) are mounted comes out of the second measurement module (101), successive measurement modules (100, 101) being connectable in this manner.

[0044] Figure 7 shows these first and second measurement modules (100, 101) already mounted on the corresponding fuse block bases (1), being arranged in series.

[0045] Figure 8 shows a second embodiment of the measurement module (100') of the invention, with an analog-to-digital converter (40) that is not built-in. The analog-to-digital converter (40) has an electrical connection point for at least two analog inputs (41), preferably a plurality thereof, which is connected to an electrical connection point (30') of the measurement module (100') providing the analog voltage and/or current signals measured by the measurement module (100'). Once connected, the result is shown in Figure 9, in which, as in the first embodiment, the measurement module (100') has at least one digital output (110), preferably a single digital output (110), to which a single cable (111) carrying the necessary information to the corresponding measurement receiving device (60, 70) is connectable.

[0046] In this second embodiment, the measurement module (100') can also have at least one digital input (120); it can therefore collect information from other measurement modules (100, 101, 100', 101'). As shown in Figure 13, a first measurement module (100') and a second measurement module (101') according to the second preferred embodiment of the invention are therefore connected by means of connecting the single digital output (110) of one module to the digital input (120) of the other module through a connection cable (112); and a single cable (111), transporting the information measured by the two measurement modules (100', 101') comes out of the assembly.

[0047] In turn, Figure 10 shows a perspective view of a variant of the second embodiment of the measurement module depicted in Figures 8 and 9. In said variant, the application of which to any of the measurement modules according to the invention is likewise contemplated, the conductive elements consist of cables (20') instead of strips (20), as depicted for the remaining figures. Figure 11 therefore depicts a detailed view of an end of an embodiment variant of the fuse block base depicted in Figure 2, where the output contacts are V-shaped strips (5'), being envisaged for being connected to the conductive elements (20') of the variant of the measurement module depicted in Figure 10 by means of a tightening element consisting of a non-depicted detachable part that allows fixing the bare cable (20') on said V-shaped strips (5') of the fuse block base.

[0048] Figure 14 shows a third embodiment of the measurement module (100") of the invention, in which an analog-to-digital converter (40) is mounted in the upper portion. The analog-to-digital converter (40) has an electrical connection point for at least two analog inputs (41) which are connected to an electrical connection point (30") of the measurement module (100") providing the analog voltage and/or current signals measured by the measurement module (100"). In this case, the connection is by means of wiring (50). Once connected, the result is shown in the right portion of said Figure 14, in which, as in the first embodiment, the measurement module (100") has at least one digital output (110), preferably a single digital output (110), as shown in Figure 15, to which a single cable (111) carrying the information necessary to the corresponding measurement receiving device is connectable.

[0049] Though not specifically shown, this third embodiment of the measurement module (100") can also allow a loop or series configuration as it can include at least one digital input (120), preferably one digital input (120).

[0050] Figure 16 schematically shows two possible configurations for connecting the different fuse block bases (1).

[0051] View a) of said Figure 16 schematically shows a switchboard with five fuse block bases (1), each with a measurement module (100, 101, 102, 103, 104), cor-

responding with any of the first embodiment (100,101), second embodiment (100', 101') and/or third embodiment (100") of the invention, which are connected in loop through the corresponding connection cables (112) connecting the digital output (110), not shown in this figure, of each measurement module (100-103) with the digital input (120), also not shown in this figure, of the adjacent measurement module (101-104). A single cable (111) with all the information to a single receiving device (60), which accumulates all the information of the different bases, can come out of the last measurement module (104).

[0052] View b) of said Figure 16 shows a switchboard also with five fuse block bases (1), each with a measurement module (100, 101, 102, 103, 104), corresponding with any of the first embodiment (100,101), second embodiment (100', 101') and/or third embodiment (100") of the invention; in this case, the measurement modules (100-104) are not connected in loop, but rather each of them sends the corresponding information to five receiving devices (70) through a single cable (111) connected to its single digital output (110).

[0053] The right portion of Figure 16 shows a diagram of the analog-to-digital converter (40), having a single digital output (110) and an electrical connection point for a plurality of analog inputs (41) and also a digital input (120), for being connected to other analog-to-digital converters (40).

[0054] In view of this description and set of drawings, the person skilled in the art could understand that the embodiments of the invention that have been described can be combined in many ways within the object of the invention.

Claims

1. Measurement module (100, 100', 101, 101', 100") for being connected to three output contacts (5, 5') of a three-pole fuse block base (1), where said measurement module (100, 100', 101, 101', 100") is connectable to the output contacts (5, 5') of the fuse block base (1), on which at least one intensity transformer is mounted to provide at least one analog current measurement signal;
characterized in that it further comprises an analog-to-digital converter (40) with at least one analog input (41) configured to receive said at least one analog current measurement signal, and with at least one digital connection port comprising at least one digital output (110).

2. Module according to claim 1, connectable to the output contacts (5, 5') of the fuse block base (1) by means of conductive elements (20, 20').

3. Module according to claim 2, wherein the conductive elements consist of conductive strips (20).

4. Module according to any of claims 1 and 2, wherein the measurement module is connectable to output contacts (5, 5') of the fuse block base (1) by means of conductive elements consisting of cables (20').

5. Module according to any of claims 2 to 4, comprising at least one voltage connection established by means of an auxiliary conductive element contacting an element selected from the conductive elements (20, 20'), the output contacts (5, 5') or a connection element of said conductive elements (20, 20') and said output contacts (5, 5') to an electrical connection point (30, 30', 30").

6. Module according to any of the preceding claims, comprising a casing (11) containing said at least one intensity transformer.

7. Module according to any of the preceding claims, **characterized in that** the analog-to-digital converter (40) is an integral part of the measurement module.

8. Module according to any of the preceding claims, **characterized in that** it further comprises a terminal block (30') for being connected to the plurality of analog inputs (41) of the analog-to-digital converter (40).

9. Module according to any of the preceding claims, **characterized in that** the analog-to-digital converter (40) further includes at least one digital input (120).

10. Module according to any of claims 6 to 9, **characterized in that** the analog-to-digital converter (40) can be fixed to the casing (11) of the module.

11. Fuse block base comprising a measurement module according to any of claims 1-10.

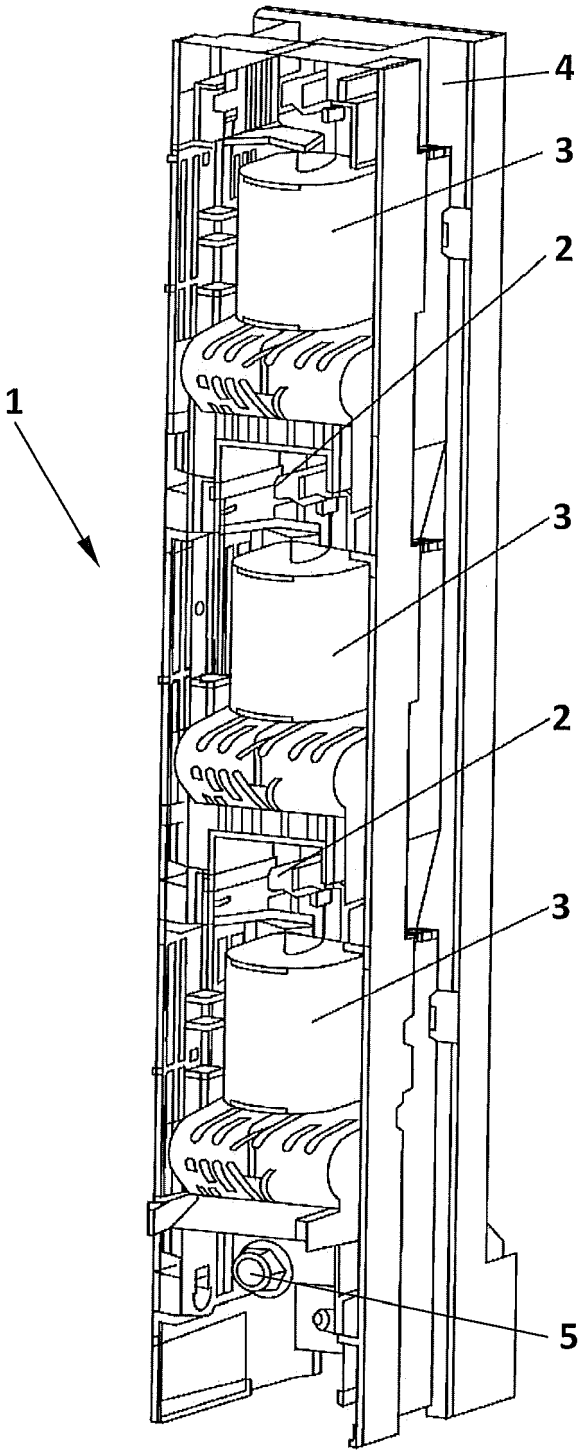


FIG. 1
PRIOR ART

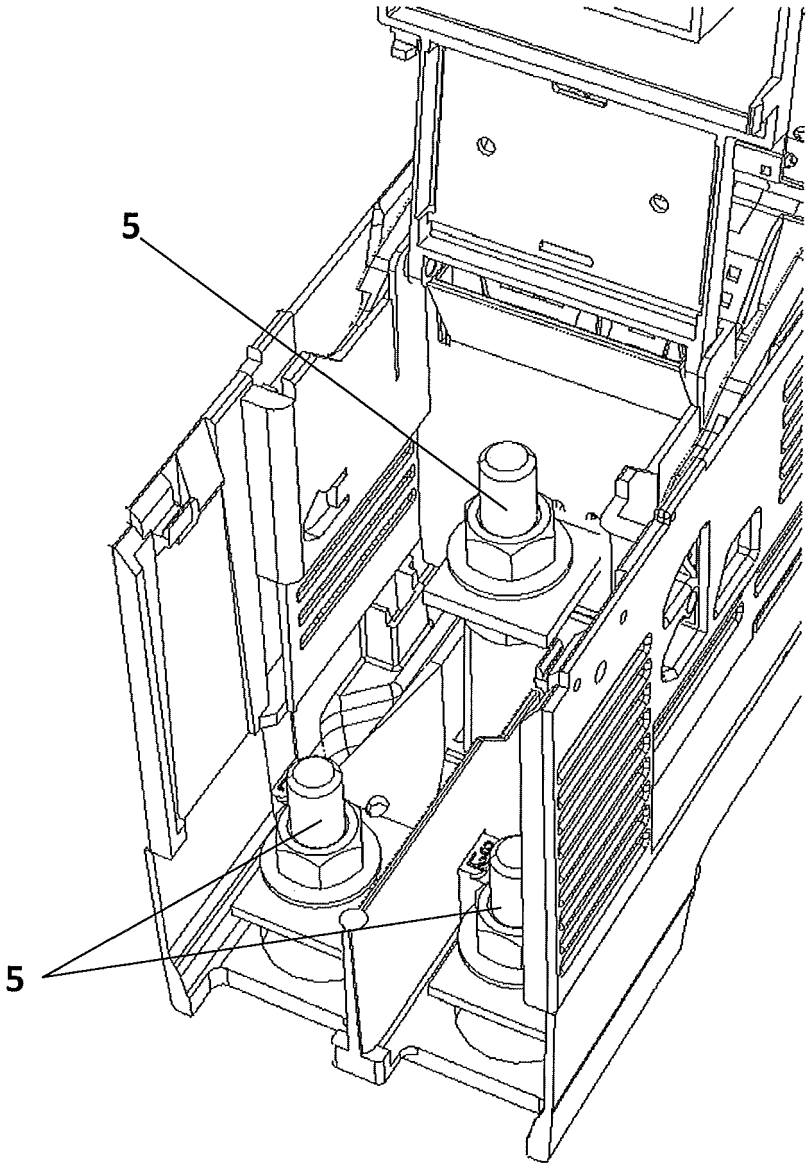


FIG. 2
PRIOR ART

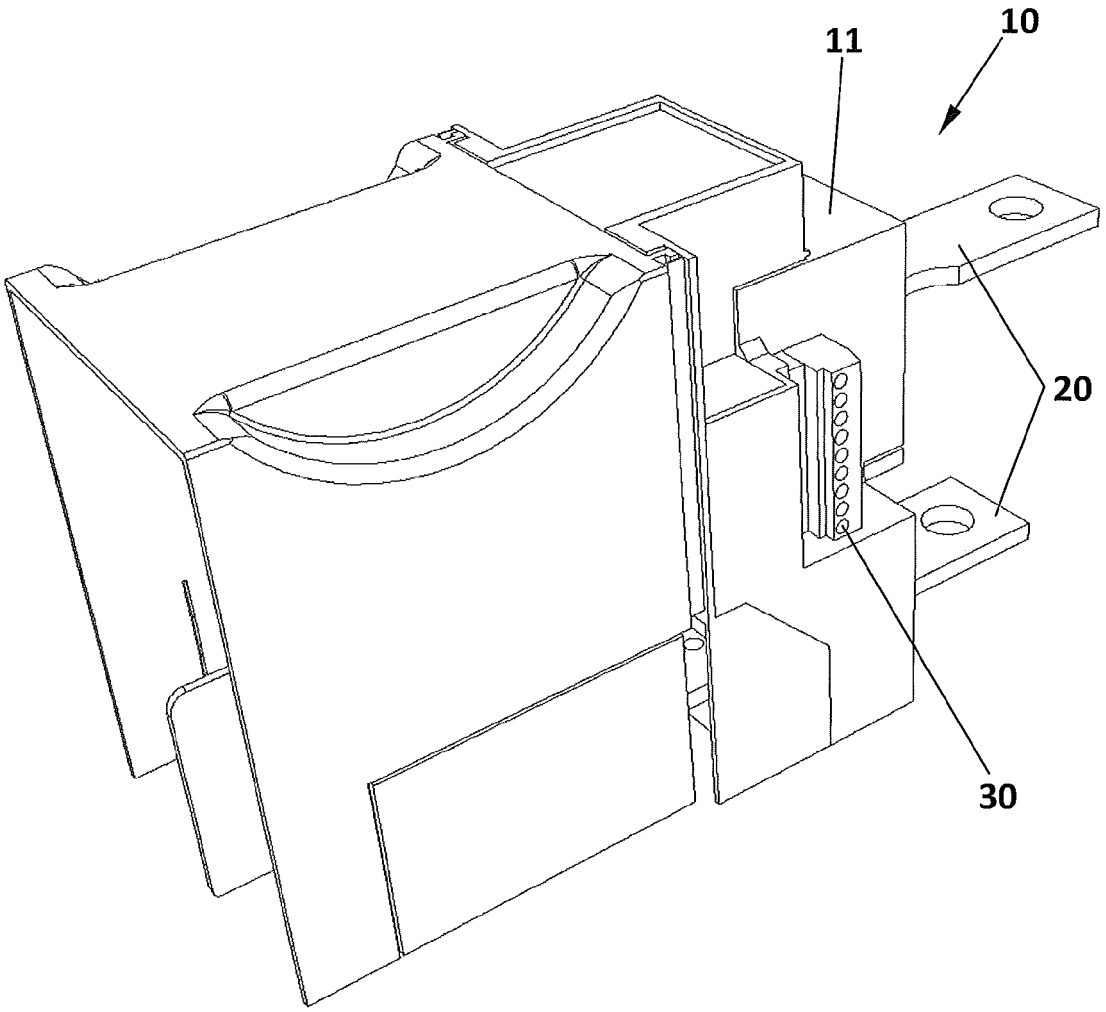


FIG. 3
PRIOR ART

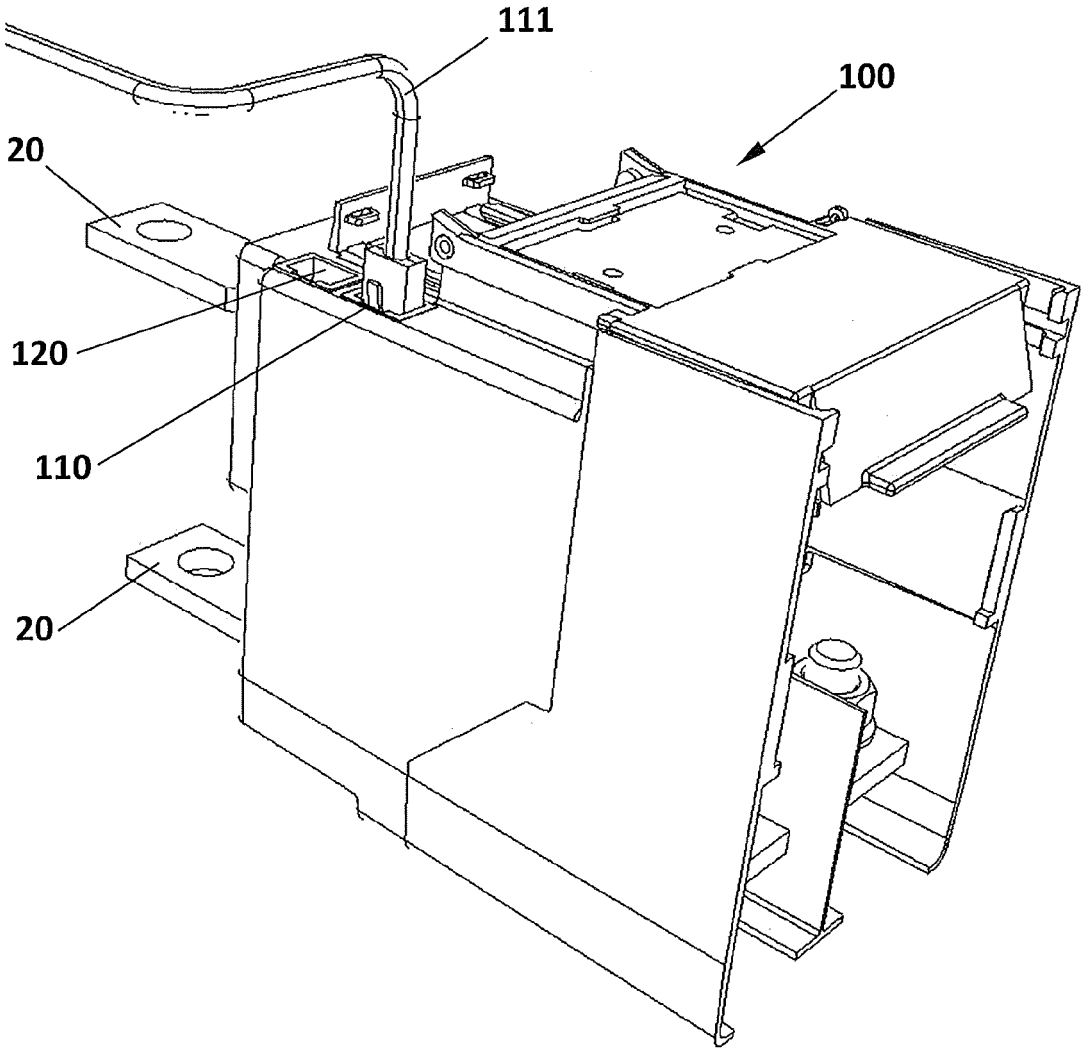


FIG. 4

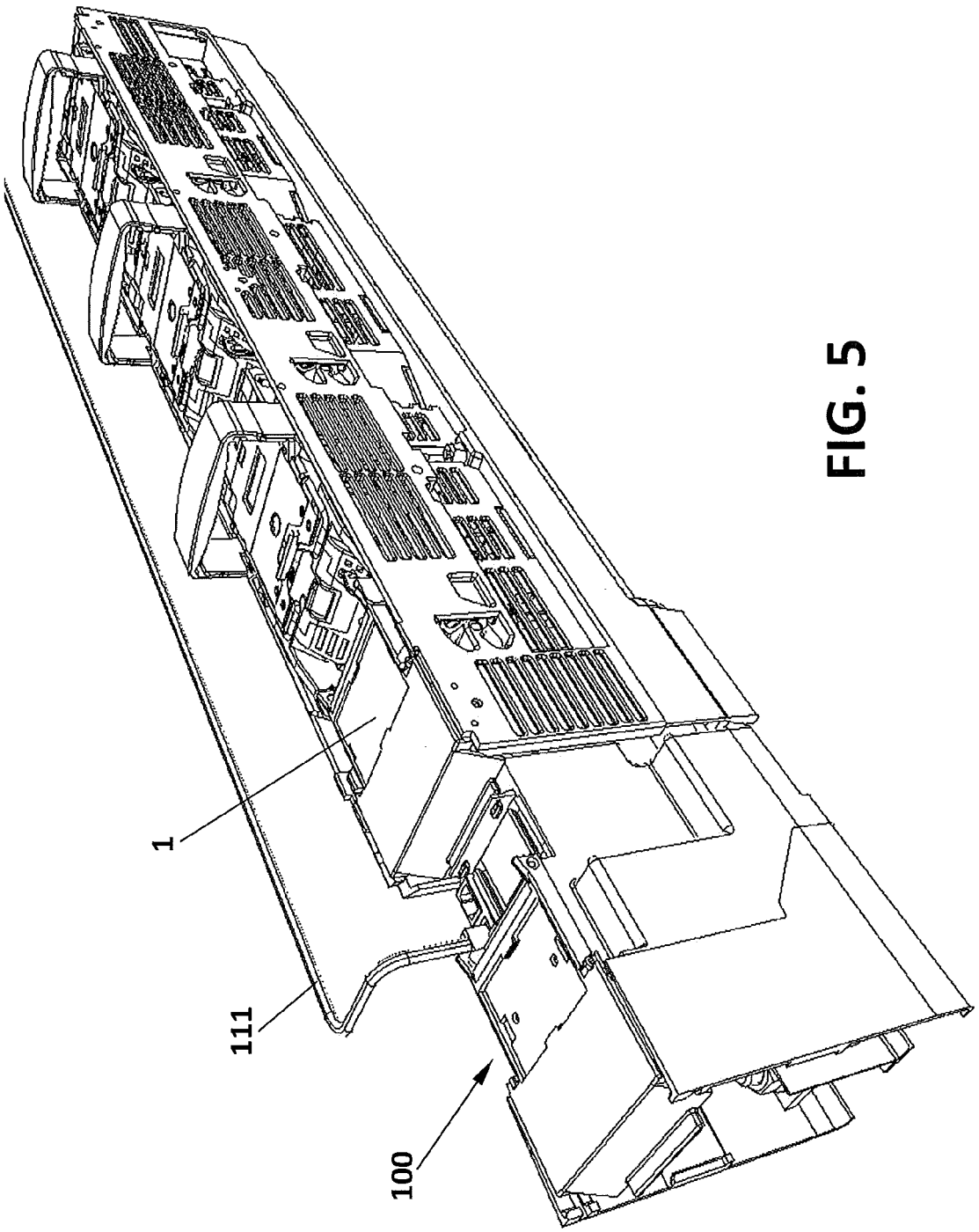


FIG. 5

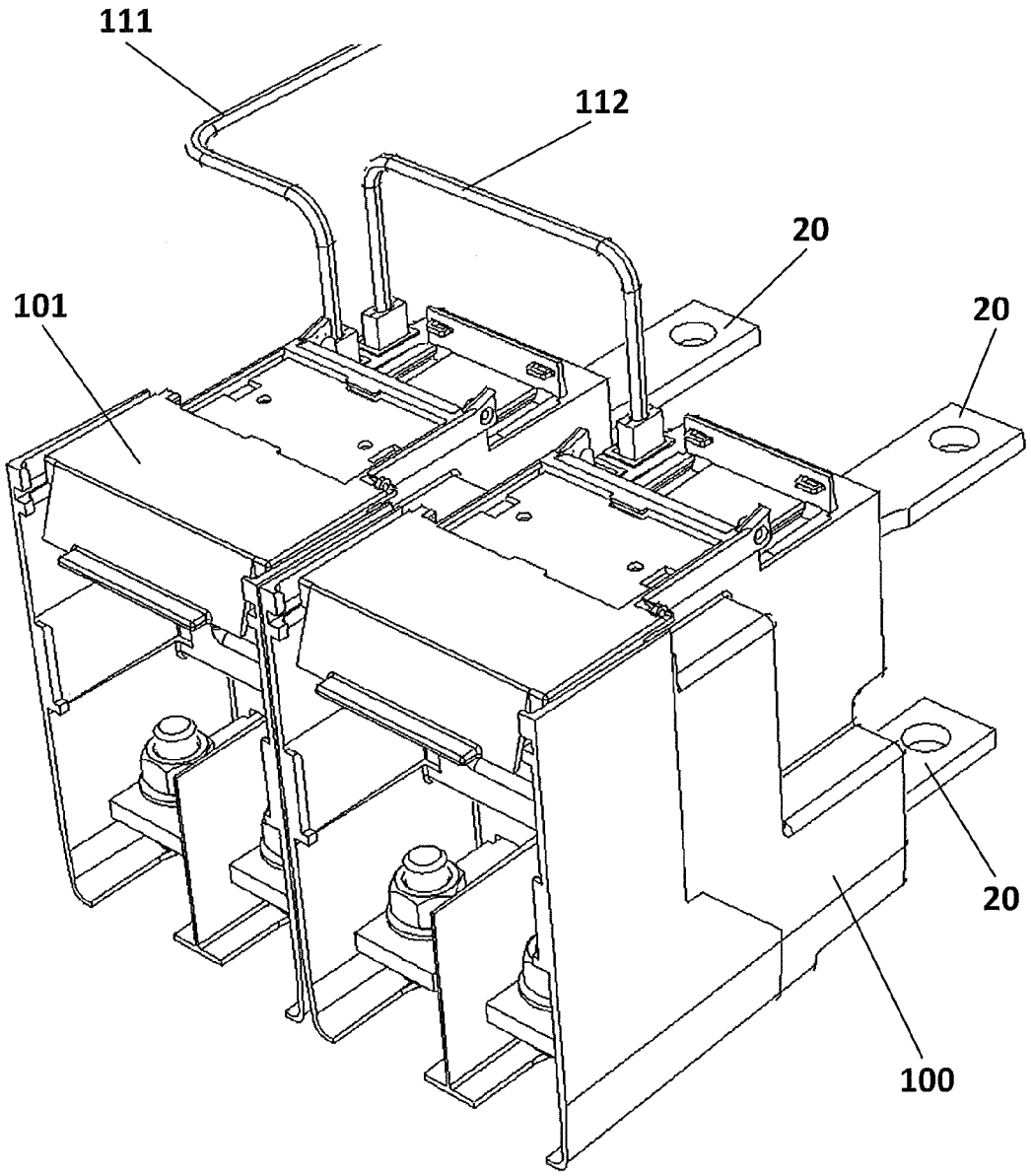


FIG. 6

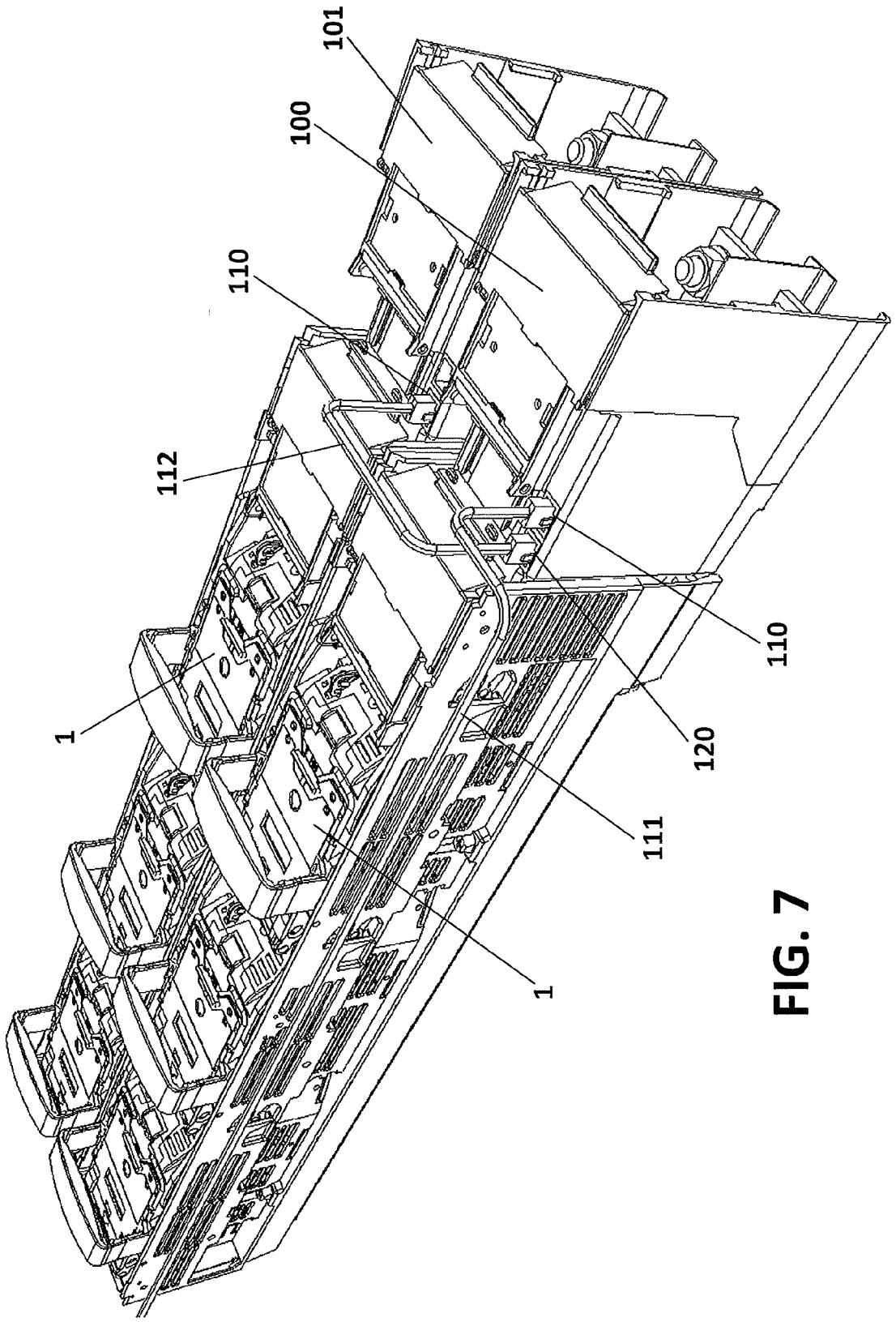


FIG. 7

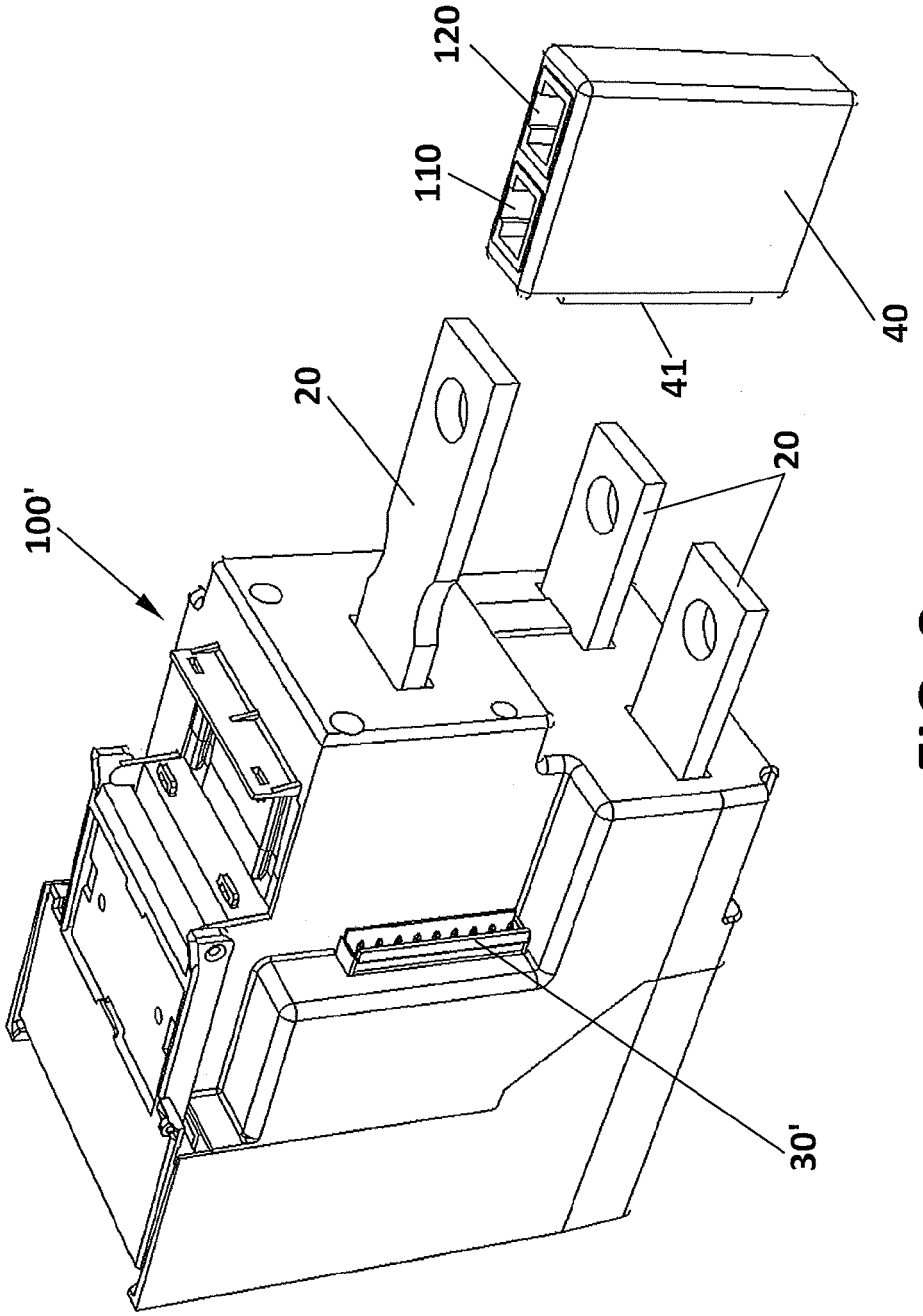


FIG. 8

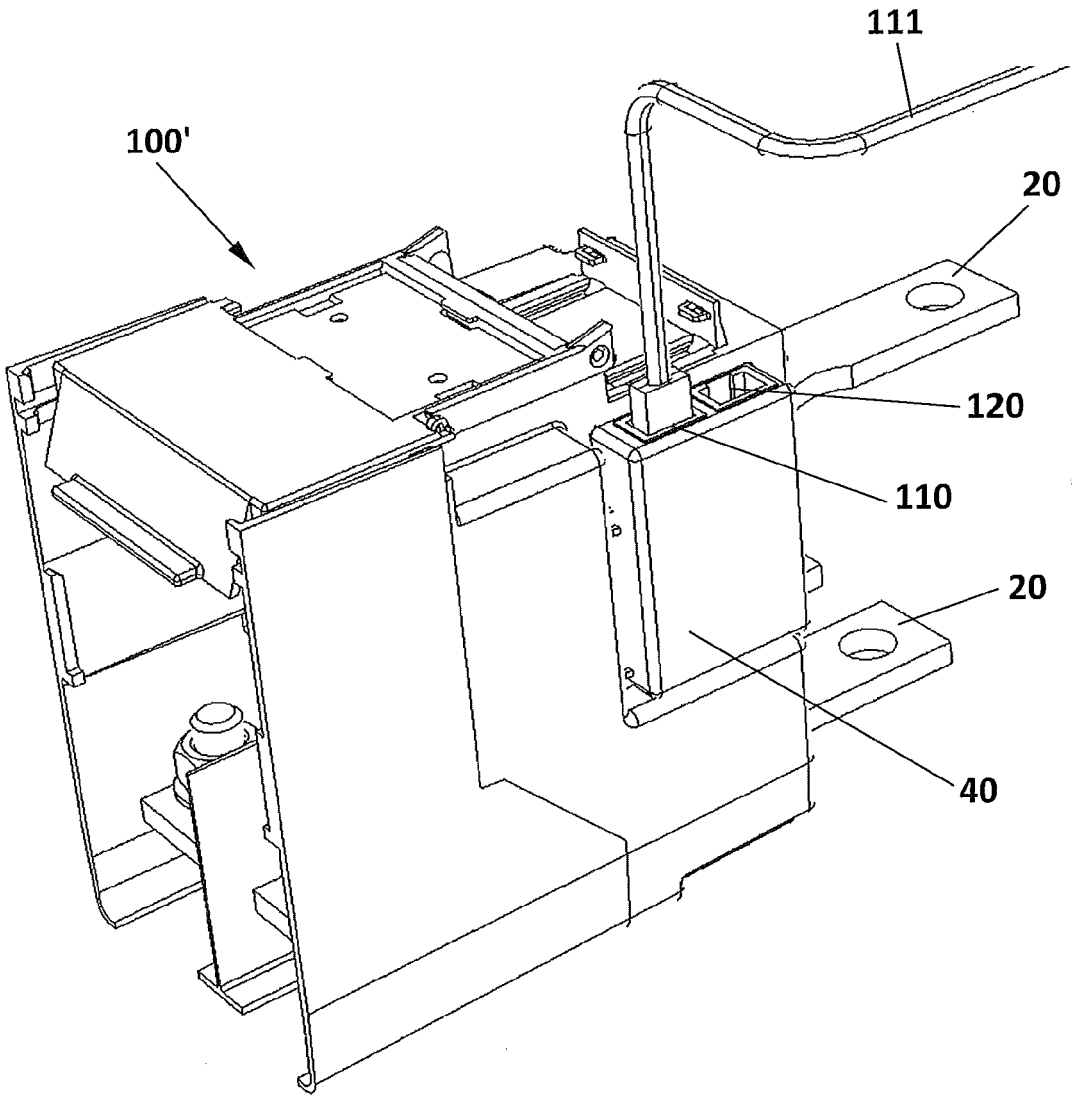


FIG. 9

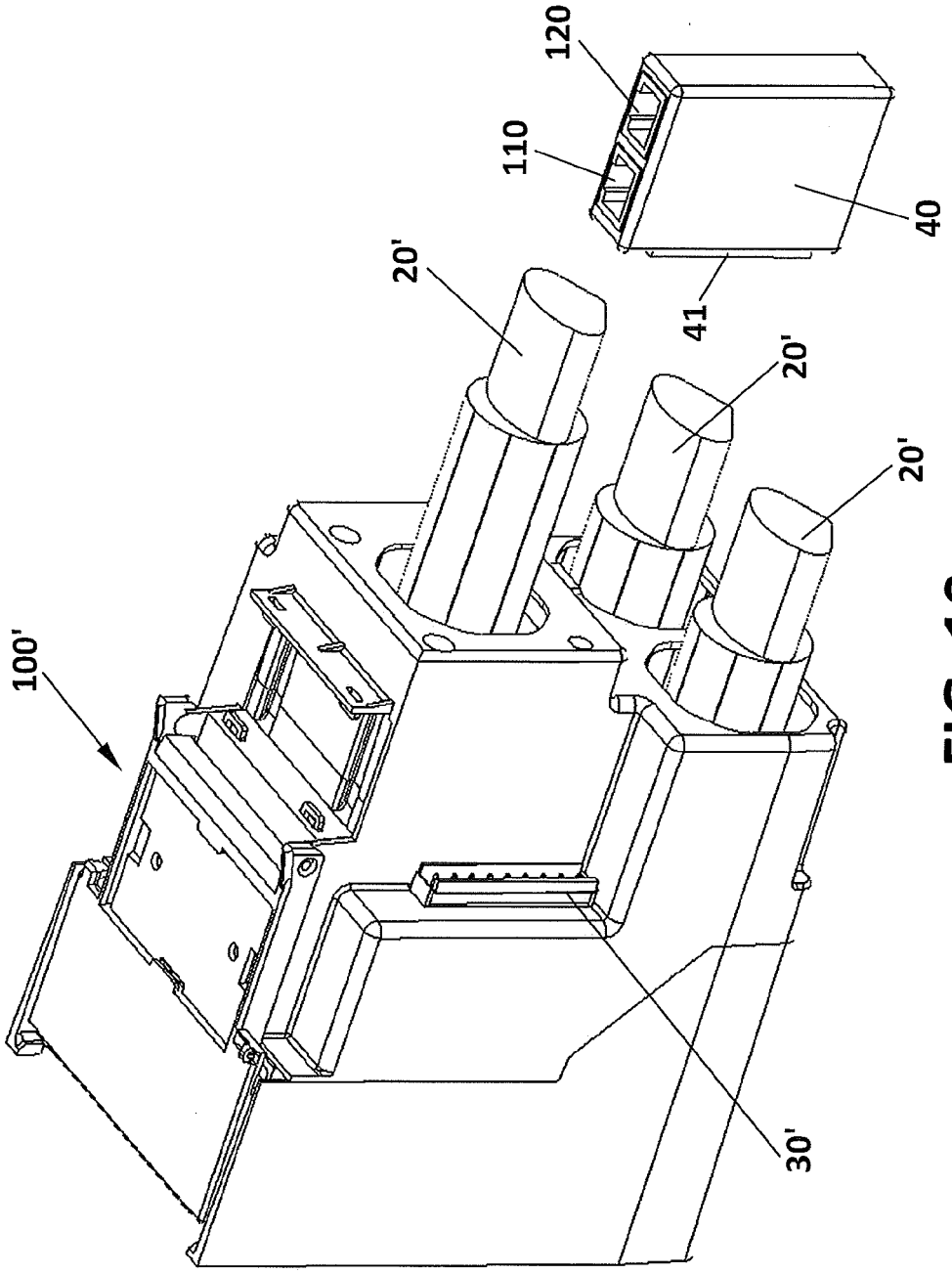


FIG. 10

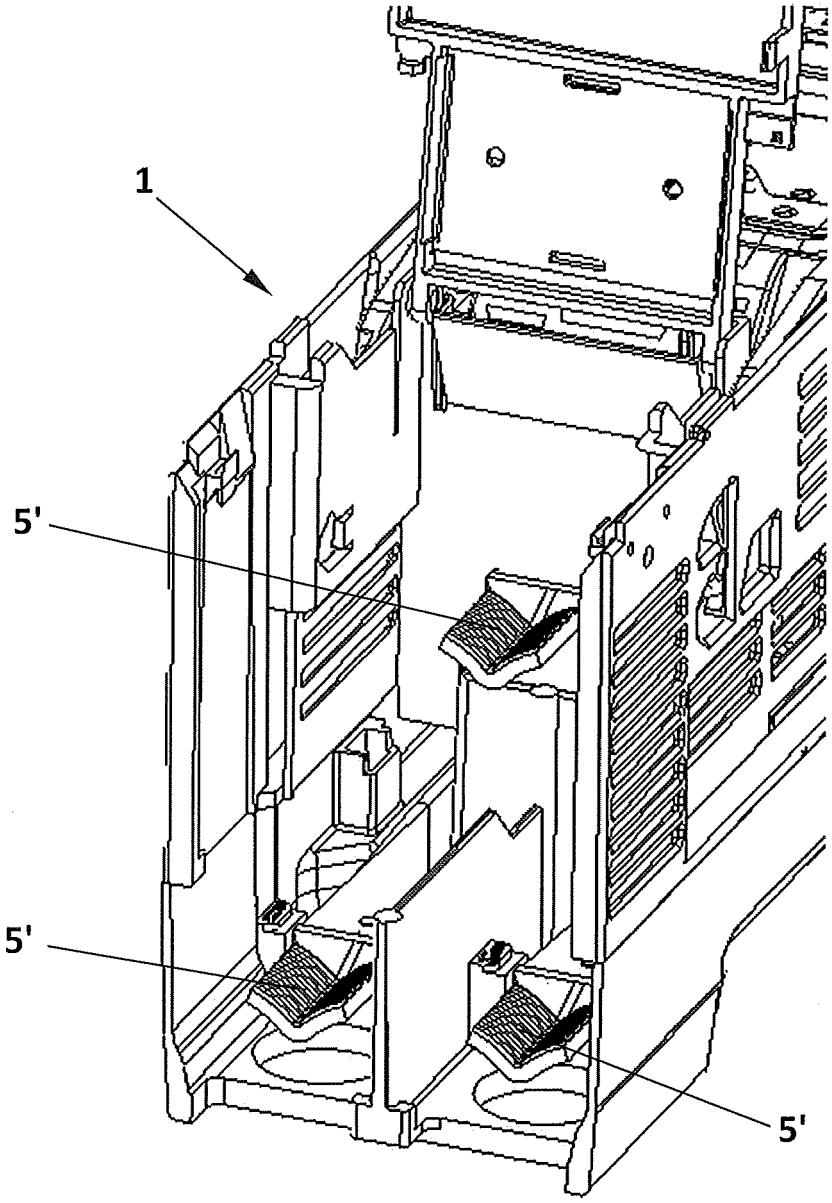


FIG. 11
PRIOR ART

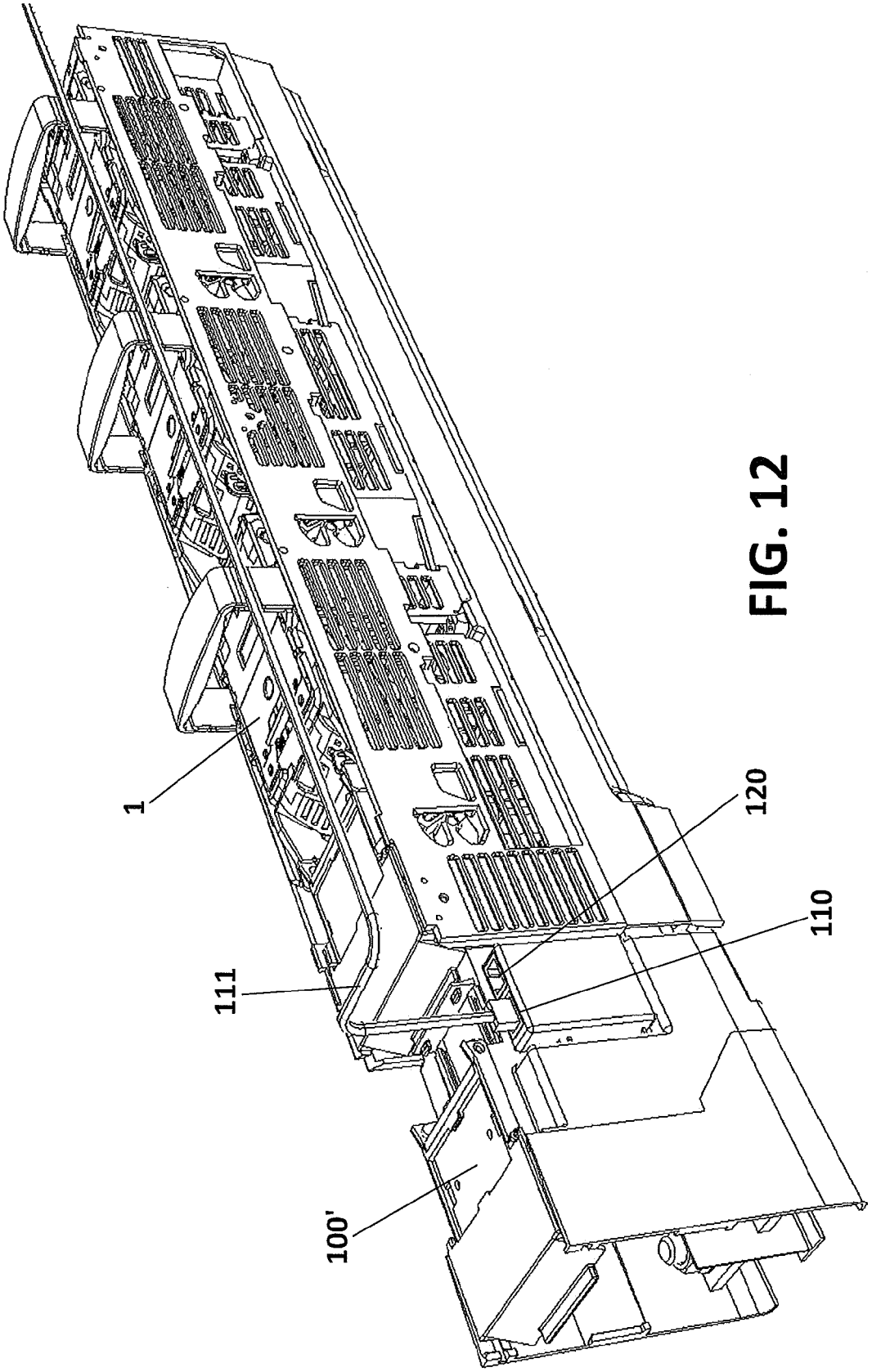


FIG. 12

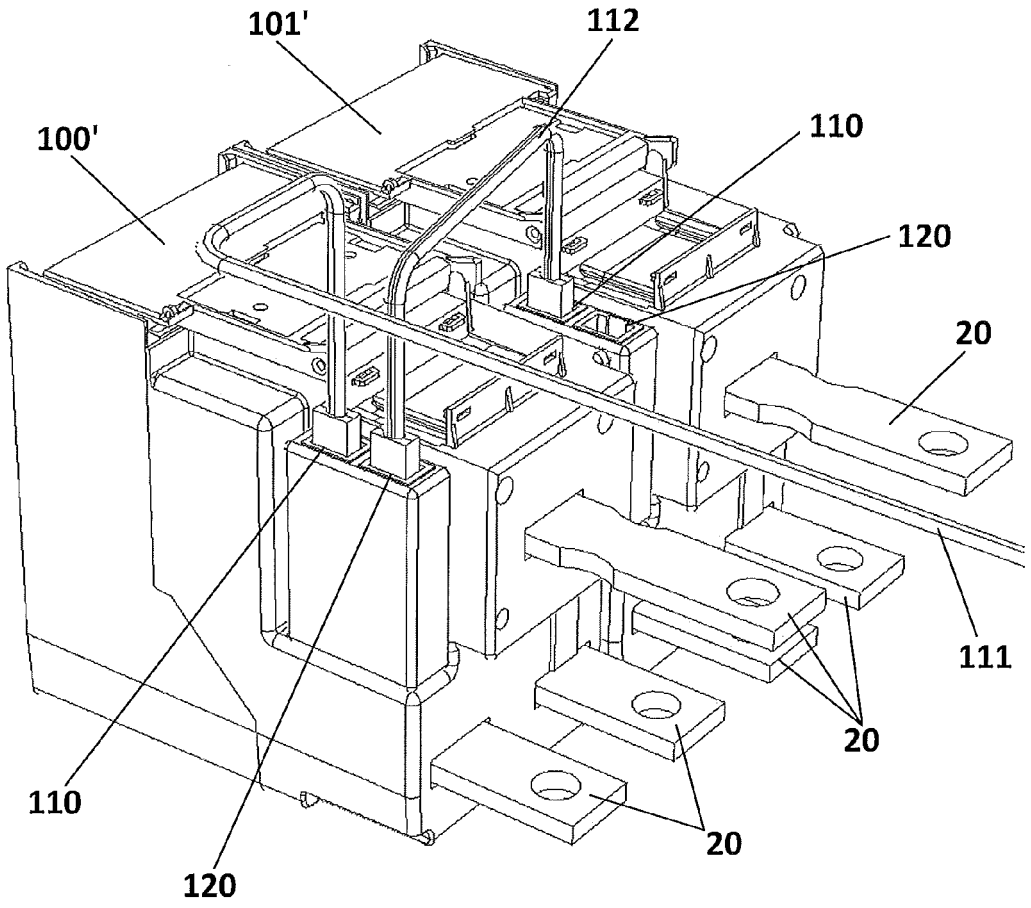


FIG. 13

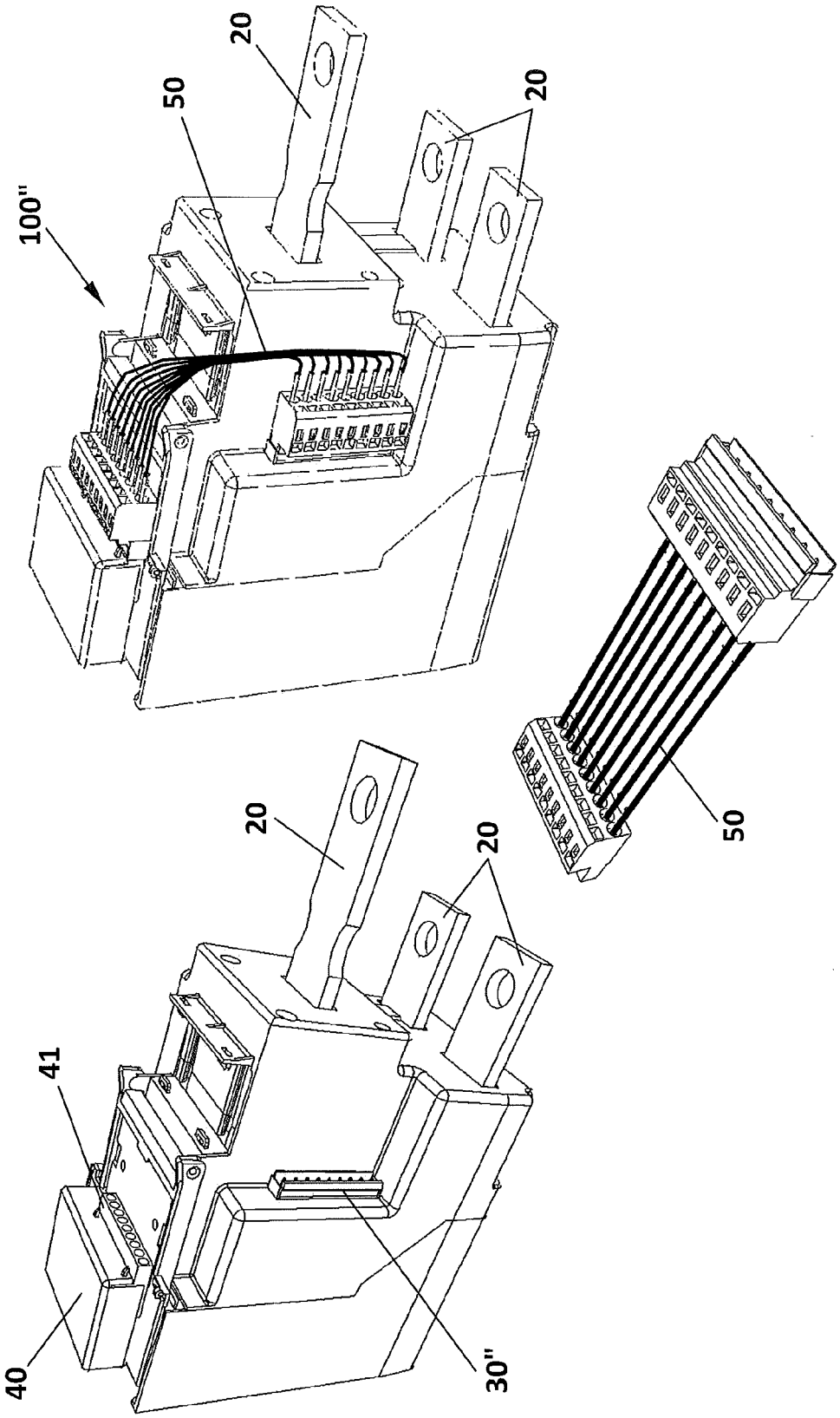


FIG. 14

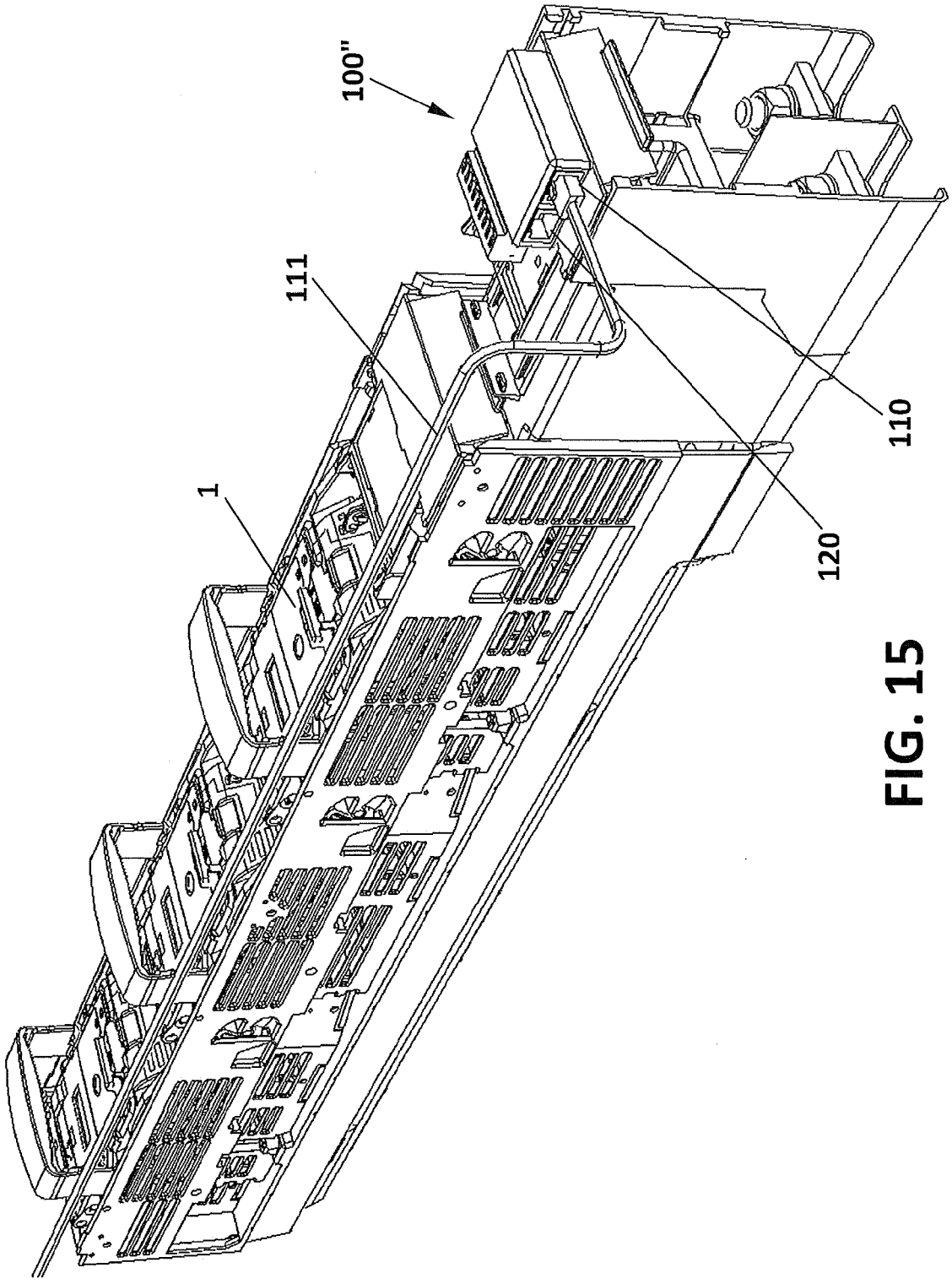


FIG. 15

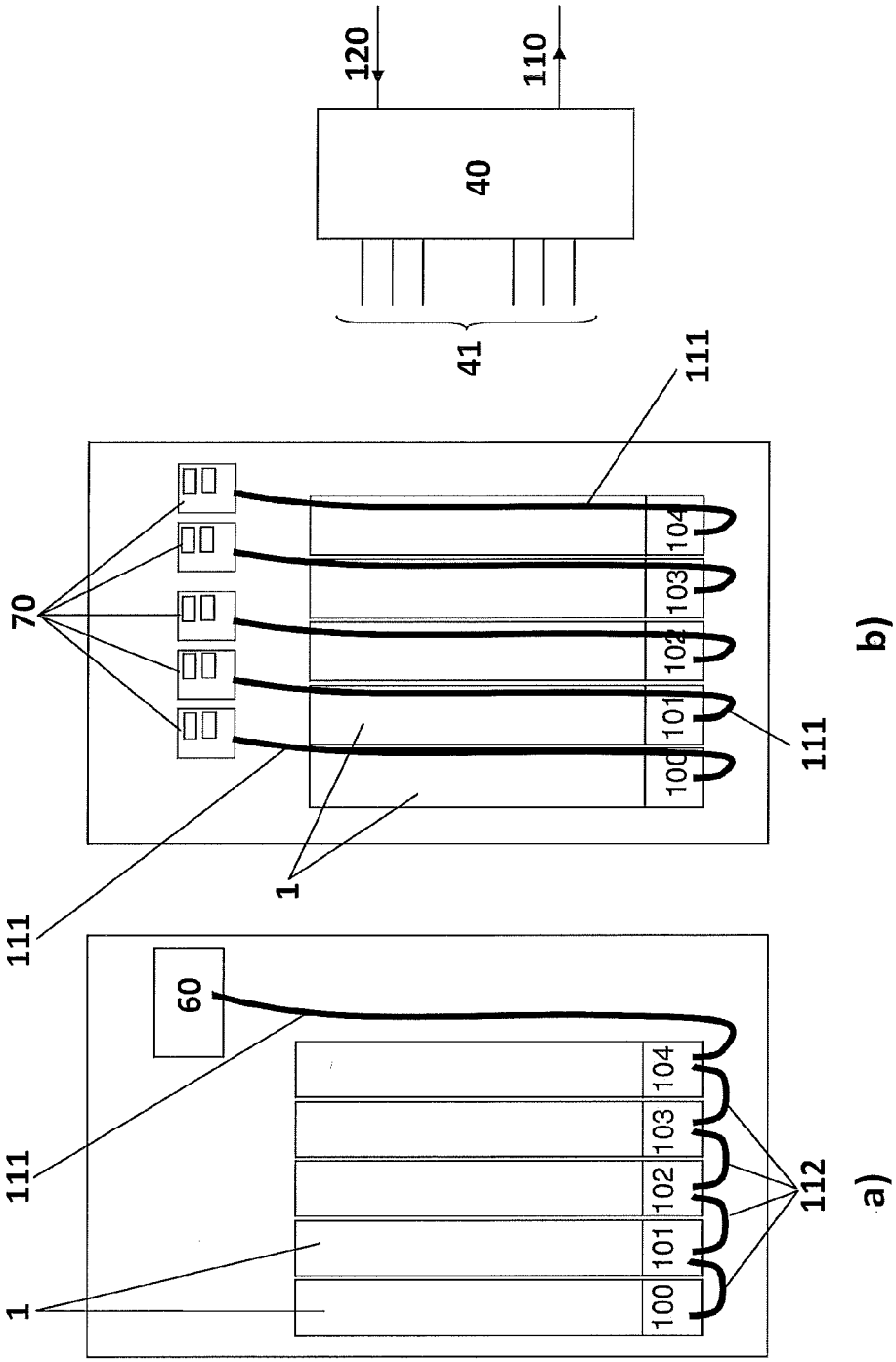

120
110
40
41
111
70
104
103
102
101
100
111
1
b)
111
60
111
1
104
103
102
101
100
112
a)

FIG. 16

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EUROPEAN SEARCH REPORT

Application Number
EP 13 38 2082

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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H01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 July 2013	Nieto, José Miguel

CATEGORY OF CITED DOCUMENTS

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