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(54) **A SWITCH-DISCONNECTOR GROUP WITH REDUCED SIZE**

(57) A switch-disconnector group, the group comprising: three first connectors having parallel axes; three second connectors having parallel axes; three interrupter switch devices having parallel axes; wherein each second connector is connected to a corresponding switch device; a disconnector device selectively switchable in at least two configurations wherein in a first configuration it transfers current from the first connectors to the switch devices; wherein the axis of each second connector does not coincide with the axis of the corresponding switch device.

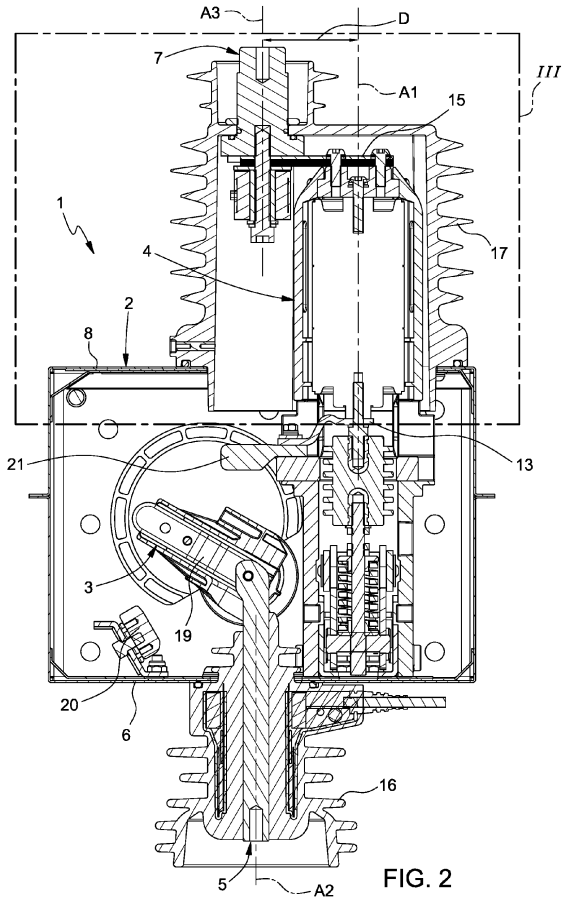

FIG. 2

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102022000006524 filed on April the 1st, 2022, the entire disclosure of which is incorporated herein by reference.

Technical field

[0002] The technical reference field of the present invention refers to switchboards or electricity substations, particularly medium/high voltage ones, which receive voltage from relevant voltage busbars and supply current through lines directed to downstream users. In particular, the technical field of the present invention refers to a switch-disconnector group for electric cabinets, which is configured to be placed between the aforementioned voltage busbars and the supply lines. In this context, the present invention will address the problem of how to provide a switch-disconnector group with reduced size.

State of the art

[0003] As stated in the previous chapter, the present invention refers to a switch-disconnector group for an electric cabinet or switchboard. In general, switch-disconnector groups, the devices making them up, and the functions thereof are well known to a person skilled in the art. Prior art patents EP1538650 and EP1226596 can be mentioned by way of example as evidence of the familiarity with these groups and of the knowledge of the person skilled in the art.

[0004] In summary, a switch-disconnector group comprises three first connectors connected to the voltage busbar (which can act as an input port for the group) and three second connectors connected to the utility line (which can act as a power supply port) . As is well known, a switch-disconnector group comprises a disconnector device and three switch devices between these first and second connectors. The disconnector device, as is well known, is selectively switchable in at least two configurations wherein in a first configuration it connects the first connectors to the switch devices. The switch devices in turn are connected to the second connectors.

[0005] Particular switch devices known as interrupter switches are known to be used in these groups. These interrupter switches comprise a cylindrical casing in which a vacuum is created. Two flat surfaces are arranged in the casing orthogonal to the axis, closely facing each other so that current flows when the switch is powered by the disconnector. Usually, the flat surface on the side of the disconnector is movable (e.g., on a bellows structure) whereas the opposite flat surface is fixed and transfers current to the end of the switch coupled to the corresponding output connector.

[0006] According to current practice, in the configuration described above, the second connector is aligned with the corresponding interrupter switch, making some kind of extension of the switch itself.

[0007] However, this current solution has some drawbacks. The first disadvantage relates to the large overall size of the group along the axis of the switch, and the second disadvantage relates to the fact that if the second connectors were to be provided with accessory electronic devices, such as sensors or the like, the overall size of the group along the axis of the switch would be further increased.

[0008] WO2019025032 describes a switch group comprising a vacuum interrupter for a gas-insulated electric cabinet. US3571543 describes an electrical drive mechanism for a gas-insulated switch group.

Description of the invention

[0009] Starting from this prior art, one object of the present invention is to provide an inventive switch-disconnector group, particularly for electric cabinets, which can overcome the described drawbacks of the prior art.

[0010] In particular, the main object of the present invention is to provide a switch-disconnector group with interrupter switches which, on the one hand, offers the same (if not better) functions as the known groups and, on the other hand, has a reduced size along the axis of the switches. As will be apparent, the present invention will also offer the possibility of incorporating sensors into the second connectors with no increase whatsoever in the size of the group along the axis of the interrupter switches.

[0011] In accordance with these objects, the implementation of the present invention requires the presence of a switch-disconnector group for electric cabinets of the type comprising:

- three first connectors (which primarily serve as input connectors to power the group but which can also work as output connectors) having parallel axes;
- three second connectors (which primarily serve as output connectors to supply power to the lines downstream of the group but which can also work as input connectors) having parallel axes;
- three interrupter switch devices having parallel axes, wherein each second connector is connected to a corresponding switch device;
- a disconnector device selectively switchable in at least two configurations wherein in a first configuration it connects the first connectors to the switch devices.

[0012] All of the above elements and the functions thereof are well known to the person skilled in the art and therefore the correct understanding of the context of the invention does not require further details to be given here. In any case, in addition to the general knowledge of the person skilled in the art, it is possible to refer to the many

prior art documents (for example those mentioned above) as well as the attached drawings for construction details.

[0013] In the structural configuration described herein, the main aspect of the present invention relates to the correlation between the axis of each second connector and the axis of the corresponding interrupter switch device. In particular, according to the present invention, these axes do not coincide and therefore the second connector does not in fact constitute an extension of the interrupter switch device along its axis. Having misaligned the second connector from the corresponding interrupter switch device, they can be arranged laterally to each other, thereby reducing the size. In addition, in this position in which the volume below the second connector is no longer occupied by the corresponding interrupter switch device, there is a free volume suitable for housing accessory devices, such as sensors, which otherwise would have increased the final size of the group.

[0014] The axis of each second connector and the axis of the corresponding interrupter switch device are parallel to each other.

[0015] The distance between the axis of each second connector and the axis of the corresponding switch device is such that a voltage sensor configured to detect the voltage present in the corresponding second connector is arranged between each second connector and the corresponding switch device. In this case, even more preferably, each second connector comprises a free end and an inner end coupled to the corresponding switch device, wherein the voltage sensor is made in the form of a ring fitted on a cylindrical support protruding from the inner end of the second connector.

[0016] Preferably, each interrupter switch device comprises an inner end selectively connected to the disconnector device, and an outer end, wherein each outer end and each inner end of the corresponding switch device and second connector are substantially aligned, i.e., in a common plane orthogonal to the axis of the interrupter switch device. In this case, even more preferably, each outer end and each inner end of the corresponding switch device and second connector are connected by a flexible connection device suitable for absorbing any misalignment. For example, such a flexible connection device can be made in the form of one or more (possibly flexible) conductive sheets suitable for compensating for any misalignments created during assembly.

[0017] Preferably, the axes of the second connectors coincide with the axes of the first connectors. In this case, the inputs and outputs are aligned whereas the switches are misaligned.

[0018] Preferably, the second connectors and the corresponding switch devices are arranged along two parallel rows.

[0019] In one embodiment of the invention, the disconnector device is housed in a box body (therefore in a closed, protected environment possibly suitably filled with gas) whereas the connectors are freely exposed. In this case, each first connector is housed in a corresponding insulator body coupled to a first side of the box body whereas each second connector and the corresponding switch device are housed in a corresponding second insulator body coupled to a second opposite side of the box body.

[0020] In an alternative embodiment of the invention, not only the disconnector but also the connectors are inside a containment body and therefore they too are possibly housed in a closed and protected environment possibly suitably filled with gas.

List of figures

[0021] Further features and advantages of the present invention will be apparent from the following description of a non-limiting embodiment thereof, with reference to the figures of the accompanying drawings, wherein:

- Figure 1 is a schematic view of an example of a switch-disconnector group according to the present invention;
- Figure 2 is a schematic cross-section view of the group in Figure 1 along the plane II indicated in Figure 1;
- Figure 3 is an enlarged schematic view of the portion of the cross-section of Figure 2 indicated as III in Figure 2.

Description of one embodiment of the invention

[0022] With reference to the accompanying figures, Figure 1 is a schematic view of an example of a switch-disconnector group according to the present invention. In this figure, the switch-disconnector group is indicated, as a whole, with the reference number 1. As mentioned above, this group 1 is suitable for being inserted in an electrical cabinet where a voltage busbar and a utility line are present. According to the (non-limiting) example shown in Figure 1, the group 1 comprises a box body 2 which only partially houses the components of the group. In fact, it can be seen that three first connectors 5 arranged along a row, having parallel axes and protected by corresponding insulators 16, protrude from one side 6 of the box body. These first connectors 5 can act as input connectors configured to be coupled to the voltage busbar to power the group 1. As can be seen, three second connectors 7 arranged along a row, having parallel axes A3 and protected by corresponding insulators 17, protrude from the opposite side 8 of the box body 2. These second connectors 7 can serve as output connectors configured to be coupled to the output line for current supply. The insulators 16 and 17 are coupled to the box body 2 and the latter is made in the form of two half-shells welded together to provide a sealed chamber which is preferably filled with a suitable gas.

[0023] Figure 2 is a schematic cross-section view of the group in Figure 1 along the plane II indicated in Figure

1 and allows the elements housed in the box body and insulators 16 and 17 to be seen. In particular, Figure 3 allows for a better disclosure of the details related to the elements housed in the insulator 17 (the one housing the second connector 7). As can be seen in these figures, each output insulator 17 also houses an interrupter switch device 4 (known per se). In accordance with the main definition of the invention, in these figures, too, the axis A3 of each second connector 7 does not coincide with the axis A1 of the corresponding switch device 4. In this example, these axes are parallel to each other and separated by a distance indicated with D. The three interrupter switch devices 4 have axes A1 parallel to each other, and each second connector 7 comprises an inner end 12 aligned with, i.e., approximately in the same plane orthogonal to the axis A1, and connected to an outer end 14 of the corresponding switch device 4. This connection is shown in this figure by a flat metal sheet 15 which can absorb any misalignment. This sheet can also be s-shaped to further place the inner end 12 of the second connector 7 at a lower height and thus offer greater compactness. In addition, in a complementary or alternative way, this connection could also be flexible so that it can adapt to any misalignment present during assembly. Reference number 18 indicates a ring nut that may (or may not) be used as a possible solution to the need to keep the gas within the casing. In this example, see Figure 2, the disconnector device 3 is in the form of a lever 19 which can rotate to selectively be coupled to an earth terminal 20 or a terminal 21 connected to the inner end 13 of the switch devices 4. As can be seen in Figure 2, the axes A3 and A2 are aligned. Figure 3 shows a distance D between the axis A3 of the second connector 7 and the axis A1 of the corresponding switch device 4. This distance D is such that a cylindrical support 10, on which to fit a voltage sensor 9 configured to detect the voltage present in the corresponding second connector 7, can be coupled to the inner end 12 of the connector 7. In the example shown, the voltage sensor 9 is made in the form of a ring fitted on the cylindrical support 10. Reference number 22 indicates the connection line of the signal between the inside and outside of the sensor 9. This connection can be made in the form of an elastic thin plate.

[0024] Finally, it can be noted that the assembly of the group is also simple. It is possible, in fact, to pre-assemble switches and second connectors together. Couple these to the half-shell of the box body and then place the insulator 17, which is possibly pre-assembled with the half-shell 8. The final step is tightening the ring nut 18.

[0025] It is clear that modifications and variations may be made to the invention described herein without departing from the scope of the appended claims.

Claims

1. A switch-disconnector group, the group (1) comprising:

- three first connectors (5) having parallel axes (A2);
- three second connectors (7) having parallel axes (A3);
- three interrupter switch devices (4) having parallel axes (A1); wherein each second connector (7) comprises a free end (11) and an inner end (12) connected to the corresponding switch device (4);
- a disconnector device (3) selectively switchable in at least two configurations wherein in a first configuration it connects the first connectors (5) to the switch devices (4); wherein
- the axis (A3) of each second connector (7) does not coincide with and is parallel to the axis (A1) of the corresponding switch device (4);

characterized in that

the distance (D) between the axis (A3) of each second connector (7) and the axis (A1) of the corresponding switch device (4) is such that a voltage sensor (9) configured to detect the voltage present in the corresponding second connector (7) is coupled to the inner end (12) of each second connector (7).

2. The group as claimed in claim 1, wherein each voltage sensor (9) is made in the form of a ring arranged on a cylindrical support (10) coupled to the corresponding second connector (7) and protruding from its inner end (12).

3. The group as claimed in any one of the foregoing claims, wherein each switch device (4) comprises an inner end (13) selectively connected to the disconnector device (3) and an outer end (14), each inner end (12) of the second connector (7) and each outer end (14) of the corresponding switch device (4) being substantially aligned.

4. The group as claimed in claim 3, wherein each inner end (12) of the second connector (7) and each outer end (14) of the corresponding switch device (4) are connected by a flexible connection device (15) suitable for absorbing any misalignment.

5. The group as claimed in claim 4, wherein each flexible connection device (15) is made in the form of one or more metal sheet(s), preferably flexible metal sheet(s).

6. The group as claimed in any one of the foregoing claims, wherein the axes (A3) of the second connectors (7) coincide with the axes (A2) of the first connectors (5).

7. The group as claimed in any one of the foregoing

claims, wherein the second connectors (7) and the corresponding switch devices (4) are arranged in two parallel rows.

8. The group as claimed in any one of the foregoing claims, wherein the disconnector device (3) is housed in a box body (2); each first connector (5) is housed in a corresponding insulator body (16) coupled to a first side (6) of the box body (2); each second connector (7) and the corresponding switch device (4) being housed in a corresponding second insulator body (17) coupled to a second opposite side (8) of the box body (2).

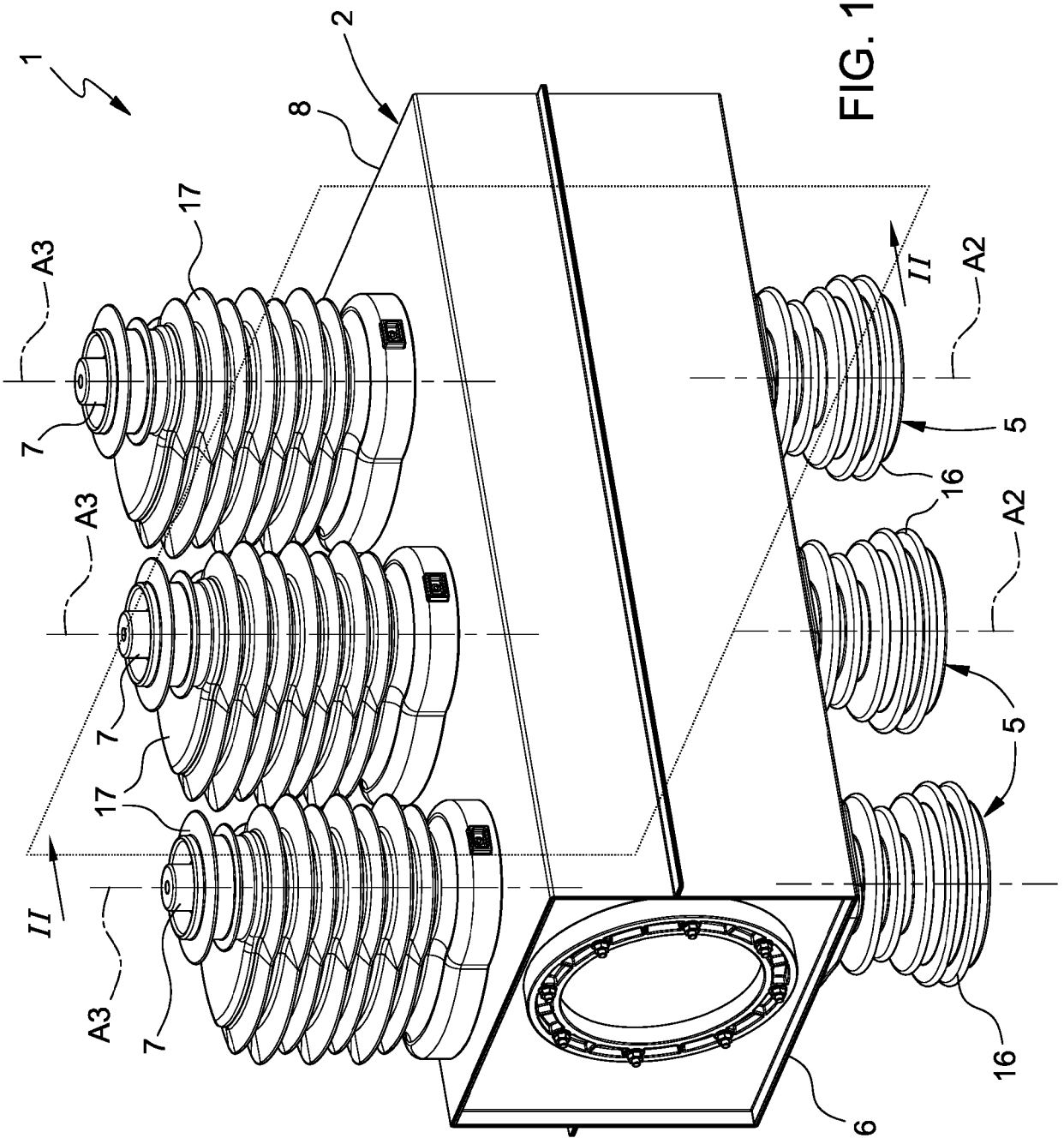


FIG. 1

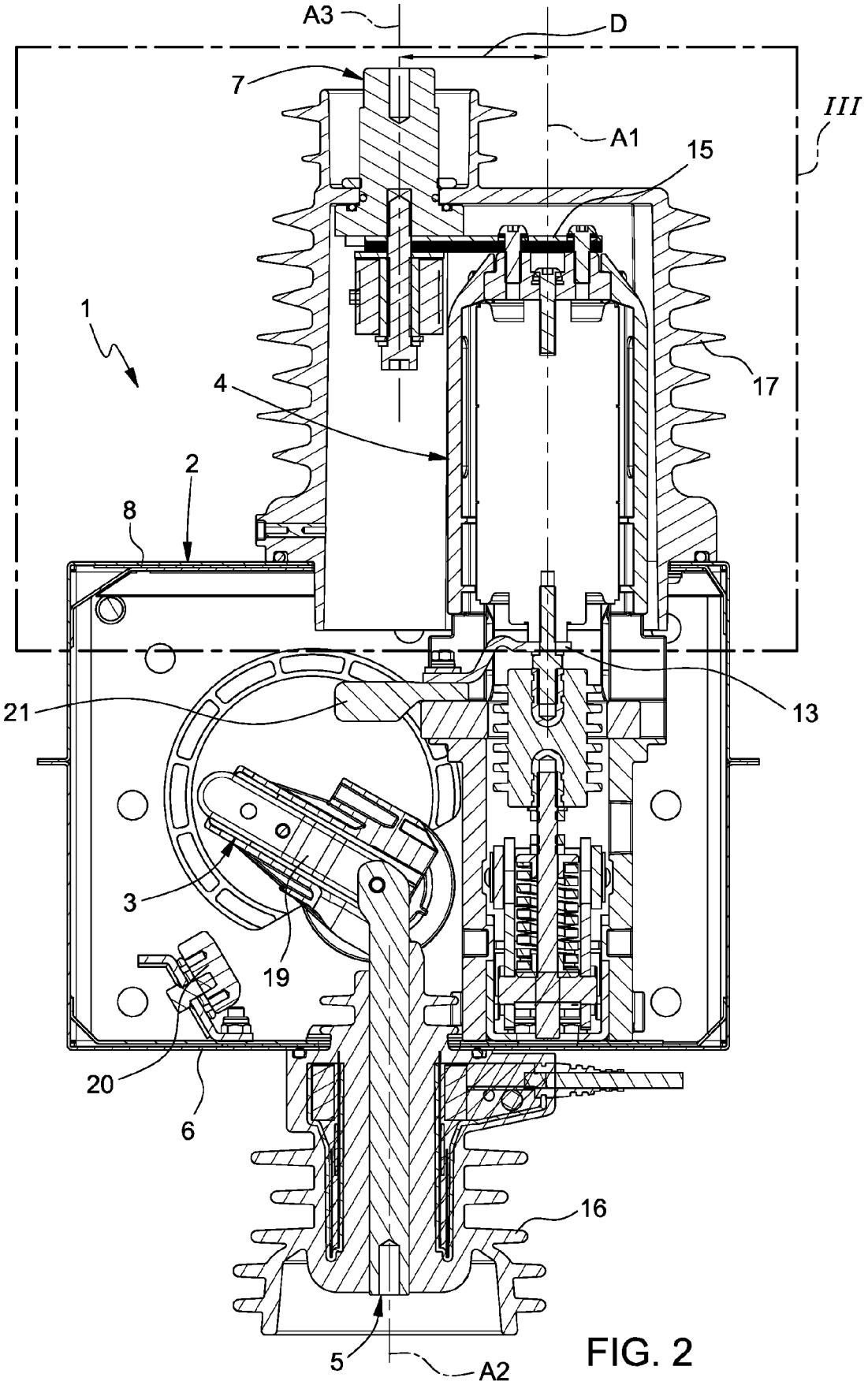
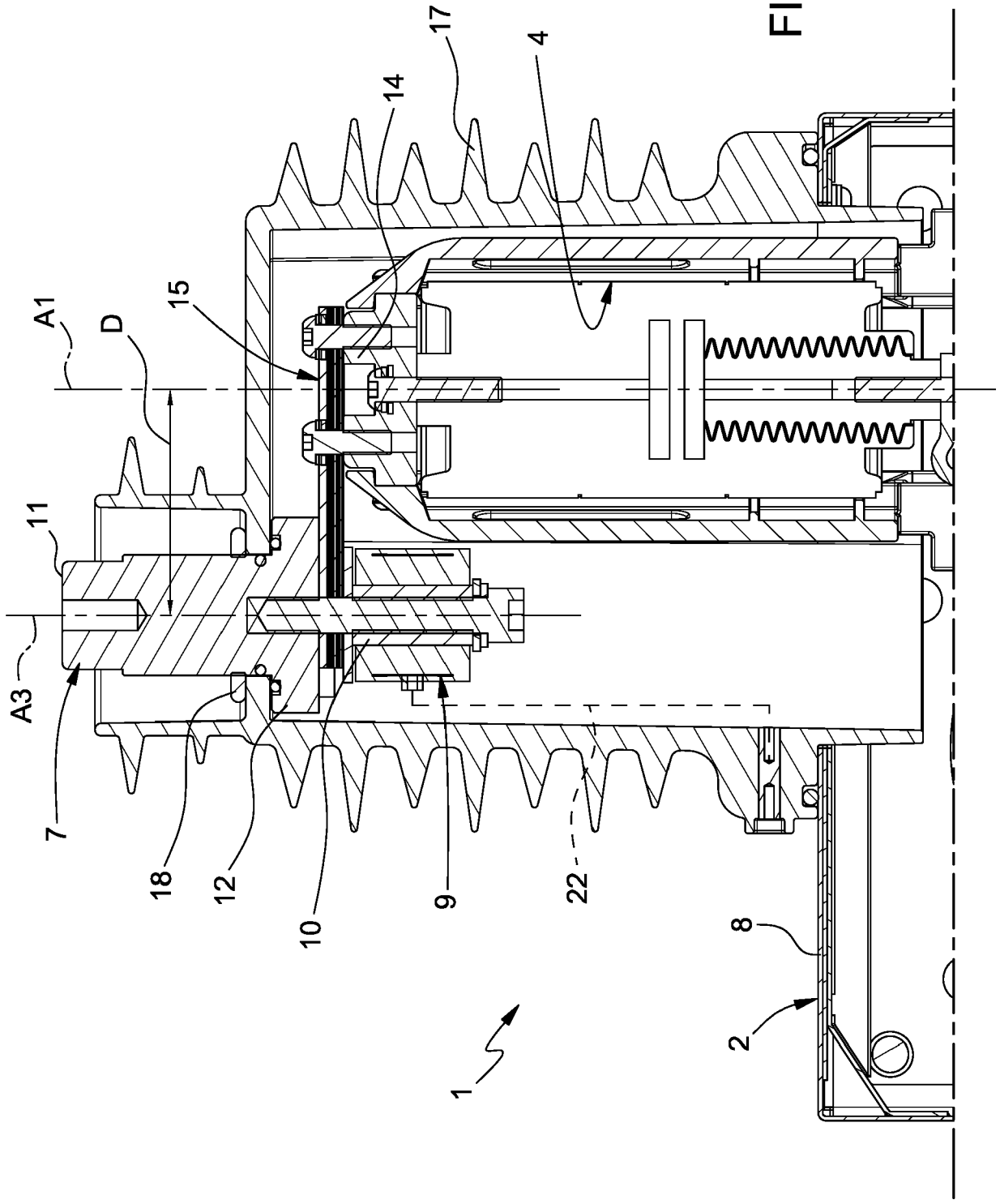


FIG. 2

FIG. 3



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Application Number
EP 23 16 5803

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 August 2023	Ramírez Fueyo, M

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