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(54) Two electrically interconnected juxtaposed electrical devices mounted in an electrical switchboard

(57) A power switch (10) and a differential module (11) are mounted side by side on a common support (12) and are connected to one another electrically by substantially rigid metal strips (21) which extend, for part of their length, through a passageway (20) delimited by the adjacent sides of the two devices.

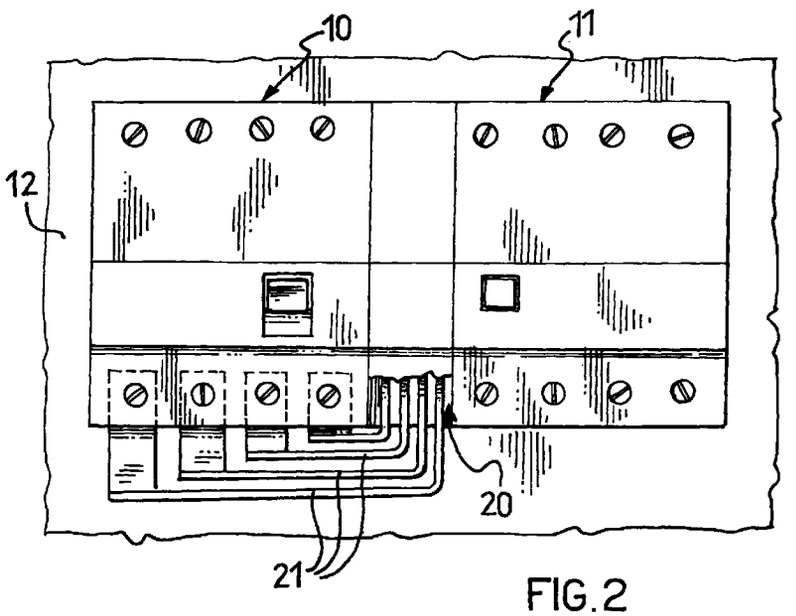

FIG.2

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Description

[0001] The present invention relates to electrical switchboards and, more particularly, to a combination of two electrical devices and of means for electrical connection between them.

[0002] In an electrical switchboard, it is sometimes necessary to connect two devices in series, that is, with the output connections of one device connected to the input connections of the other. This is the case, for example, with a cut-out switch in an electrical system and a differential device associated with the switch. The differential device detects any earth leakage currents in the system and causes the switch to open if the leakage current detected exceeds a predetermined safety value.

[0003] For the supply of low-voltage electrical energy (125-690V) with medium-high currents (100-400A), the switch used also comprises devices for protection against any over-currents or over-voltages, these devices being disposed in the same box-shaped body of rigid plastics material which contains the switch and which performs the dual function of a mechanical support for its fixed and movable portions and of an insulator between the live metal parts. In applications in which it is also necessary to interrupt the supply of electrical energy to the system in the presence of earth leakage currents, as may occur, for example owing to an accidental contact between persons and live parts of the system, a differential device is connected in series between the switch and the electrical system. This device can detect even very low leakage currents and can supply a corresponding signal to the associated switch to open its contacts by means of a suitable tripping device.

[0004] Switches and differential devices are formed in a manner such that their input connections, that is, those which are to be connected to the electrical supply mains, are accessible from one side of the respective box-shaped body, and their output connections, that is, those for connection to the electrical system to be supplied, are accessible from the opposite side.

[0005] By convention, all of the devices of the same electrical switchboard are mounted with the same orientation, for example, all with their input connections at the top and with their output connections at the bottom.

[0006] When the differential device can be mounted below the switch, the connection between the two devices is very simple and requires only short connectors for connecting the output connections of the switch to the input connections of the differential device. If, however, the differential device has to be mounted beside the switch, the connection requires longer and more bulky connectors. Normally, use is made of flexible insulated conductors each of which has one end fixed to one of the input connections of the differential device and which extend through a space in the bottom of the box-shaped body of the differential device emerging from the same side as the output connections of the differential device, the opposite end of each conductor being fixed to one of the output connections of the switch, as shown in Figure 1.

[0007] This configuration has some disadvantages which limit its use. More particularly, the larger the cross-section of the wires is, the more problematical their arrangement becomes, so that it is not convenient to exceed certain nominal-current values. Moreover, the need for the space through which the wires extend leads to a considerable increase in the depth of the differential device. Finally, the electrical and dynamic stresses on the wires and on the devices in the event of a short-circuit necessitate the use of strong structures for fixing the wires and the devices. The intrinsic mobility of the flexible connections may in any case give rise to vibrations and movements such as to prejudice the mechanical connection and hence also the electrical connection between the wires and the connections of the devices.

[0008] To prevent these problems, according to the invention, the electrical connection means comprise a plurality of substantially rigid metal strips insulated from one another electrically and extending, for part of their length, through a passageway defined by the two adjacent sides of the two devices.

[0009] A better understanding of the invention will be gained from the following detailed description of an embodiment thereof, given by way of non-limiting example with reference to the appended drawings, in which:

Figure 1 shows, in perspective, a known combination of two electrical devices with respective electrical interconnection means,
Figure 2 is a front view of a combination according to the invention of a switch, a differential device, and means for connection between them, and
Figure 3 is a front view of the differential device of Figure 2, without the portion covering its box-shaped body, and of the means for connecting the differential device to the switch.

[0010] As can be seen in Figure 1, a four-pole electrical power switch and a differential device, also with four poles, are indicated 10 and 11, respectively, and are mounted side by side on a common support panel 12 of an electrical switchboard by suitable fixing means, not shown. The switch 10 is mounted on a spacer base 8 of a thickness such that the front of the switch is aligned with the front of the differential device 11. The mechanical connection between the two devices is strengthened by U-shaped clips, indicated 9, which can be snap-engaged in suitable seats provided in their box-shaped bodies.

[0011] The switch 10 has four input connections accessible through corresponding holes 13 in the top of its box-shaped body. The connections are constituted, for example, by plates with threaded holes and respective fixing screws, not shown, which can be operated

through corresponding holes 14 provided in the front of the switch body. Four output connections, just the same as the input connections, are accessible through corresponding holes provided in the bottom of the switch body.

[0012] Similar output connections are provided on the bottom of the differential device 11. The latter also has four input connections but these are not accessible from outside the device. However, one of them, indicated 15, is made visible in the drawing by the removal of a portion of the top of the differential body. The ends of four flexible electrical wires 16 with insulating sheaths are fixed to these four input connections during the assembly of the device, the wires extending through a space 17 along the rear of the differential body 11 and emerging from the bottom of the device through suitable holes in the bottom of the body. The opposite ends of the wires 16 can be inserted and clamped in the output connections of the switch 10. In the drawing, only two wires are shown connected.

[0013] The usual accessories and the usual connection elements which enable the differential device to cause the switch to open in the event of earth leakage currents greater than the predetermined limit value are also provided but are not shown.

[0014] In Figures 2 and 3, in which elements the same as those of Figure 1 are indicated by the same reference numerals, an electrical switch 10 and a differential module 11 are again shown side by side on a panel 12 but a certain distance apart so as to define a passageway 20 between their two adjacent sides.

[0015] Instead of the interconnection wires 16, four metal strips 21 are provided and extend, for part of their length, through the passageway 20. The strips 21 are bent, as can be seen in particular in Figure 3 and their ends have holes 22 for fixing to the connections by means of screws 23. In this embodiment, each strip is formed by an intermediate portion which extends through the passageway 20 and is bent at 90° at two points, and by two small plates with holes welded to the two ends of the intermediate portion. An insulating sheath, preferably formed by immersion in a thermosetting epoxy resin and subsequent drying, covers the strips, insulating them from one another electrically, naturally except for the ends with the holes.

[0016] In this embodiment, the passageway 20 houses, above the strips 21, a known device 24, associated with the switch 10, for detecting and indicating the state of the switch. The device 24 comprises an arm 24a which interferes with a linkage of the switch through a suitable side opening in the switch body, and a microswitch 24b operated by the am 24a. As can be seen in Figure 2, the passageway 20 is closed by a covering panel which is connected to the fronts of the two devices disposed side by side.

[0017] The combination according to the invention has many advantages:

the differential device has a box-shaped body the thickness of which is reduced to that which is strictly necessary for the actual electrical device, since it does not have a space through which the wires can extend; it is not therefore necessary to mount the switch on a spacer base in order to align the fronts of the devices, nor is it necessary to provide specific box-shaped bodies with spaces for differential devices to be mounted beside switches;

the stiffness and strength of the connecting strips are such that restraining devices between the switch and the differential device, such as the clips 9 shown in Figure 1, are rendered superfluous;

the electrical and dynamic stresses on the connections in the event of short-circuit are limited;

there are no wires extending through the region of the output connections of the differential device so that access to the connections is easier.

Claims

1. A combination of two electrical devices (10, 11) and of means (21) for electrical connection between them, in which the two electrical devices are mounted on a common support (12) with two sides disposed adjacent one another and each device has input connections on one side and output connections on an opposite side, and in which the electrical connection means (21) are fixed between the output connections of one (10) of the devices and the input connections of the other device (11), characterized in that the electrical connection means comprise a plurality of substantially rigid metal strips (21) insulated from one another electrically and extending, for part of their length, through a passageway (20) defined by the adjacent sides of the two devices.

2. A combination according to Claim 1, in which the metal strips (21) are covered by a sheath of epoxy resin.

3. A combination according to Claim 1 or Claim 2, in which the two electrical devices are a switch (10) and a differential device (11).

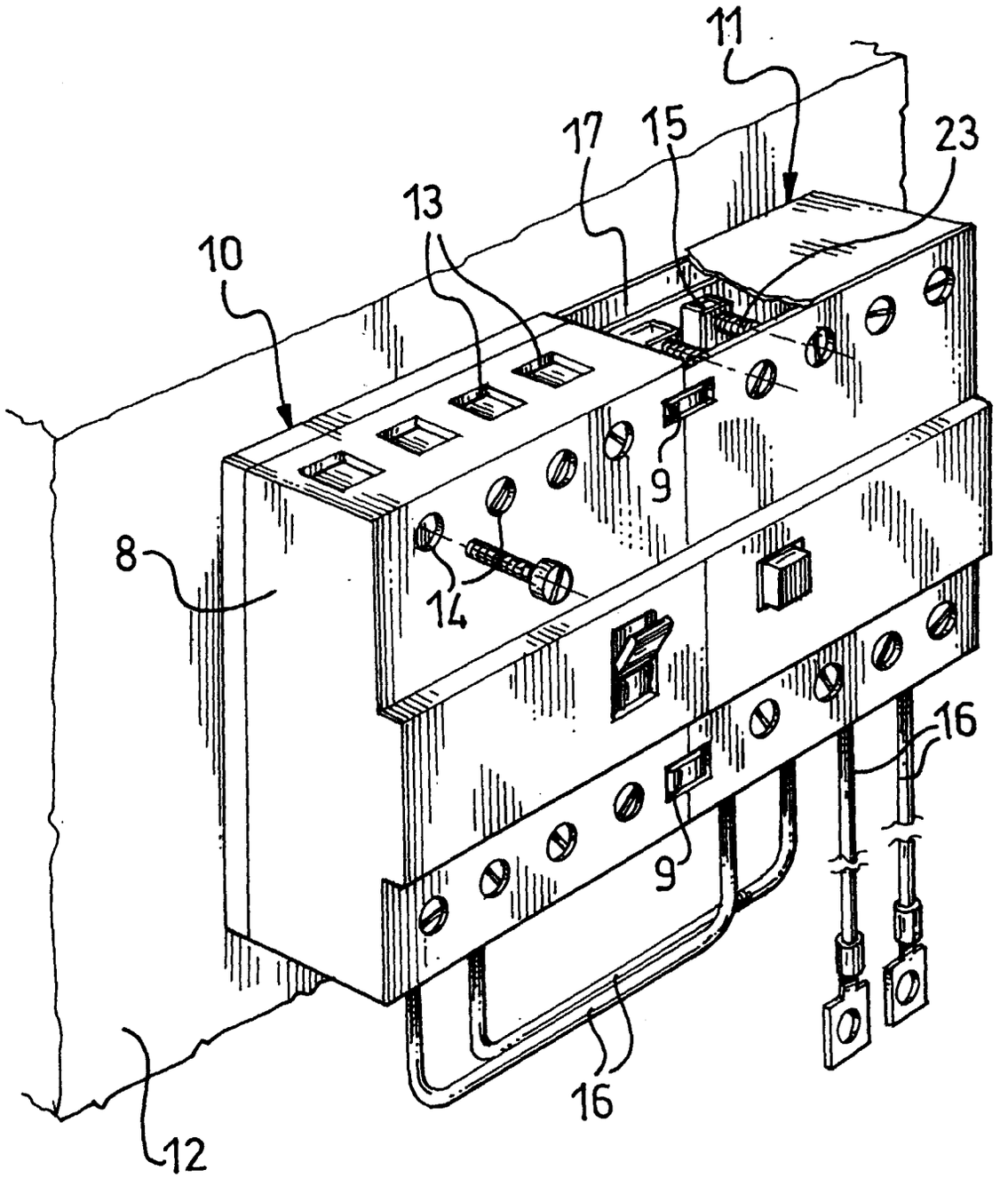

FIG.1

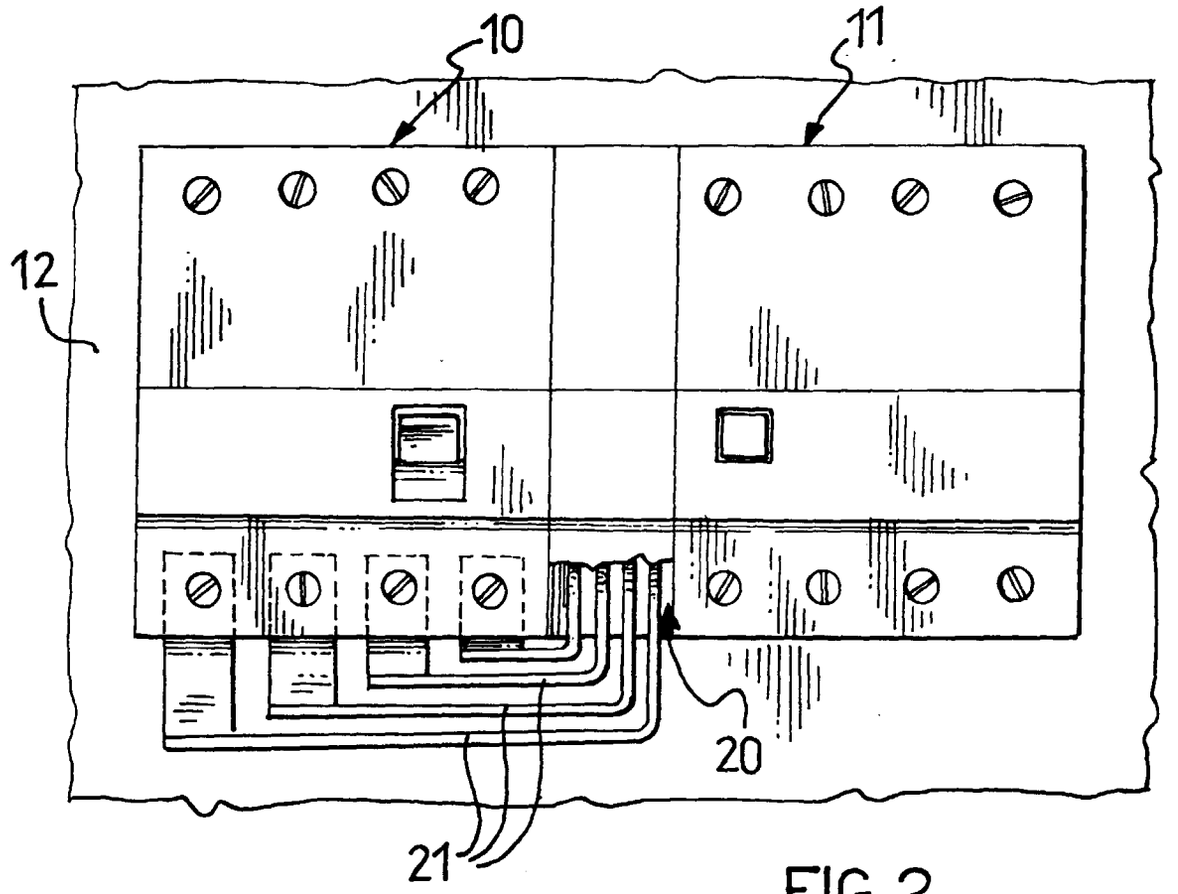

FIG.2

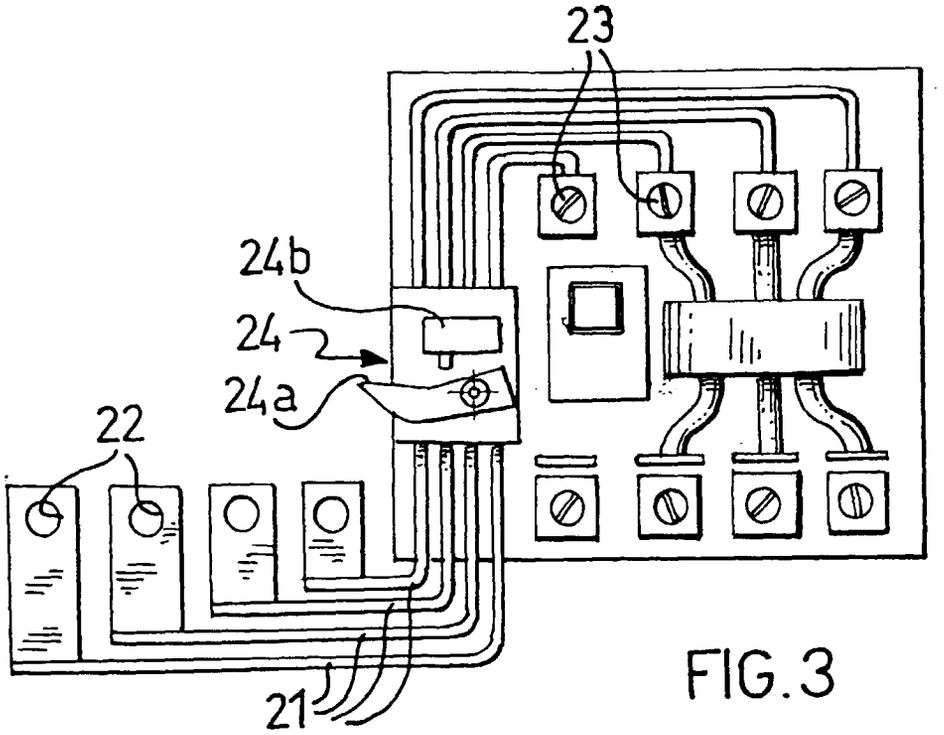

FIG.3