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(54) **Electrical switching device for low voltage circuits**

(57) An electrical switching device for low voltage circuits comprising an enclosure having a front wall, a rear wall, a first lateral wall, a second lateral wall, a lower wall and an upper wall that define a volume for containing the members of said switching device, said enclosure comprising:

- a first section that defines a first housing space for a switching unit that comprises one or more electrical poles, each of said electrical poles comprising at least one fixed contact and one moving contact, mutually couplable/decouplable;
- a second section that defines a second housing space for a control mechanism of the moving contacts of said electrical poles;
- a third section that defines a third housing space for one or more accessory devices of said switching device;

An electrical switching device is characterized in that said front wall comprises a first shaped portion and a second shaped portion adapted to respectively close the housing spaces defined by said second and third section, at said front wall, said first and second shaped portion being mechanically separable from one another.

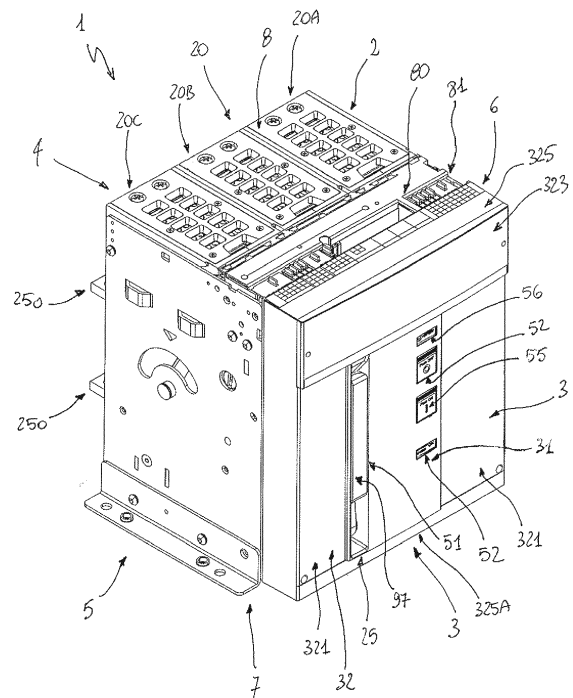


FIG. 1

Description

[0001] The present invention refers to an electrical switching device, for example a switch, a disconnecter or a contactor, preferably for use in low voltage circuits.

[0002] As it is known, electrical switching devices (briefly "switching devices") used in low voltage electrical systems (i.e. for applications with operating voltages up to 1000V AC / 1500V DC), are devices conceived to enable the correct operation of specific parts of electrical systems and of the loads operatively associated therewith.

[0003] A switching device generally comprises a switching unit provided with one or more electrical poles.

[0004] Each electrical pole comprises at least one fixed contact and a respective moving contact, electrically connected to corresponding terminals for connection with the line conductors of an electric line.

[0005] Suitable control means enable the moving contacts to be moved so as to couple/separate them with/from the corresponding fixed contacts.

[0006] In a switching device, the movement of the moving contacts can be determined by the manual operation of the operator or by the operation of a protection and control unit (i.e. an electronic relay), operatively associated with the switching unit, where provided.

[0007] A switching device can be provided with auxiliary devices, such as the aforesaid protection and control unit, the main function of which is to regulate the operation of the switching unit, according to functions that can be predefined or set by the operator through suitable user interface means.

[0008] Moreover, a switching device can also be provided with various accessory devices, operatively associated with the switching unit to perform predetermined functions, for example auxiliary contacts, contacts to signal the status of the switching device (open, closed), spring charging actuators, solenoid release devices, sensors and the like.

[0009] Prior art switching devices have some problems.

[0010] As it is known, these comprise an enclosure inside which there are defined various sections for housing the switching unit, the control mechanism, any protection and control unit and any accessory devices.

[0011] In general, the front wall of the enclosure is arranged so as to have a single closing panel of the housing spaces destined to house the control mechanism and the accessory devices.

[0012] It is therefore necessary to remove this closing panel in order to perform any operation that requires access to the housing spaces of the control mechanism or of the accessory devices. The control mechanism of the switching unit is therefore accessible each time this closing panel is removed for each reason, and therefore also while performing ordinary maintenance operations (in general performed by unskilled personnel), for example to install an accessory device in the related housing

space.

[0013] It is evident how this causes noteworthy problems with regard to the operation and safety of the switching device.

[0014] The object of the present invention is to provide an electrical switching device for low voltage electrical circuits that has improved features with respect to prior art devices.

[0015] In particular, the present invention intends to provide an electrical switching device that is easy to operate and ensures relatively high safety levels.

[0016] A further object of the present invention is to provide an electrical switching device that is relatively easy to produce at competitive costs.

[0017] These objects are achieved by an electrical switching device according to the appended claims and to the description below.

[0018] Further features and advantages of the electrical switching device according to the present invention will be more apparent from the description of preferred, but not exclusive, embodiments of a switching device according to the present invention, shown by way of example in the accompanying drawings, wherein:

- Fig. 1 is a perspective front view of an embodiment of an electrical switching device according to the present invention;
- Figs. 2-6 are partially exploded perspective views of the electrical switching device of Fig. 1.

[0019] With reference to the aforesaid figures, the electrical switching device 1 (hereinafter "switching device 1") comprises an enclosure 2, substantially prismatic in shape and provided with a front wall 3, a rear wall 4, a first lateral wall 5, a lateral wall 6, a lower wall 7 and an upper wall 8.

[0020] The walls 3, 4 are in mutually opposite positions with respect to the switching device 1, as are the pair of lateral walls 5, 6 and the pair of lower and upper walls 7, 8.

[0021] The walls 3, 4, 5, 6, 7, 8 of the enclosure 2 define a volume for containing the members of the switching device 1.

[0022] The switching device 1 can be of fixed or withdrawable type.

[0023] In the first case, the enclosure 2 is fastened to a supporting structure (for example a switchboard) at the rear wall 4 and/or the lateral walls 5, 6.

[0024] In the second case, the enclosure 2 is operatively connected, at the lateral walls 5, 6, to a further supporting enclosure, in turn fastened to a supporting structure (for example a switchboard). Due to the action of manual or motorized actuating members, the switching device 1 can be moved between a position "inserted" in said further enclosure, in which it is electrically connected with an electric line, and a position "extracted" from said further enclosure, in which it is electrically disconnected from the aforesaid electric line.

[0025] Naturally, in both configurations considered, the

switching device 1 is positioned so as to have the rear wall 4 facing the supporting structure and the front wall 3 free, easily accessible to an operator.

[0026] The enclosure 2 of the switching device 1 comprises a first section 21 that defines a first housing space for a switching unit 20.

[0027] The switching unit 20 comprises one or more electrical poles 20A, 20B, 20C each of the which comprises at least one fixed contact and one moving contact (not shown), mutually couplable/decouplable, inside a corresponding arc chute (not shown).

[0028] The movement of the moving contacts of the switching unit 20 advantageously takes place due to a control mechanism 98, operatively associated with these latter.

[0029] Advantageously, the switching unit 20 is provided with electrical terminals 250 for electrical connection with the line conductors of an electric line. Preferably, the electrical terminals 250 protrude from the rear wall 4 of the enclosure 2.

[0030] Preferably, the section 21 of the enclosure 2 comprises one or more insulating partitions (not shown) adapted to define the housings for the electrical poles 20A, 20B, 20C and ensure optimal electrical insulation between these.

[0031] The enclosure 2 comprises a second section 22 that defines a second housing space for the control mechanism 98, operatively associated with the moving contacts of the electrical poles 20A, 20B, 20C.

[0032] The enclosure 2 also comprises a third section 23 that defines a third housing space for one or more accessory devices 91A, 91B, 91C, 91D, operatively connectable to the members of the switching device 1.

[0033] Preferably, the enclosure 2 also comprises a fourth section 24 that defines a fourth housing space for a protection and control unit 99 of the switching device 1.

[0034] The presence of the protection and control unit 99 depends substantially on the method of use of the switching device 1.

[0035] When this latter is used as disconnecter of an electric line, the protection and control unit 99 will be absent and the housing space defined by the section 24 of the enclosure 2 will remain substantially empty.

[0036] Preferably, the enclosure 2 also comprises a fifth section 25 that defines a fifth housing space for a manual control lever 97 (spring charging lever) operatively associated with the control mechanism 98.

[0037] With reference to normal vertical mounting of the switching device 1, the section 21 of the enclosure 2 is positioned operatively in proximity to the rear wall 4, between the lower 7 and upper 8 walls, while the sections 22, 23, 24, 25 are positioned in proximity to the front wall 3. Preferably, the sections 22, 23 are located in a position distal from the upper wall 8 of the enclosure 2 while the section 24 is positioned in proximity to this latter, above the sections 21, 22, 23, 25.

[0038] Preferably, the section 22 of the enclosure 2 is positioned in a central area of the front wall 3 while the

section 23 is positioned in proximity to at least one of the lateral walls 5, 6. Preferably, the section 23 is divided into two distinct compartments, each positioned in proximity to a lateral wall 5, 6.

[0039] In a first compartment, the section 23 advantageously comprises first seats 231A, 231B positioned in proximity to the lateral wall 5. The first seats 231A, 231B define a first plurality of third housing spaces for some accessory devices, for example for a spring charging motor 91A and one or more auxiliary contacts 91B.

[0040] In a second compartment, the section 23 advantageously comprises second seats 232A, 232B positioned in proximity to the lateral wall 6. The second seats 232A, 232B define a second plurality of third housing spaces for further accessory devices, for example for a plurality of signaling contacts 91C or a plurality of release devices 91D.

[0041] The described operating arrangement of the sections 21, 22, 23, 24, 25 of the enclosure 2 enables optimization of the housing space destined for the members of the switching device 1, in particular the housing space destined for the accessory devices 91A, 91B, 91C, 91D and for the protection and control unit 99.

[0042] The switching device 1 therefore has a compact structure, with particularly limited overall dimensions.

[0043] According to the present invention, the front wall 3 comprises a first shaped portion 31 and a second shaped portion 32 adapted to close, at the same front wall, respectively the housing spaces defined by the sections 22, 23 of the enclosure 2.

[0044] According to the present invention, the shaped portions 31, 32 of the front wall 3 are mechanically separable from one another.

[0045] Advantageously, the shaped portions 31, 32 are removable from the front wall 3 so as to enable access to the housing spaces defined by the sections 22, 23 of the enclosure 2. Preferably, the shaped portion 32 is removable from the front wall 3 separately with respect to the shaped portion 31.

[0046] Preferably, the shaped portions 31, 32 are mechanically coupled to one another so as to be able to be removed separately from the front wall 3, according to a predefined sequence. In particular, the shaped portions 31, 32 are mechanically coupled to one another so that said shaped portion 31 can be removed from the front wall 3 only after having removed said the shaped portion 32.

[0047] Preferably, the shaped portion 31 is constituted by a cover which can be removably connected to a structural component of the control mechanism 98 (for example a supporting bracket), by fixing means of known type, for example by screws or by interlocking or snap fastening mechanical connections or the like.

[0048] Preferably, the cover 31 comprises a first opening 51 adapted to enable direct access to the housing space defined by the fifth section 25 of the enclosure 2.

[0049] The operator can therefore operate the control lever 97 manually with ease, without requiring to remove

parts of the front wall 3.

[0050] Preferably, the cover 31 comprises second openings 52 adapted to house control buttons 55 that advantageously protrude from the front wall 3. The control buttons 55 are operatively associated, for example, with the control mechanism 98, and enable the operator to control operation thereof, without removing parts of the front wall 3.

[0051] The second openings 52 can also be adapted to house signaling indicators 56 that enable the operator to easily acquire information on the operating status of the switching device, without removing parts of the front wall 3.

[0052] Preferably, the shaped portion 32 comprises a shaped frame 325 that defines, at least partially, the edges of the same front wall.

[0053] Preferably, the shaped portion 32 comprises a first and second closing panel 321, 322, connected integral with the shaped frame 325.

[0054] The closing panels 321, 322 are advantageously arranged so as to close the housing spaces (destined to house the accessory devices 91A, 92B, 91C, 91D) respectively defined by the seats 231A, 231B, 232A, 232B of the section 23 of the enclosure 2.

[0055] From the above, it is evident that the shaped portion 32 is advantageously constituted by a closing structure, comprising at least the shaped frame 325 and the closing panels 321, 322, which can be removably connected to the front wall 3, by fixing means of known type, for example by screws or by interlocking or snap fastening mechanical connections or the like.

[0056] As shown above, the shaped portion 32 is removable from the front wall 3 independently with respect to the shaped portion 31.

[0057] For this purpose, the shaped frame 325 and the closing panels 321, 322 are arranged so as to define an opening 324 inside which the cover 31 of the front wall 3 is positioned, when this latter is in the normal operating position thereof.

[0058] Preferably, a lower length 325 of the shaped frame 325 is mechanically coupled with corresponding lower ribs 310 of the cover 31 so that this latter is removable from the front wall 3 only after having removed the shaped frame 325.

[0059] Preferably, the second shaped portion 32 of the front wall 3 comprises a third closing panel 323, removably connectable to the shaped frame 325, by fixing means of known type, for example by screws or by interlocking or snap fastening mechanical connections or the like. The closing panel 323 is advantageously arranged so as to close the housing space (destined to house the protection and control unit 99) defined by the section 24 of the enclosure 2.

[0060] As shown by Fig. 2, when the protection and control unit 99 is housed in the housing space defined by the section 24 of the enclosure 2, it is accessible through an opening 326 defined by the cover 31, by the closing panels 321, 322 and by the shaped frame 25.

[0061] The opening 326 is occluded by the closing panel 323 when this latter is operatively connected to the shaped frame 325.

[0062] According to some embodiments of the present invention, the closing panel 323 can be arranged to support electronic user interface means (not shown), operatively connectable, removably, with the protection and control unit 99.

[0063] Preferably, these electronic means can comprise a display adapted to enable easy viewing and selection of the input or output data of the protection and control unit, a further control unit and one or more communication ports, for example USB ("Universal Serial Bus") type connectors.

[0064] Preferably, the upper wall 8 is shaped so as to have a seat 81 for an electrical terminal block 80, positioned between the switching unit 20 and the protection and control unit 99 and electrically connectable to the latter.

[0065] Due to the terminal block 80, the switching unit 20 and/or the protection and control unit 99 can exchange data signals and/or control signals with devices outside the switching device 1 and/or receive an autonomous power supply.

[0066] Further interesting aspects of the switching device according to the present invention relate to the operational positioning of the accessory devices 91A, 91B, 91C, 91D in the corresponding housing seats 231A, 231B, 232A, 232B of the section 23 of the enclosure 2.

[0067] Preferably, the accessory devices 91A, 91B, 91C, 91D are operatively positionable according to "plug-and-play" or "click-on" type installation modes in the corresponding seats 231A, 231B, 232A, 232B.

[0068] With this definition it is meant that the accessory devices 91A, 91B, 91C, 91D can be installed simply by inserting them in the aforesaid seats 231A, 231B, 232A, 232B, without the need for further electrical or mechanical connections.

[0069] For this purpose, the release devices 91D preferably comprise first shaped edges 901, destined to couple mechanically (by interlocking or snap fastening) with corresponding second shaped edges 2321 produced in the walls of the corresponding housing seats 232B, and first electrical contacts 902, destined to couple electrically, according to a socket/plug type mode or vice versa, with corresponding second electrical contacts 2322, positioned in the corresponding housing seats 232B.

[0070] Analogously, the auxiliary contacts 91B can advantageously comprise third shaped edges 903, destined to mechanically couple (by interlocking or snap fastening) with corresponding fourth shaped edges 2311 produced in the walls of the corresponding housing seat 231B, and electrical connectors 904 destined to form part of the terminal block 80.

[0071] To facilitate installation thereof in the related housing seat 321A, the spring charging motor 91A can advantageously comprise a coupling pin 905 destined to mechanically couple (by interlocking or snap fastening)

with a centering bracket 2313 positioned in the corresponding housing seat 231A and a shaped connection portion 906 destined to mechanically couple, by suitable fixing means (such as a screw), with the supporting wall 2312 that delimits the housing seat of the motor 91A.

[0072] Preferably, a drive shaft 980 of the control mechanism 98 protrudes inside the housing seat 231A of the motor 91A to couple with this latter, at a shaped wall thereof 907.

[0073] Preferably, one or more retaining covers 96 can be operatively associated with the housing seats 231A, 231B, 232A, 232B to maintain one or more of the accessory devices 91A, 91B, 91C, 91D in their operating position.

[0074] For example, one or more retaining covers 96 can be operatively associated with the seats 232B destined to house the release devices 91D.

[0075] Advantageously, these retaining covers are reversibly movable between a locking position and a release position of said release devices.

[0076] The switching device 1 according to the present invention has noteworthy advantages in terms of efficacy and ease of use with respect to prior art devices.

[0077] The front wall 3 of the enclosure 2 advantageously has a substantially modular structure that greatly simplifies access to each of the housing spaces defined by the sections 22, 23, 24 of the enclosure 2.

[0078] To access the housing space destined to house the protection and control unit 99 (section 24 of the enclosure 2), the operator can simply remove the closing panel 323 from the shaped frame 325, without removing the remaining parts of the front wall 3, in particular the cover 31.

[0079] To access the housing space destined to house the accessory devices 91A, 91B, 91C, 91D (section 23 of the enclosure 2), the operator can remove the closing structure constituted by the shaped frame 325, by the closing panels 321, 322 and optionally 323, again without removing the cover 31.

[0080] To access the housing space destined to house the control mechanism 98 (section 22 of the enclosure 2), the operator can remove the cover 31 of the front wall 3, advantageously after having also removed the closing panels 321, 322, 323.

[0081] It is evident how this modular structure of the front wall 3 makes it possible to maintain segregated the housing spaces that the operator does not intend to or must not access.

[0082] Access to the various housing spaces can thus be selectively regulated as a function of the type of operation to be performed, with a considerable increase in safety standards.

[0083] Both skilled and unskilled personnel can be permitted to access the housing spaces destined to house the accessory devices 91A, 91B, 91C, 91D and the protection and control unit 99 (sections 23, 24 of the enclosure 2) to perform ordinary maintenance operations.

[0084] Instead only skilled personnel can be permitted

to access to the housing space destined to house the control mechanism 98 (section 22 of the enclosure 2), to perform extraordinary maintenance operations.

[0085] Based on the above, it is evident how the switching device 1 is easy to operate and ensures relatively high safety levels.

[0086] The switching device 1 has a relatively simple structure and is relatively easy and inexpensive to produce at industrial level.

Claims

1. An electrical switching device (1) for low voltage circuits comprising an enclosure (2) having a front wall (3), a rear wall (4), a first lateral wall (5), a second lateral wall (6), a lower wall (7) and an upper wall (8) that define a volume for containing the members of said switching device, said enclosure (2) comprising:

- a first section (21) that defines a first housing space for a switching unit (20) that comprises one or more electrical poles (20A, 20B, 20C), each of said electrical poles comprising at least one fixed contact and one moving contact, mutually couplable/decouplable;
- a second section (22) that defines a second housing space for a control mechanism (98) of the moving contacts of said electrical poles;
- a third section (23) that defines a third housing space for one or more accessory devices (91A, 91B, 91C, 91D) of said switching device;

characterized in that said front wall (3) comprises a first shaped portion (31) and a second shaped portion (32) adapted to respectively close the housing spaces defined by said second and third section (22, 23), at said front wall (3), said first and second shaped portion (31, 32) being mechanically separable from one another.

2. The electrical switching device according to claim 1, **characterized in that** said third section (23) comprises first seats (231A, 231B) and second seats (232A, 232B) that respectively define a first and second plurality of third housing spaces for said accessory devices (91A, 91B, 91C, 91D), said second shaped portion (32) comprising a shaped frame (325) that defines, at least partially, the edges of said front wall (3) and a first and second closing panel (321, 322), connected integral with said shaped frame (325) and adapted to close the housing spaces respectively defined by said first and second seats (231A, 231B, 232A, 232B).

3. The electrical switching device according to one or more of the preceding claims, **characterized in that** said enclosure (2) comprises a fourth section (24)

that defines a fourth housing space for a protection and control unit (99) of said switching device, said second shaped portion (32) being adapted to close the housing space defined by said fourth section (24) at said front wall (3).

4. The electrical switching device according to claims 2 and 3, **characterized in that** said second shaped portion (32) comprises a third closing panel (323) removably connectable to said shaped frame (325) and adapted to close the housing space defined by said fourth section (24). 10
5. The electrical switching device according to one or more of the preceding claims, **characterized in that** said first shaped portion (31) comprises a cover removably connectable to said control mechanism (98). 15
6. The electrical switching device according to one or more of the preceding claims, **characterized in that** said second shaped portion (32) is removable from said front wall (3) separately with respect to said first shaped portion (31). 20
7. The electrical switching device according to claim 6, **characterized in that** said first shaped portion (31) and said second shaped portion (32) are mechanically coupled to one another so that said first shaped portion (31) is removable from said front wall (3) only after having removed said second shaped portion (32). 25 30
8. The electrical switching device according to claims 2, 5 and 7, **characterized in that** said cover (31) is mechanically coupled with said shaped frame (325), so as to be removable from said front wall (3) only after having removed said shaped frame (325). 35
9. The electrical switching device according to one or more of the preceding claims, **characterized in that** said enclosure (2) comprises a fifth section (25) that defines a fifth housing space for a manual control lever (97), operatively associated with said control mechanism (98). 40 45
10. The electrical switching device according to claims 5 and 9, **characterized in that** said cover (31) comprises a first opening (51) adapted to enable direct access to the housing space defined by said fifth section (25). 50
11. The electrical switching device according to claims 5 or 10, **characterized in that** said cover (31) comprises second openings (52) adapted to house control buttons (55) or signaling indicators (56) of said switching device. 55

12. The electrical switching device according to claim 2, **characterized in that** one or more of said accessory devices (91A, 91B, 91C, 91D) are operatively positionable in said first seats (231A, 231B) and/or in said second seats (232A, 232B) according to "plug-and-play" or "click-on" type installation modes. 5
13. The electrical switching device according to claims 2 or 12, **characterized in that** one or more retaining covers (96) are operatively associated with one or more of said first seats (231A, 231B) and/or with one or more of said second seats (232A, 232B) to maintain in position one or more of said accessory devices (91A, 91B, 91C, 91D). 10
14. The electrical switching device according to one or more of the preceding claims, **characterized in that** it is of fixed type. 15
15. The electrical switching device according to one or more of the preceding claims, **characterized in that** it is of withdrawable type. 20
16. The electrical switching device according to one or more of the preceding claims, **characterized in that** it is a switch or a disconnecter or a contactor. 25 30

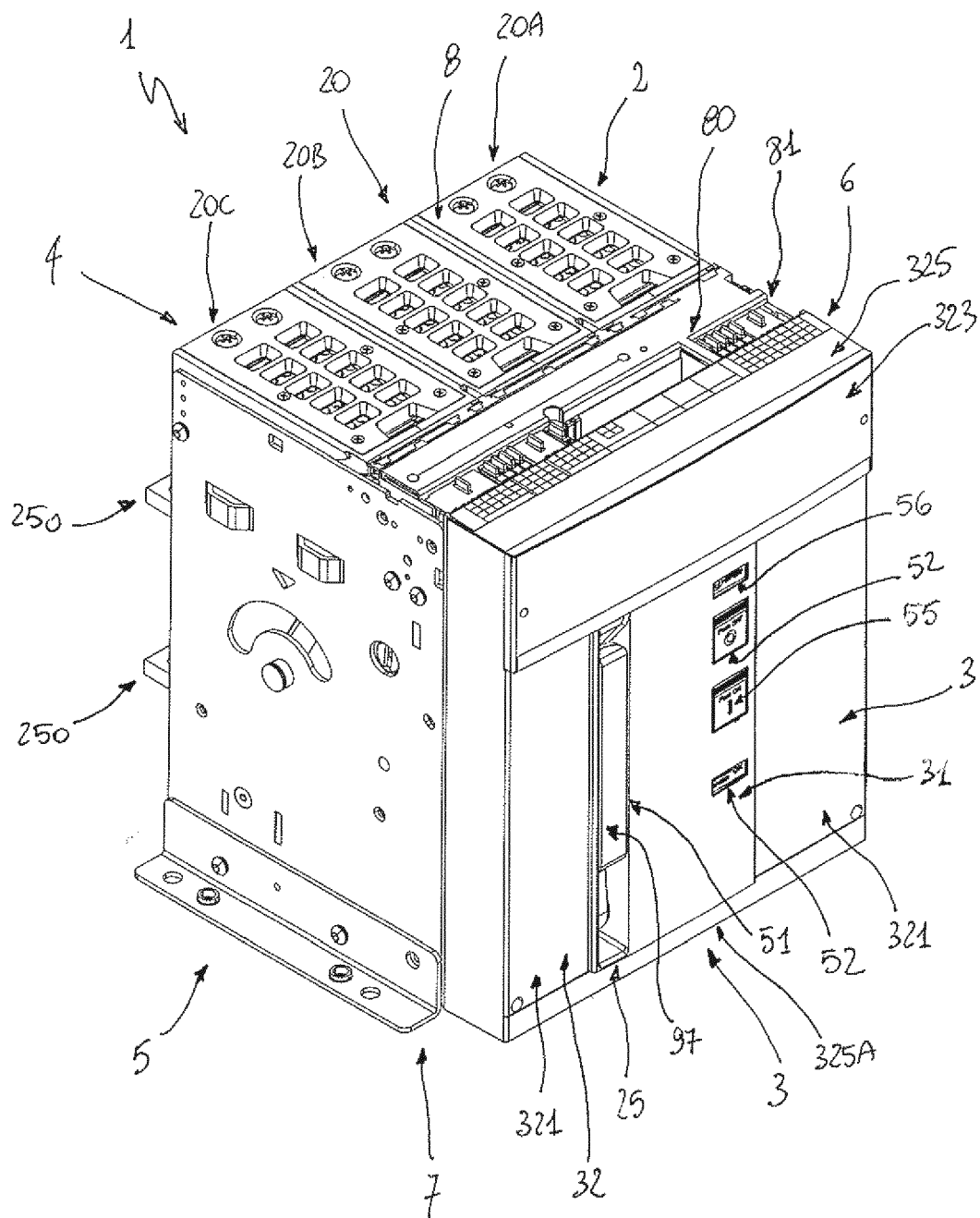


FIG. 1

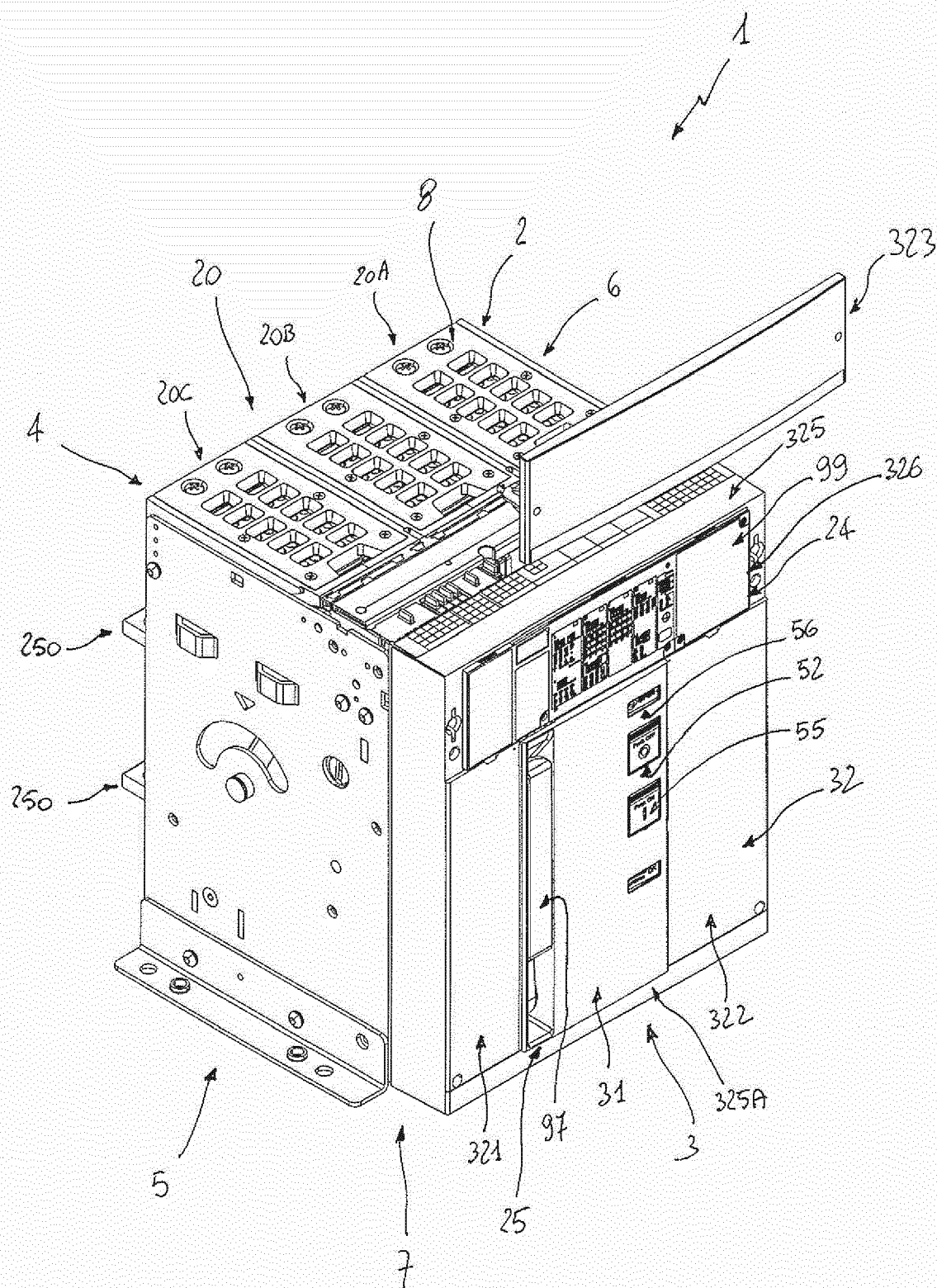
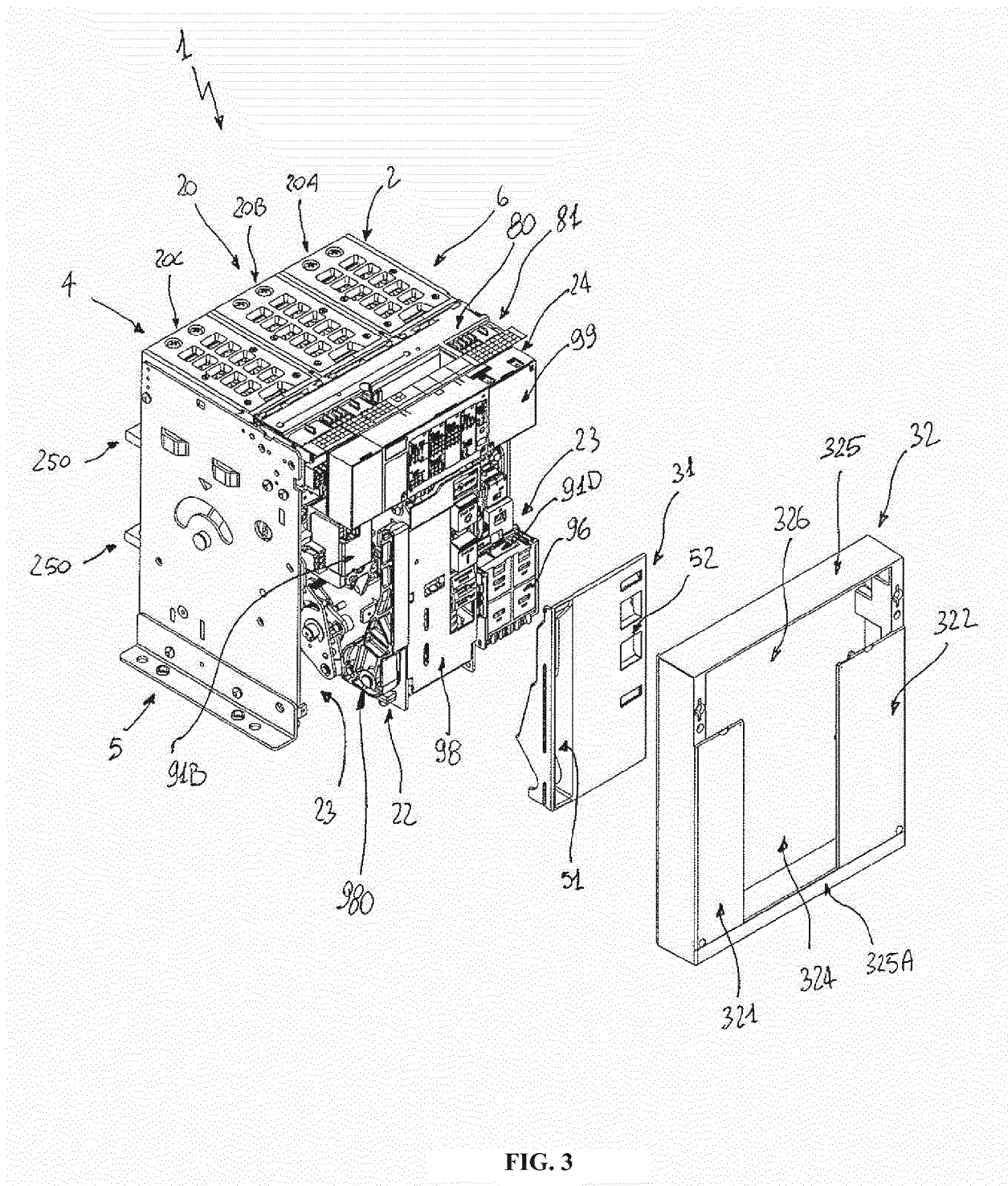


FIG. 2



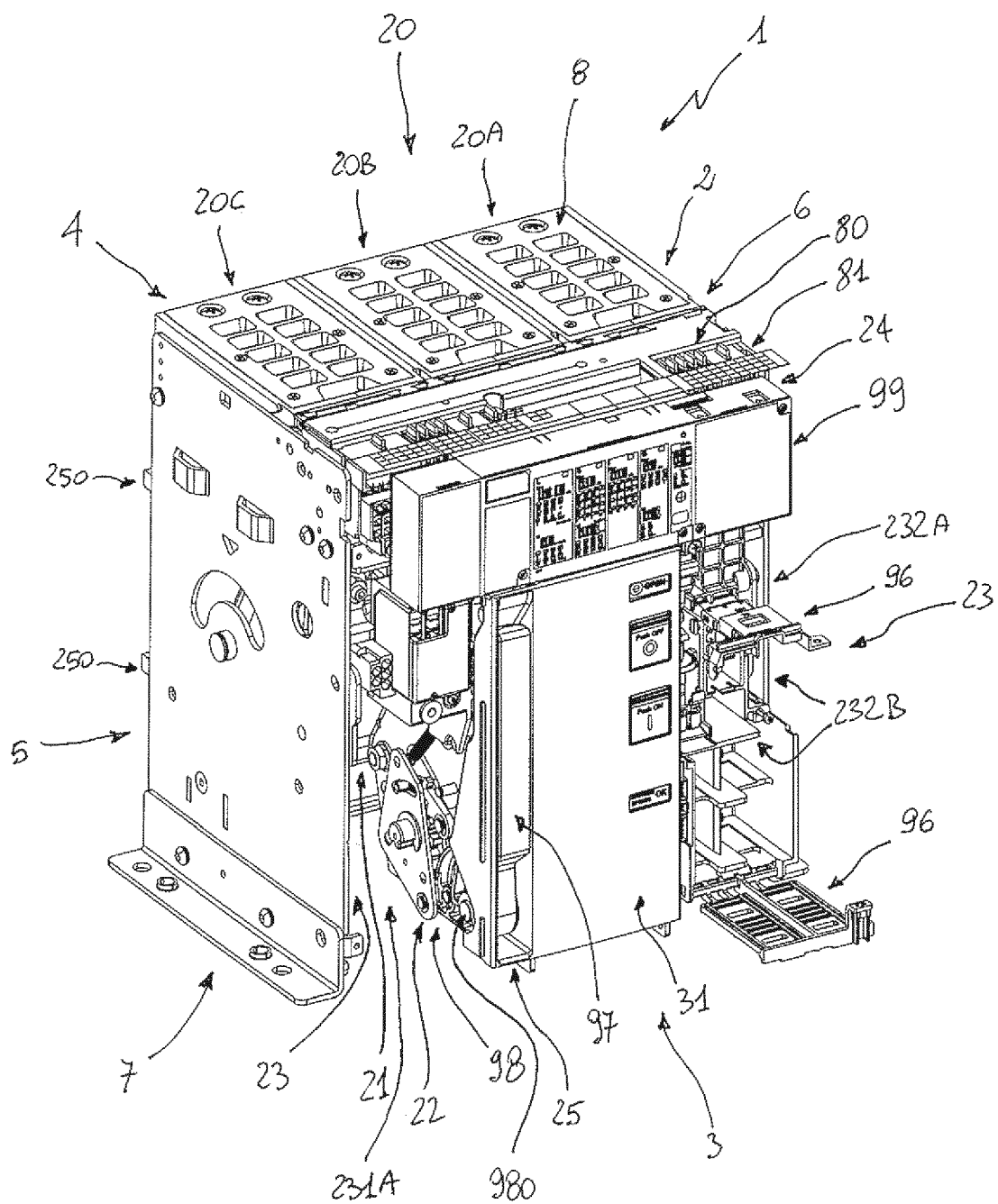


FIG. 4

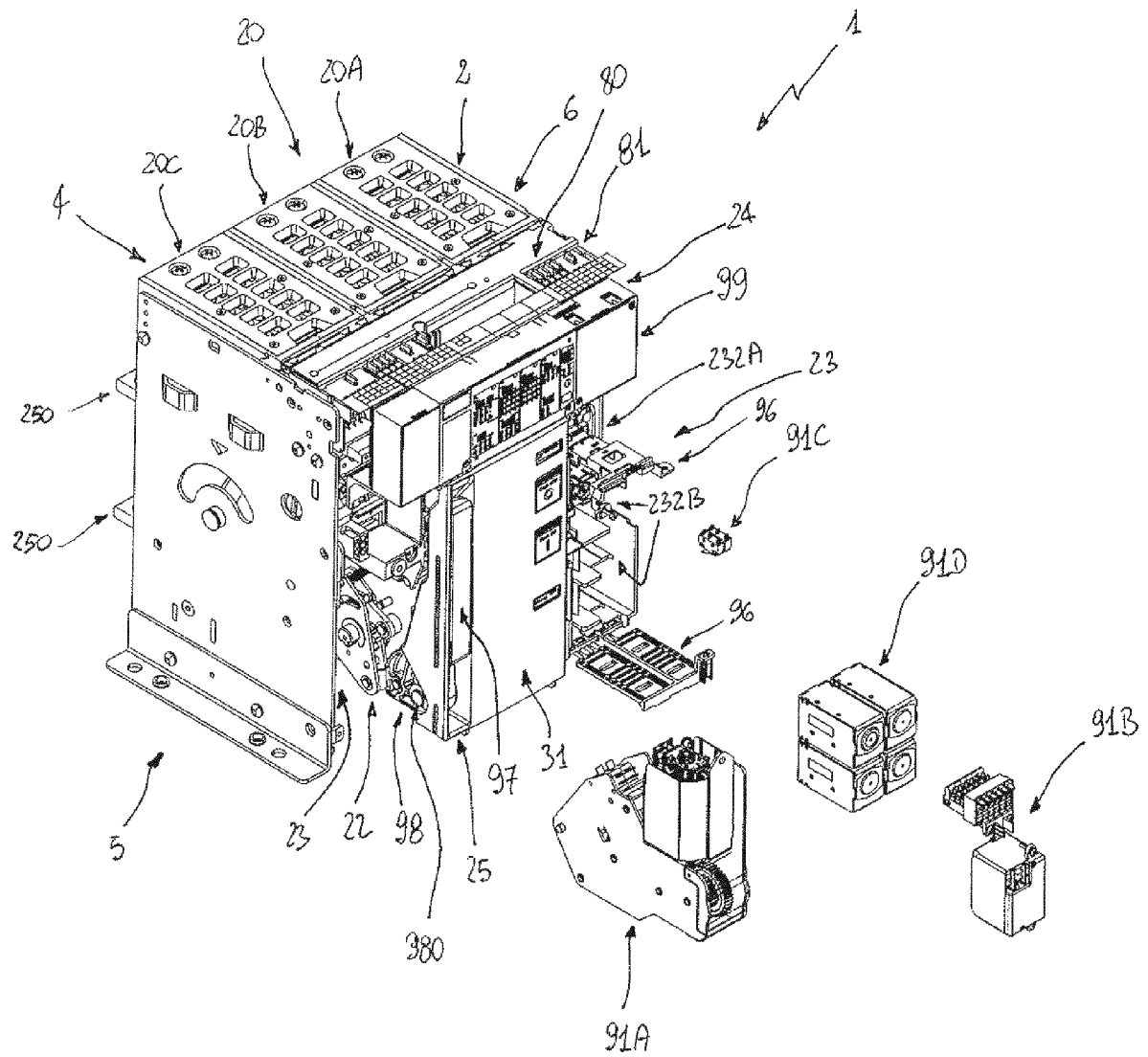


FIG. 5

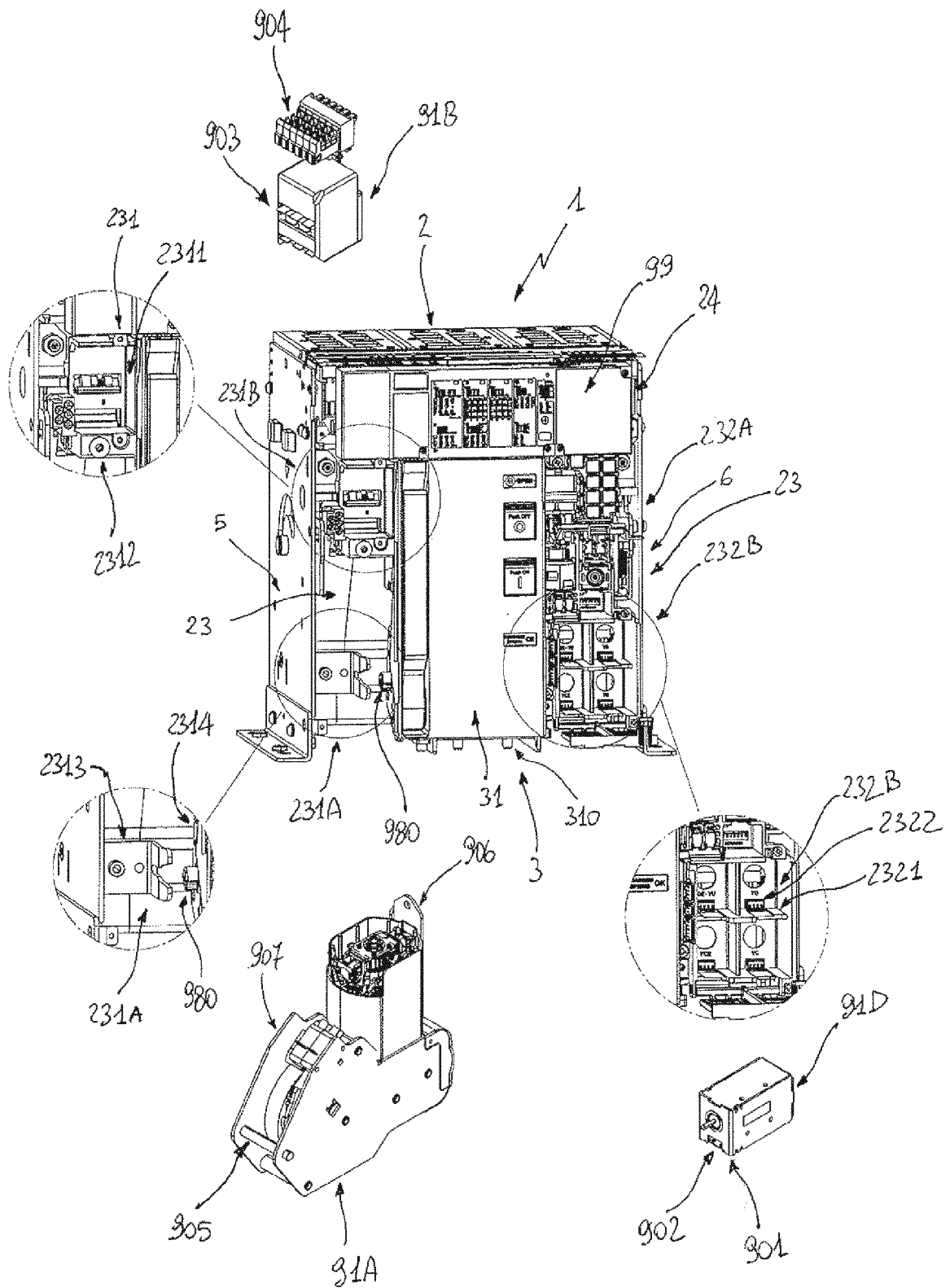


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 13 18 9845

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 February 2014	Examiner Nieto, José Miguel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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