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(71) Applicant: ABB S.P.A. [IT/IT]; Via Vittor Pisani, 16, I-20124 Milano (IT).

(72) Inventors: **ROTA MARTIR, Roberto**; Via Ugo Foscolo, 26, I-24030 Brembate di Sopra (BG) (IT). **BRIGNOLI, Gustavo**; Via Giovanni Caboto, 1, I-24125 Bergamo (IT). **ZANNI, Roberto**; Via Somas, 7, I-24020 Fino del Monte (BG) (IT).(74) Agent: **DE SANTIS, Giovanni**; ABB S.p.A., Via L. Lama, 33, I-20099 Sesto San Giovanni (MI) (IT).(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

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(54) Title: ASSEMBLY FOR A WITHDRAWABLE SWITCHING DEVICE AND RELATED SWITCHING DEVICE

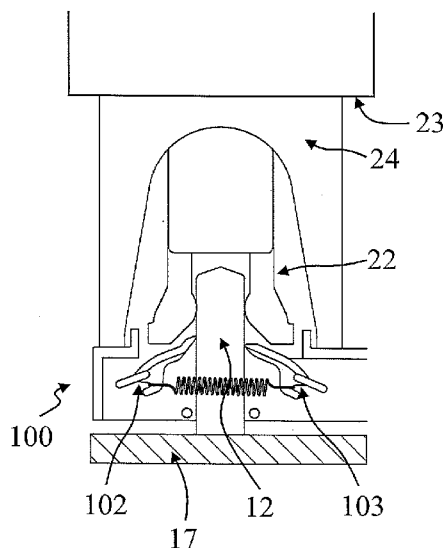


Fig. 11

(57) Abstract: An assembly for a low voltage withdrawable switching device, comprising: a supporting frame into which/from which a switching unit of the withdrawable switching device can be inserted/withdrawn; at least one first connector placed at a bottom portion of the supporting frame and adapted to be coupled with a second connector of the switching unit; and a shutter assembly. The shutter assembly comprises: an opening for allowing the coupling between the first and second connectors; and at least one cover member which is adapted to be moved from a cover position to an open position so as to make the opening accessible for the coupling between the first and second connectors. The at least one cover member is adapted to be moved from the cover position to the open position by at least one protruding element which protrudes from the bottom portion. The shutter assembly is operatively mounted movable into the supporting frame. The shutter assembly is adapted to operatively interact with the switching unit under insertion into the supporting frame so as to be moved towards the bottom portion for causing the movement of the at least one cover member from the cover to the open position by the at least one protruding element.

“ASSEMBLY FOR A WITHDRAWABLE SWITCHING DEVICE AND RELATED
SWITCHING DEVICE”

The present invention relates to an assembly for a low voltage withdrawable switching device.

- 5 As known, switching devices used in low voltage electrical circuits, i.e. circuits with application voltages lower than 1 kV AC and 1.5 kV DC, typically circuit breakers, disconnectors and contactors, are devices designed to allow the correct operation of specific parts of the electric circuits in which they are installed, and of the associated electric loads.

A low voltage switching device comprises a switching unit having a main casing which houses
10 one or more electric poles, or phases, each one comprising at least one movable contact and a corresponding fixed contact.

A driving mechanism causes the actuation of the movable contacts between a closed position, where they are coupled to the corresponding fixed contacts, and an open position, in which they are spaced away from the corresponding fixed contacts.

- 15 As known, a switching device can be used in a fixed configuration (fixed switching device), i.e. with the main casing permanently fixed to a cabinet support in its installation position, or in a withdrawable configuration (withdrawable switching device), i.e. with the switching unit operatively associated to a corresponding assembly which is also part of the withdrawable switching device.

- 20 In particular, such assembly comprises a supporting frame into/from which the switching unit can be inserted/withdrawn. The insertion/withdrawn of the switching unit to/from the supporting frame is generally assisted by a guiding mechanism, using a crank.

The assembly further comprises one or more first connectors which are adapted to be operatively connected to distribution means of the electrical circuit, such as bus bars, when the assembly is
25 connected to a cabinet support according to its installation position.

The first connectors protrude from a bottom portion of the supporting frame, in such a way to be also adapted for coupling with corresponding second connectors of the switching unit, when the switching unit reaches a connected, or inserted, position into the supporting frame.

The switching unit can further be at least in:

- 30 - a disconnected, or extracted, position where the switching unit is positioned relative to the supporting frame such that no electrical connection is established between components

and/or elements of the switching unit itself and of the corresponding assembly; and

- a test position where the switching unit is positioned relative to the supporting frame such that there is not yet a connection between the first and second connectors, but there is an electrical connection between other components or elements of the switching unit itself and the corresponding assembly, in order to perform control and/or testing functionalities.

In order to guarantee an adequate safety for an operator, the assembly for the switching unit further comprises one or more shutter assemblies operatively associated to its first connectors.

In known solutions, each one of the shutter assemblies is fixedly mounted into the supporting frame to provide an insulating barrier against an access by the operator to the corresponding first connectors placed at the bottom portion of the supporting frame.

The shutter assembly comprises, for each associated first connector, an opening allowing the coupling between the first connector and the corresponding second connector of the switching unit under insertion in the supporting frame.

For example, according to a known solution, the shutter assembly comprises a first, fixed, cover member having one or more first through holes aligned with corresponding first connectors, and a second, sliding, cover member having also one or more second through holes.

The second cover member can slide between an open position and a cover position. In the open position, the second through holes are aligned with corresponding first through holes to provide accesses for the coupling between the first and second connectors. In the cover position, the second through holes are offset with respect to and cover the first through holes, so as the accesses towards the first connectors are covered.

Various known shutter mechanisms are adapted to be connected to the second cover member and to operatively interact with the switching unit under insertion into the frame, for sliding the second cover member from the cover position to the open position.

These shutter mechanisms are bulky and, due to high mechanical stress and friction forces, could be damaged during their operation or could not duly perform their tasks.

For improving the safety of the operators, the sliding of the second cover member from the cover position to the open position has to occur when the switching unit is adequately close to the shutter assembly itself, generally after that the switching unit has passed through the test position.

However, there is also the need of waiting the conclusion of the full operation by the shutter mechanism; in this way, the second connectors can find the first and second through holes of the

first and second cover members completely aligned to each other, when they have to cross the shutter assembly for coupling to the first connectors.

To this aim, a safety distance is provided, e.g. between the test position and the shutter assembly, which extends the path travelled by the switching unit into the supporting frame to reach its
5 connected position; this means an increasing in the overall depth of the supporting frame.

Furthermore, considering the withdrawing of the switching unit from the supporting frame, the guiding mechanism introduces a mechanical clearance which can offset the predicted position of the switching unit in its withdrawn position from the connected position.

Hence, the above mentioned safety distance has to be further extended in order to avoid that the
10 sliding of the second cover member from the open position to the cover position can occur while the second connectors are still passing through the aligned first and second through holes.

The safety distance is further increased in the case that, according to relevant normative, the second connectors of the switching units comprise claws.

In light of above, at the current state of the art, although known solutions perform in a rather
15 satisfying way, there is still reason and desire for further improvements.

Such desire is fulfilled by an assembly for a withdrawable switching device which is adapted to be installed in a low voltage electrical circuit. The assembly comprises:

- a supporting frame into which a switching unit of the withdrawable switching device can be inserted and from which the switching unit can be withdrawn;

- at least one first connector placed at a bottom portion of the supporting frame and adapted
20 to be coupled with a corresponding second connector of the switching unit, when the switching unit reaches a connected position into the supporting frame.

The assembly further comprises a shutter assembly comprising:

- an opening for allowing the coupling between the first connector and the corresponding
25 second connector; and

- at least one cover member which is adapted to be moved from a cover position to an open position so as to make the opening accessible for the coupling between the first connector and the corresponding second connector.

The at least one cover member is adapted to be moved from the cover position to the open position
30 by at least one protruding element which protrudes from the bottom portion. The shutter assembly is operatively mounted movable into the supporting frame. The shutter assembly is adapted to

operatively interact with the switching unit under insertion into the supporting frame so as to be moved towards the bottom portion for causing the movement of the at least one cover member from the cover position to the open position by the at least one protruding element.

Another aspect of the present disclosure is to provide a withdrawable switching device adapted to be installed in a low voltage electrical circuit; this withdrawable switching device comprises an assembly, as the assembly defined in the annexed claims and disclosed in the following description, and a switching unit which can be inserted into/withdrawn from the supporting frame of the assembly.

Further characteristics and advantages will become more apparent from the description of some preferred but not exclusive embodiments of the assembly and related withdrawable switching device according to the disclosure, illustrated only by way of non-limiting examples with the aid of the accompanying drawings, wherein:

- figure 1 is a perspective view of a withdrawable circuit breaker according to the present disclosure;
- figure 2 is a front perspective view of an assembly for the withdrawable circuit breaker illustrated in figure 1;
- figure 3 is an exploded view of some components of the assembly illustrated in figure 2;
- figure 4 is a rear perspective view of a switching unit for the withdrawable circuit breaker illustrated in figure 1;
- figures 5 and 6 are a front perspective view and a rear perspective view, respectively, of a shutter assembly which can be used in the assembly illustrated in figure 2;
- figures 7 and 8 are two sectional lateral views of a portion of the assembly illustrated in figure 2, wherein such portion comprises a shutter assembly and associated locking means which are illustrated in figures 6 and 7 in two different positions;
- figures 9-11 illustrate: a rear portion of a first switching unit, a shutter assembly, and a connector protruding from a bottom portion of a first supporting frame for a withdrawable switching device according to the present disclosure, wherein figures 9, 10 and 11 correspond to the first switching unit in its disconnected, test and connected position, respectively;
- figures 12-14 illustrate: a rear portion of a second switching unit, a shutter assembly, and a connector protruding from a bottom portion of a second supporting frame for a withdrawable switching device according to the present disclosure, wherein figures 12, 13 and 14 correspond

- to the second switching unit in its disconnected, test and connected position, respectively; and
- figure 15 illustrates a modular component of an assembly for a withdrawable switching device according to the present disclosure.

It should be noted that in the detailed description that follows, identical or similar components, either from a structural and/or functional point of view, have the same reference numerals, regardless of whether they are shown in different embodiments of the present disclosure; it should also be noted that in order to clearly and concisely describe the present disclosure, the drawings may not necessarily be to scale and certain features of the disclosure may be shown in somewhat schematic form.

Further, when the term “adapted” or “arranged” or “configured” or “shaped” is used herein while referring to any component as a whole, or to any part of a component, or to a whole combinations of components, or even to any part of a combination of components, it has to be understood that it means and encompasses correspondingly either the structure, and/or configuration and/or form and/or positioning of the related component or part thereof, or combinations of components or part thereof, such term refers to.

Finally, the term transversal or transversally hereinafter used encompasses a direction non-parallel to the element or direction it is related to, and perpendicularity has to be considered a specific casing of transverse direction.

With reference to above cited figures, the present disclosure is related to an assembly for a withdrawable switching device 1 adapted to be installed in a low voltage electrical circuit.

For example, the switching device 1 illustrated in figure 1 is a withdrawable circuit breaker 1 which comprises the exemplary assembly 10 illustrated in figure 2 and the exemplary switching unit 20 illustrated in figure 4, which are associable to each other.

Even if the exemplary assembly 10 is particularly referred to the withdrawable circuit breaker 1, the assembly 10 according to the present disclosure can be also used for other types of withdrawable switching devices 1, such as disconnectors or contactors.

The switching unit 20 comprises a main casing 21, preferably made at least partially of insulating material. According to well known solutions, hence not disclosed herein in detail, in order to perform its switching tasks the unit 20 comprises, accommodated into the main casing 21, one or more electric poles, or phases, each one comprising at least one movable contact and a corresponding fixed contact (not viewable in the attached figures). The main casing 21 further

houses a driving mechanism (also not viewable in the attached figures) for causing the actuation of the movable contacts between a closed position, where they are coupled to the corresponding fixed contact to realize a conductive current path, and an open position, in which they are spaced away from the corresponding fixed contacts for interrupting the conductive current path.

- 5 The switching unit 20 further comprises one or more connectors 22 which are operatively associated to its electrical poles; in the exemplary embodiment illustrated in figure 4 the connectors 22 protrude from a rear portion 23 of the main casing 21 and comprise a claw 22.

The assembly 10 according to the present disclosure comprises a supporting frame 11 into which the corresponding switching unit 20 can be inserted, and from which the switching unit 20 can be
10 withdrawn. In other words, the switching unit 20 and the supporting frame 11 are substantially a movable part and a corresponding fixed part, respectively, of the withdrawable switching device 1. Preferably, a guiding mechanism is used for performing the inserting/withdrawn operations; this guiding mechanism is well known in the art and, hence, no further herein disclosed.

In the exemplary but not limiting embodiment illustrated in figure 2 and 3, the supporting frame
15 11 comprises at least two metal flanks 13 and 16 linked by a base 14 and by a rear wall 15 which is preferably made of insulating material. The elements 13, 14, 15 and 16 are connected to each other to define an internal volume for receiving the switching unit 20 through a frontal access 18. The assembly 10 according to the present disclosure further comprises one or more connectors 12 placed at a bottom portion 17 of its supporting frame 11.

- 20 The connectors 12 are adapted to be operatively connected to distribution means of the electrical circuit into which the switching device 1 is installed. For example, the connectors 12 are adapted to be operatively connected to busbars, when the assembly 10 is mounted on a cabinet support according to its installation position.

The connectors 12 are further adapted to be coupled with corresponding connectors 22 of the
25 switching unit 20, when such switching unit 20 reaches a connected, or inserted, position into the supporting frame 11. In this way, an electrical connection can be established between the distribution means of the electrical circuit and the poles of the switching unit 20, through the coupling between the connectors 12 and the corresponding connectors 22.

Preferably, the connectors 12 protrude from the corresponding bottom portion 17 of the supporting
30 frame 11 in order to couple with the corresponding connectors 22.

For example, figure 11 illustrates a claw connector 22 of the switching unit 20 in the connected

position; such claw connector 22 clamps the pin-shaped connector 12 protruding transversally from the corresponding bottom portion 17 of the supporting frame 11.

According to another example, the switching unit 20, instead of the claw connectors 22, comprises substantially pin-shaped connectors 22. Accordingly, each connector 12 comprises a claw 12 which transversally protrudes from the corresponding bottom portion 17 of the supporting frame 11. As illustrated in figure 14, this claw connector 12 is adapted to clamp the corresponding pin-shaped connector 22, when the switching unit 20 is in the connected position.

As disclosed above, the switching unit 20 can be withdrawn from the supporting frame 11 in order to reach a disconnected, or extracted, position. In this disconnected position the switching unit 20 is positioned relative to the supporting frame 11 such that no electrical connection is established between components and/or elements of the switching unit itself 20 and of the assembly 10. In particular, the connectors 12 and 22 are separated from each other, as illustrated for example in figures 9 and 12.

Preferably, the switching unit 20 can be also in a test position between the connected and the disconnected positions, as illustrated for example in figures 10 and 13. In this test position the switching unit 20 is positioned relative to the supporting frame 11 in such a way that the connectors 12 and 22 are separated, but an electrical connection can be established between other components or elements of the switching unit 20 itself and of the assembly 10.

For example, in the test position a connection can be established between one or more auxiliary and/or accessory devices housed into or connected to the main casing 21 and one or more auxiliary and/or accessory devices associated to the supporting frame 11. This connection can occur by means of a connection board 25 on the main casing 21 and a corresponding connection board 150 on the supporting frame 11.

The assembly 10 according to the present disclosure comprises at least one shutter assembly 100 which is associated to one or more corresponding connectors 12.

In particular, for each corresponding connector 12, the shutter assembly 100 comprises:

- an opening 101 for allowing the coupling between the connector 12 and the corresponding connector 22 of the switching unit 20; and
- at least one cover member 102, 103 which can be moved from a cover position to an open position to make the opening 101 accessible for the coupling between the connectors 12 and 22.

In other words, the at least one cover member 102, 103 can be moved away from the cover position,

in which it covers the opening 101, towards the open position in which the opening 101 is accessible for the coupling between the connectors 12 and 22.

In practice, according to the exemplary embodiments illustrated in the attached figures, the at least one shutter assembly 100 is operatively mounted into the supporting frame 11, between the bottom portion 17 and the access 18, so as to provide a safety barrier towards the corresponding connectors 12.

Preferably, the at least one cover member 102, 103 is made of insulating material, and more preferably the whole shutter assembly 100 is made of insulating material.

Advantageously, the at least one cover member 102, 103 associated to each opening 101 of the shutter assembly 100 is adapted to be moved from the cover position to the open position by at least one corresponding element 12 which protrudes from the bottom portion 17 of the supporting frame 11.

The shutter assembly 100 is operatively mounted movable into the supporting frame 11, and it is adapted to operatively interact with the switching unit 20 under insertion into the supporting frame 11 so as to be moved towards the bottom portion 17, for causing the movement of the at least one cover member 102, 103 from the cover position to the open position by the at least one protruding element 12.

In practice, the shutter assembly 100 remains in a starting position, where the at least one cover member 102, 103 associated to each opening 101 is in its cover position, until it is moved towards the bottom portion 17 by an operative interaction with the switching unit 20 also moving towards the bottom portion 17. Due to this movement of the shutter assembly 100 towards the bottom portion 17, the protruding element 12 can directly act an opening action on the corresponding at least one cover member 102, 103.

Preferably, at least one elastic element 30 is operatively connected to the supporting frame 11 and to the shutter assembly 100, in such a way to be compressed by the shutter assembly 100 moving towards the bottom portion 17. In this way, when the switching unit 20 is extracted from the connected position to the disconnected position, the at least one elastic element 30 causes a return of the shutter assembly 100 in its starting position. During this returning movement, contact is lost between the at least one protruding element 12 and the corresponding at least one cover member 102, 103 which, hence, can return in its initial cover position.

Preferably, the at least one protruding element 12 comprises the connector 12; in other words, the

connector 12 itself is adapted to cause the movement of the corresponding at least one cover member 102, 103 from the cover position to the open position, in order to reach and couple with the corresponding connector 22 through the opening 101.

Having the connector 12 itself causing the movement of the at least one cover member 102, 103 from the cover position to the open position means that this opening movement advantageously occurs when the switching unit 20 is near to its connected position. For example, with reference to figures 9-11 and 12-14, the opening movement of the at least one cover member 102, 103 occurs after that the switching unit 20 has passed through the test position.

Preferably, the shutter assembly 100 is adapted to be pushed towards the bottom portion 17 by the switching unit 20 under insertion into the supporting frame 11 for reaching its connected position. For example, the switching unit 20 illustrated in figure 4 comprises, for each of its connectors 22, a pushing element 24 which protrudes from its rear portion 23. The pushing elements 24 are adapted to contact and push the shutter assembly 100 towards the bottom portion 17, during the insertion of the switching unit 20 into the supporting frame 11.

Preferably, as illustrated in figures 4 and 9-14, the pushing elements 24 surrounds at least laterally the corresponding connectors 22.

Preferably, the shutter assembly 100 is adapted to be contacted by the switching unit 20 when the switching unit 20 itself is in the disconnected position. For example, in figures 9 and 12 the illustrated pushing element 24 is in contact with the corresponding shutter assembly 100, while the switching unit 20 is in the disconnected position. In this way, the pushing element 24 can start its pushing action on the shutter assembly 100 as soon as the switching unit 20 moves away from the disconnected position, towards the bottom portion 17.

This is advantageous because, during the movement of the switching unit 20 from the disconnected position towards the test or connected position, the pushing element 24 provides an additional electrical segregation and an additional mechanical protection around the opening 101, the cover members 102, 103, and the live parts represented by the connector 22 and the corresponding connector 12.

According to the exemplary embodiment illustrated in the cited figures, the at least one cover member 102, 103 associated to each opening 101 of the shutter assembly 100 comprises a first cover member 102 and a second cover member 103. The first and second cover members 102, 103 are adapted to be moved by the corresponding at least one protruding element 12 from their cover

position, where they are adjacent to each other so as to cover the opening 101, to their open position, where they are separated from each other so as to make the opening 101 accessible for the coupling between the connectors 12 and 22.

Preferably, the first and second cover members 102, 103 are adapted to be rotated by the
5 corresponding protruding element 12 from their cover position to their open position about a first axis of rotation 112 and a second axis of rotation 113, respectively.

Preferably, the first and second cover members 102 and 103 are adapted to be moved from their cover position to their open position by the insertion between them of the at least one protruding element 12, insertion which is due to displacement of the overall shutter assembly 100 towards the
10 bottom portion 17 from which the element 12 itself protrudes.

Preferably, the first and second cover members 102 and 103 are operatively linked to each other by at least one elastic element 105, such as a spring 105, so as the movement of the first and second cover members 102, 103 from their cover to open position causes an elastic deformation of the elastic element 105. In this way, at the extraction of the switching unit 20 from its connected to its
15 disconnected position, the action of the spring 105 recalls the first and second cover members 102, 103 in their cover position, when contact is lost between the first and second cover members 102, 103 and the corresponding at least one protruding element 12.

The assembly 10 illustrated for exemplary purposes in figures 2-3 comprises two shutter assemblies 100, as the exemplary shutter assembly 10 illustrated in figures 5 and 6. In particular,
20 such exemplary shutter assembly 100 comprises a frame 110 through which three openings 101 are defined for allowing the coupling between three connectors 12 and three corresponding connectors 22.

Each of the two exemplary shutter assemblies 100 illustrated in figures 2 and 3 is operatively mounted movable into the supporting frame 11, by operatively inserting its frame 110 in a
25 corresponding cavity 19 defined in the supporting frame 11. In particular, the bottom portion 17 of each cavity 19 is defined by the rear wall 15, and it comprises through holes from which three connectors 12 protrudes for extending into the cavity 19.

With reference also to figures 7-8, two springs 30 are operatively connected to the supporting frame 11 and to a corresponding surface 130 of each shutter assembly 100, in such a way to be
30 compressed by the shutter assembly 100 moving towards the bottom portion 17.

With reference to the exemplary shutter assembly 100 illustrated in figures 5 and 6, the first and

second cover members 102 and 103 associated to each of its openings 101 are pivotally mounted to the frame 110, in such a way to define the first axis of rotation 112 and the second axis of rotation 113.

For example, with reference to figure 6, the frame 110 comprises:

- 5 - a plurality of cavities 111, each one under a corresponding opening 101;
- a couple of portions 115, 120 extending into each cavity 111, faced and opposed to each other.

Each one of the two portions 115, 120 defines into the corresponding cavity 111:

- 10 - a seat 116 for receiving therein a corresponding pin portion 117 of the first cover member 102, so as to define the first axis of rotation 112; and
- a seat 118 for receiving therein a corresponding pin portion 119 of the second cover member 103, so as to define the second axis of rotation 113.

In particular, the first and second cover members 102, 103 illustrated in figure 6 preferably comprise a rod 121 and a rod 122, respectively. The opposed ends 117 of the rod 121 are the pin portions 117 inserted into the seats 116 of the portions 115 and 120, while the opposed ends 119 of the rod 122 are the pin portions 119 inserted into the seats 118 of the portions 115 and 120.

With reference to figure 5, each of the portions 115, 120 preferably comprises a surface of contact 125 for the first cover member 102 and for the second cover member 103, which is defined between the opening 101 and the seats 116 and 117.

20 In this way, a movement of the first and second cover members 102, 103 relative to the frame 110, which would cause an exit of the pin portions 117 and 119 from the corresponding seats 116 and 118, is prevented by the contact surfaces 125.

Preferably, the assembly 10 according to the present disclosure comprises locking means for blocking the movement of each shutter assembly 100 towards the corresponding bottom portion 25 17 of the supporting frame 11.

According to the exemplary embodiment illustrated in figures 2-8, the locking means comprises at least one locking component 200 which protrudes from and comprises an abutment portion 201 for a corresponding shutter assembly 100.

30 In particular, the locking component 200 in a locking position is adapted to be operatively constrained, e.g. by a padlock, to the supporting frame 11. In this way, its abutment portion 201 can block an undesired movement of the corresponding shutter assembly 100 towards the bottom

portion 17. Therefore, an undesired, dangerous, movement of the cover members 102, 103 from the cover position to the open position by the corresponding protruding element 12 is avoided while the locking component 200 is constrained in its locking position.

With reference to the exemplary shutter assembly 100 illustrated in figure 5-8, two holes 160 are defined through the frame 110, each one placed between two adjacent openings 101. Each one of the holes 160 is adapted to be crossed by a corresponding locking component 200, in such a way that this locking component 200 protrudes from the shutter assembly 100 towards the access 18 of the supporting frame 11.

Each of the locking components 200 is adapted to be moved away from the locking position towards the bottom portion 17 by the switching unit 20 under insertion in the supporting frame 11. Preferably, the locking means further comprise, for each locking component 200, a tab 210 for contacting a corresponding surface 211 of the supporting frame 11; this tab 210 is operatively connected to the shutter assembly 100.

With particular reference to figures 7 and 8, the locking component 200 and the tab 210 are adapted to operatively interact each other in such a way that:

- the tab 210 contacts the corresponding surface 211 when the locking component 200 is in the locking position (figure 7); and
- the tab 210 disengages from the corresponding surface 11 upon the starting of the movement of the locking component 200 away from the locking position (figure 8).

In this way, the contact between the tab 210 and the corresponding surface 211 blocks an accidental movement of the shutter assembly 100 towards the bottom portion 17, even if the locking component 200 in the locking position is not constrained to the supporting frame 11. In other words, the tab 210 provides an additional guarantee to avoid an accidental access by an operator to the connectors 12.

The locking component 200 is adapted to be moved away from its locking position by the switching unit 20 under insertion into the supporting frame 11, before that the switching unit 20 starts moving the shutter assembly 100 towards the bottom portion 17. In this way, the shutter assembly 100 is free to be moved by the switching unit 20, i.e. there is no more a constrain between the shutter assembly 100 and a fixed part such as the supporting frame 11.

Preferably, a spring 31 is operatively connected to the supporting frame 11 and to each one of the locking components 200, in such a way to be compressed by the locking component 200 moved

away from the locking position by the switching unit 20. In this way, the spring 31 can cause the return of the corresponding locking component 200 to the locking position, when the switching unit 20 is withdrawn from the supporting frame 11.

The inserting and withdrawing operations of the switching unit 20 into/from the corresponding supporting frame 11 of the assembly 10 are disclosed in the followings, by making particular reference to the exemplary embodiments of figures 1-14.

With reference to figure 2, before an insertion of the switching unit 20 into the supporting frame 11, the shutter assemblies 100 are in their initial positions, where their first and second cover members 102 and 103 are in the cover position and they cover the respective openings 101.

In this situation, the locking components 200 associated to the shutter assemblies 100 can be constrained to the supporting frame 11, to lock the shutter assemblies 100. Even if this constrain does not occur, the tabs 210 are in contact with the corresponding surfaces 211 of the supporting frame 11, so as to prevent an undesired movement of the shutter assemblies 100 towards the corresponding bottom portions 17 of the supporting frame 11.

After removing an eventual constrain of the locking components 200 to the supporting frame 11, the switching unit 20 is placed in its disconnected position with respect to the supporting frame 11, as illustrated in figures 9 and 12.

With reference to figure 8, while reaching the disconnected position as illustrated in figures 9 and 12, the switching unit 20 causes a displacement of the locking elements 200 away from their locking position. This displacement causes the tabs 210 to disengage from the corresponding surfaces 211 of the supporting frame 11; hence, the shutter assemblies 100 are free to start being pushed by the switching unit 20 moving towards the disconnected position.

The pushing elements 24 of the switching unit 20 in the disconnected position are in contact with the frame 110 of the corresponding shutter assemblies 100.

Upon the starting of the movement of the switching unit 20 from the disconnected position, towards the bottom portion 17 of the supporting frame 11, the elements 24 push the shutter assembly 100 also towards the bottom portion 17.

Preferably, the inserting movement of the switching unit 20 into the supporting frame 11 can be stopped at the test position as illustrated in figures 10 and 13, where at least test and/or control functionalities on the switching unit 20 can be performed.

The switching unit 20 is then further moved away from the test position, so as to reach the

connected position as illustrated in figures 11 and 14; during such movement the switching unit 20 further pushes the shutter assemblies 100 toward the bottom portion 17, from which the connectors 12 protrudes.

During this pushing, each connector 12 inserts between the first and second cover members 102, 103 clearing the corresponding opening 101. In particular, such insertion causes the rotation of the first cover member 102 and the second cover member 103 about the first rotation axis 112 and the second rotation axis 113, respectively, from their cover position illustrated in figures 10 and 13 to their open position illustrated in figures 11 and 14.

Upon the insertion between the first and second cover members 102, 103, the connector 12 passes through the opening 101 and starts contacting the corresponding connector 22, to reach the coupled position as illustrated in figures 11 and 14.

The connector 12 in this coupled position keeps the first and second cover members 102 and 103 separated from each other in their open position.

During the above mentioned movement of the switching unit 20 from the disconnected position to the connected position, the springs 30 are compressed by the corresponding shutter assemblies 100. Hence, considering the withdrawing of the switching unit 20 from the supporting frame 11, the compressed springs 30 elongate to return in their rest position while the switching unit 20 is moving away with respect to the bottom portion 17. In practice, the springs 30 cause a return of the corresponding shutter assemblies 100 in their initial position as illustrated in figure 2.

The spring 105 between the first and second cover members 102 and 103 cause their return in the cover position, as soon as the connector 12 disengages from them, due to shutter 100 return towards the initial position.

The springs 31, also compressed during the movement of the switching unit 20 from the connected to the disconnected position, cause the return of the corresponding locking components 200 in their locking position, while the switching unit 20 is withdrawn from the supporting frame 11.

In practice, it has been seen how the assembly 10 and related withdrawable switching device 1 allow achieving the intended objective offering significant improvements over known solutions.

In particular, the disclosed assembly 10 allows the movement of the cover members 102, 103 of its shutter assemblies 100, from their cover to their open position, without using a dedicated shutter mechanism acting on the cover members 102, 103.

Indeed, the opening of the cover members 102, 103 is only due to the movement of the shutter

assembly 100 towards the bottom portion 17, and to the corresponding element 12 protruding from such portion 17.

This means a reduction of space into the supporting frame 11, and a more reliable opening operation of the cover members 102, 103 with respect to the known shutter mechanisms subjected to high frictions and other mechanical stresses.

Furthermore, there is no need of adding a safety distance to the path travelled by the switching unit 20 into the supporting frame 11. Indeed, the movement of the cover members 102, 103 of each shutter assembly 100 is directly caused by pushing such cover members 102, 103 on the corresponding protruding element 12, hence without using a shutter mechanism of the known type which requires a safety distance to wait the end of its opening operation. This applies even in the more critical solution where the connectors 22 of the switching unit 20 comprise a claw 22.

Furthermore, considering the exemplary preferred embodiment illustrated in the attached figures, in which the first and second cover member 102 and 103 are adapted to be rotated by the corresponding protruding element 12, no additional distance has to be added to the travelled path of the switching unit 20 for allowing such rotation. Indeed, such rotation is caused by moving the shutter assemblies 100 towards the corresponding portions 17, so as to push the cover members 102, 103 against the corresponding protruding element 12.

The assembly 10 thus conceived also provides advantages in view of the extraction of the switching unit 20 from the supporting frame 11.

Even considering an offset with respect to the predicted position of the switching unit 20 under extraction, due to the mechanical clearance introduced by the guiding mechanism, the movement of the cover members 102, 103 from their open position to their cover position always occurs correctly. Indeed, this opening movement is guided by the disengagement between such cover members 102, 103 and the corresponding protruding element 12.

The assembly 10 and related withdrawable switching device 1 thus conceived are also susceptible of modifications and variations, all of which are within the scope of the inventive concept as defined in particular by the appended claims.

For example, alternatively to the exemplary embodiment illustrated in the attached figures, the first cover member and the second cover member associated to each opening 110 of the shutter assembly 100 can be adapted to slide from their cover position, where they are adjacent one to the other for covering the opening 101, to their open position where the opening 101 is accessible,

preferably by the insertion between them of the corresponding protruding element 12.

Even if according to the preferred exemplary embodiment illustrated in the attached figures the at least one protruding element is the connector 12, the at least one protruding element causing the opening of the cover members 102, 103 can comprise one or more additional elements other than the connector 12.

Preferably, according to this alternative solution such one or more other additional protruding elements could be made of insulating material and/or they would have an height such that the opening of the corresponding cover members 102, 103 occurs when the switching unit 20 is near to reach its connected position, e.g. after the crossing of the test position.

In practice, such one or more additional protruding elements would protrude from the bottom portion 17 near a respective connector 12, and would have a height equal or slightly different with respect to the height of the connector 12.

Even if according to the exemplary embodiment illustrated in figures 9-14 the switching unit 20 starts contacting the shutter assemblies 100 at its disconnected position, alternatively the shutter assemblies 100 can be operatively mounted into the supporting frame 11 so as the switching unit 20 starts contacting and moving them after the disconnected position, e.g. at the test position or between the test position and the connected position.

Even if in the exemplary embodiment illustrated in figures 2-3 the assembly 10 comprises three upper connectors 12, three lower connectors 12 and two corresponding shutter assemblies 100, each having three openings 101, the number of connectors 12 and/or the number of shutter assemblies 100 can be different with respect to the illustrated one.

For example, if the switching unit 20 comprises four electrical poles, the assembly 10 would comprise four upper connectors 12, four lower connectors 12 and two corresponding shutter assemblies 100, each having four openings 101. Alternatively, this assembly 10 can comprise two upper shutter assemblies 100, each having two openings 101 for two corresponding upper connectors 12, and two lower shutter assemblies 100, each having two opening openings 101 for two corresponding lower connectors 12.

For example, with reference to figure 15, the assembly 10 can comprise a plurality of modules 400 which can be modularly positioned adjacent to each other and linked by metal pieces, so as to assemble the rear part of the supporting frame 11.

Each of the modules 400 corresponds to a pole of the switching unit 20 and comprises a casing

401 having a wall 17 which defines a corresponding bottom portion 17 of the supporting frame 11. Connectors 12 are placed at and preferably protrude from the wall 17 for coupling with the corresponding connectors 22 of the pole.

In the exemplary embodiment illustrated in figure 15, even not viewable in such figure, two upper
5 connectors 12 and two lower connectors 12 are placed at the wall 17, and a shutter assembly 100 is operatively mounted movable in the casing 401. Preferably, the shutter assembly 100 comprises hole portions 151 which can slide on corresponding guiding pins 402 connected to the casing 401, for allowing the movement of the shutter assembly 100 towards and away with respect to the wall 17.

10 The illustrated shutter assembly 100 comprises four openings 101, each one associated to a corresponding connector 12, and it is adapted to operatively interact with the switching unit 20 under insertion into the supporting frame 11 to be moved towards the wall 17. This movement causes the displacement of the cover members 102, 103 associated to each opening 101, from their cover position to the open position, by an element protruding from the wall 17, preferably by the
15 connector 12 itself.

In practice, all parts/components can be replaced with other technically equivalent elements; in practice, the type of materials, and the dimensions, can be any according to needs and to the state of the art.

CLAIMS

1. An assembly (10) for a withdrawable switching device (1) adapted to be installed in a low voltage electrical circuit, said assembly comprising:
 - a supporting frame (11) into which a switching unit (20) of the withdrawable switching device (1) can be inserted and from which the switching unit (20) can be withdrawn;
 - at least one first connector (12) placed at a bottom portion (17) of the supporting frame (11) and adapted to be coupled with a corresponding second connector (22) of the switching unit (20), when the switching unit (20) reaches a connected position into the supporting frame (11);
 - a shutter assembly (100) comprising:
 - an opening (110) for allowing the coupling between said first connector (12) and the corresponding second connector (22); and
 - at least one cover member (102, 103) which is adapted to be moved from a cover position to an open position so as to make said opening (101) accessible for the coupling between the first connector (12) and the corresponding second connector (22);characterized in that:
 - said at least one cover member (102, 103) is adapted to be moved from the cover position to the open position by at least one protruding element (12) which protrudes from said bottom portion (17);
 - said shutter assembly (100) is operatively mounted movable into the supporting frame (11); and
 - said shutter assembly (100) is adapted to operatively interact with said switching unit (20) under insertion into the supporting frame (11) so as to be moved towards said bottom portion (17) for causing the movement of said at least one cover member (102, 103) from the cover position to the open position by said at least one protruding element (12).
2. The assembly (10) according to claim 1, wherein said at least one protruding element comprises said first connector (12).
3. The assembly (10) according to claim 1 or claim 2, wherein said shutter assembly (100) is adapted to be pushed towards said bottom portion (17) by said switching unit (20) under insertion into the supporting frame (11).

4. The assembly (10) according to claim 3, wherein said shutter assembly (100) is adapted to be contacted by the switching unit (20) when the switching unit (20) is in a disconnected position.
5. The assembly (10) according to one or more of the preceding claims, wherein said at least one cover member comprises a first cover member (102) and a second cover member (103) which are adapted to be moved by said at least one protruding element (12) from their cover position, where said first and second cover members (102, 103) are adjacent to each other, to their open position, where said first and second cover members (102, 103) are separated from each other.
6. The assembly (10) according to claim 5, wherein said first and second cover members (102, 103) are adapted to be moved from their cover position to their open position by the insertion between them of said at least one protruding element (12).
7. The assembly (10) according to claim 5 or claim 6, wherein said first cover member (102) and said second cover member (103) are adapted to be rotated by said at least one protruding element (12) from the cover position to the open position about a first axis of rotation (112) and a second axis of rotation (113), respectively.
8. The assembly (10) according to claim 7, wherein said shutter assembly (100) comprises a frame (110) through which said opening (101) is defined, and wherein said first and second cover members (102, 103) are pivotally mounted to said frame (110).
9. The assembly (10) according to claim 8, wherein said frame (110) comprises:
 - a cavity (111) under said opening (110);
 - at least one first portion (115, 120) extending into the cavity (111) and defining a first seat (116) for receiving therein a corresponding pin portion (117) of the first cover member (102);
 - at least one second portion (115, 120) extending into the cavity (111) and defining a second seat (118) for receiving therein a corresponding pin portion (119) of the second cover member (103).
10. The assembly (10) according to claim 9, wherein:
 - said at least one first portion (115, 120) comprises a first surface of contact (125) for the first cover member (102), said first surface of contact being defined between said opening (100) and said first seat (116);
 - said at least one second portion (115, 120) comprises a second surface of contact (125) for the second cover member (103), said second surface of contact being defined between said opening (110) and said second seat (118).

11. The assembly (10) according to one or more of the preceding claims, wherein at least one first elastic element (30) is operatively connected to said supporting frame (11) and to said shutter assembly (100), in such a way to be compressed by the shutter assembly moving towards said bottom portion (17).
12. The assembly (10) according to one or more of the preceding claims, comprising locking means (200, 210) for blocking the movement of the shutter assembly (100) towards the bottom portion (17).
13. The assembly (10) according to claim 12, wherein said locking means comprise at least one locking component (200) which protrudes from the shutter assembly (100) and which defines an abutment portion (201) for the shutter assembly (100), and wherein said locking component (200) in a locking position is adapted to be operatively constrained to said supporting frame (11).
14. The assembly (10) according to claim 13, wherein:
 - said locking component (200) is adapted to be moved away from said locking position towards said bottom portion (17) by the switching unit (20) under insertion into the supporting frame (11); and
 - said locking means further comprise at least one tab (210) for contacting a corresponding surface (211) of the supporting frame (11), said at least one tab being operatively connected to the shutter assembly (100);said locking component (200) and said tab (210) are adapted to operatively interact each other in such a way that:
 - the tab (210) contacts said corresponding surface (211), when the locking component (200) is in the locking position; and
 - the tab (210) disengages from the corresponding surface (211) upon the starting of the movement of the locking component (200) away from the locking position.
15. The assembly (10) according to claim 14, wherein at least one second elastic element (31) is operatively connected to said supporting frame (11) and to said locking component (200), in such a way to be compressed by the locking component (200) moved away from the locking position.
16. A withdrawable switching device (1) adapted to be installed in a low voltage electrical circuit, characterized in that it comprises an assembly (10) according to one or more of the

preceding claims, and a switching unit (20) which can be inserted into/withdrawn from the supporting frame (11) of said assembly (10).

17. The withdrawable switching device (1) according to claim 16, wherein said at least one first connector comprises a claw (12).
18. The withdrawable switching device (1) according to claim 16, wherein said at least one second connector comprises a claw (22).

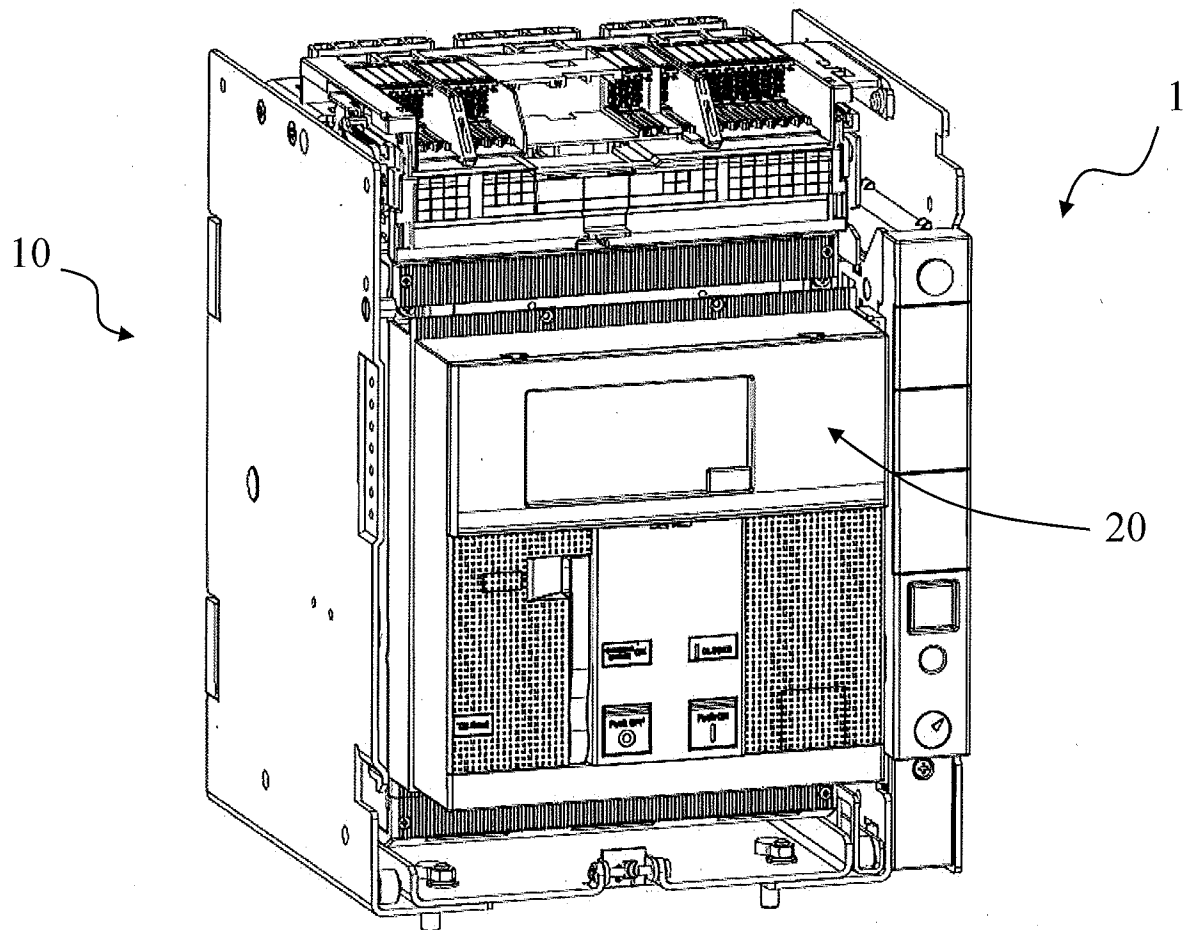


Fig. 1

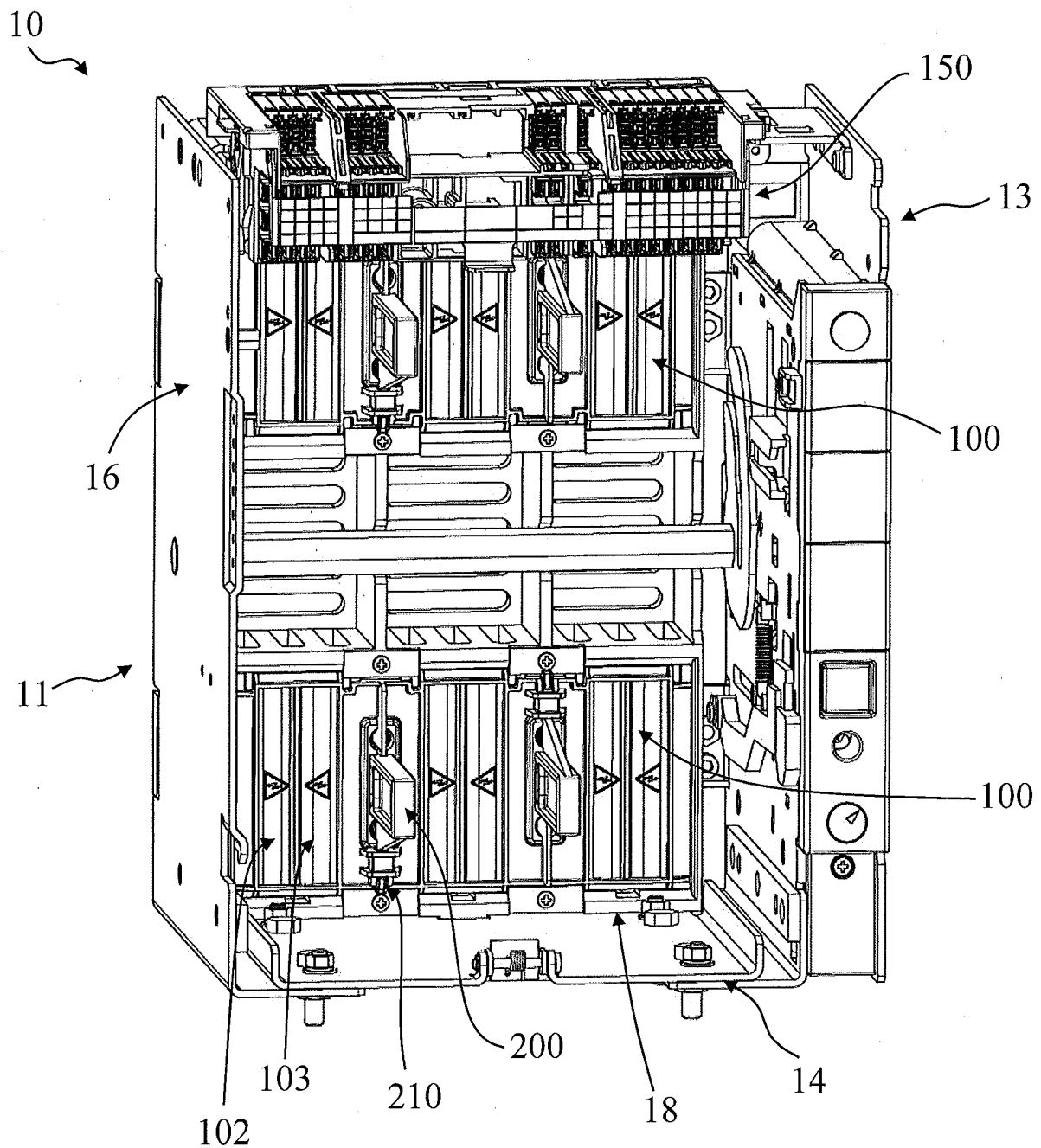


Fig. 2

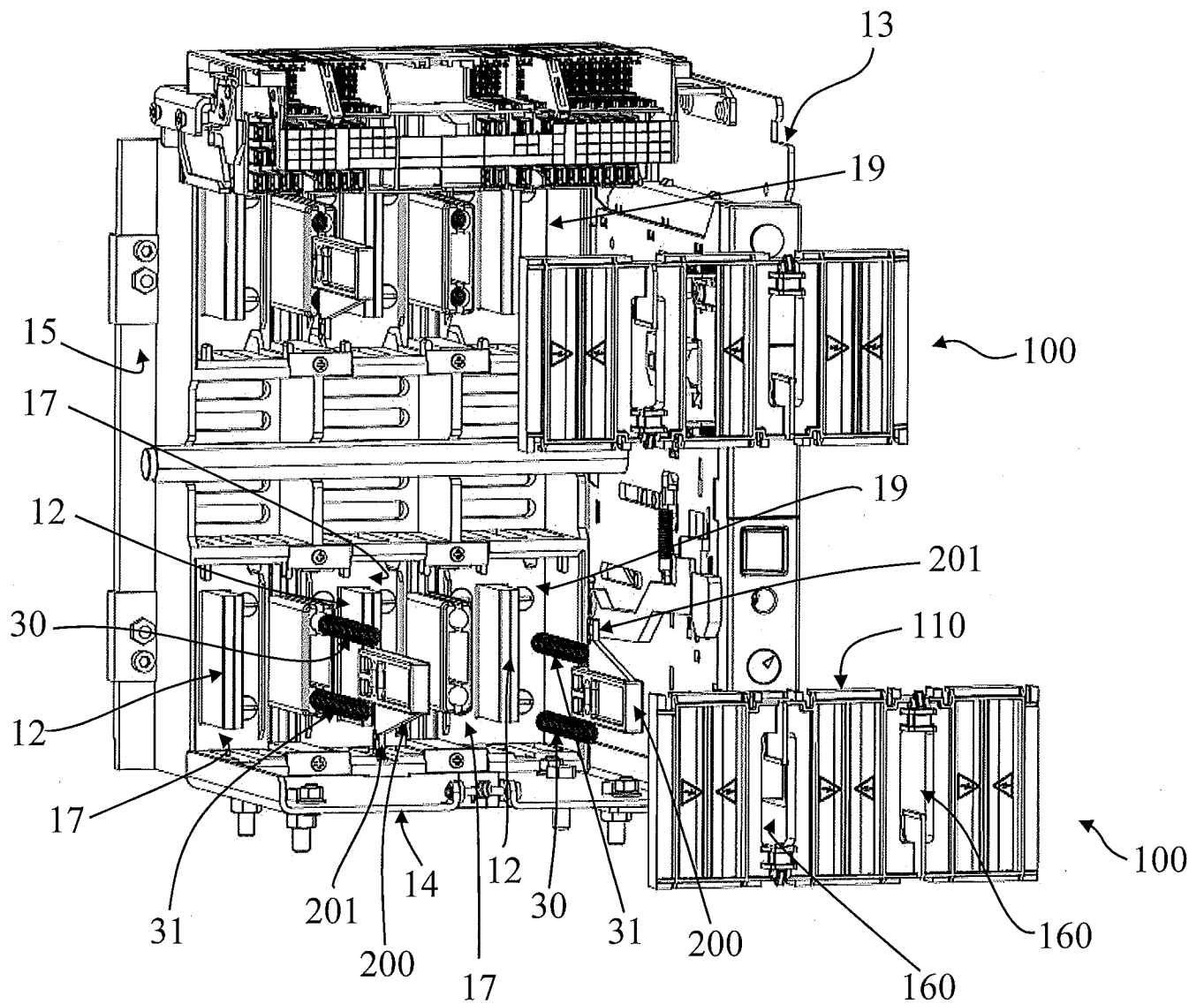


Fig. 3

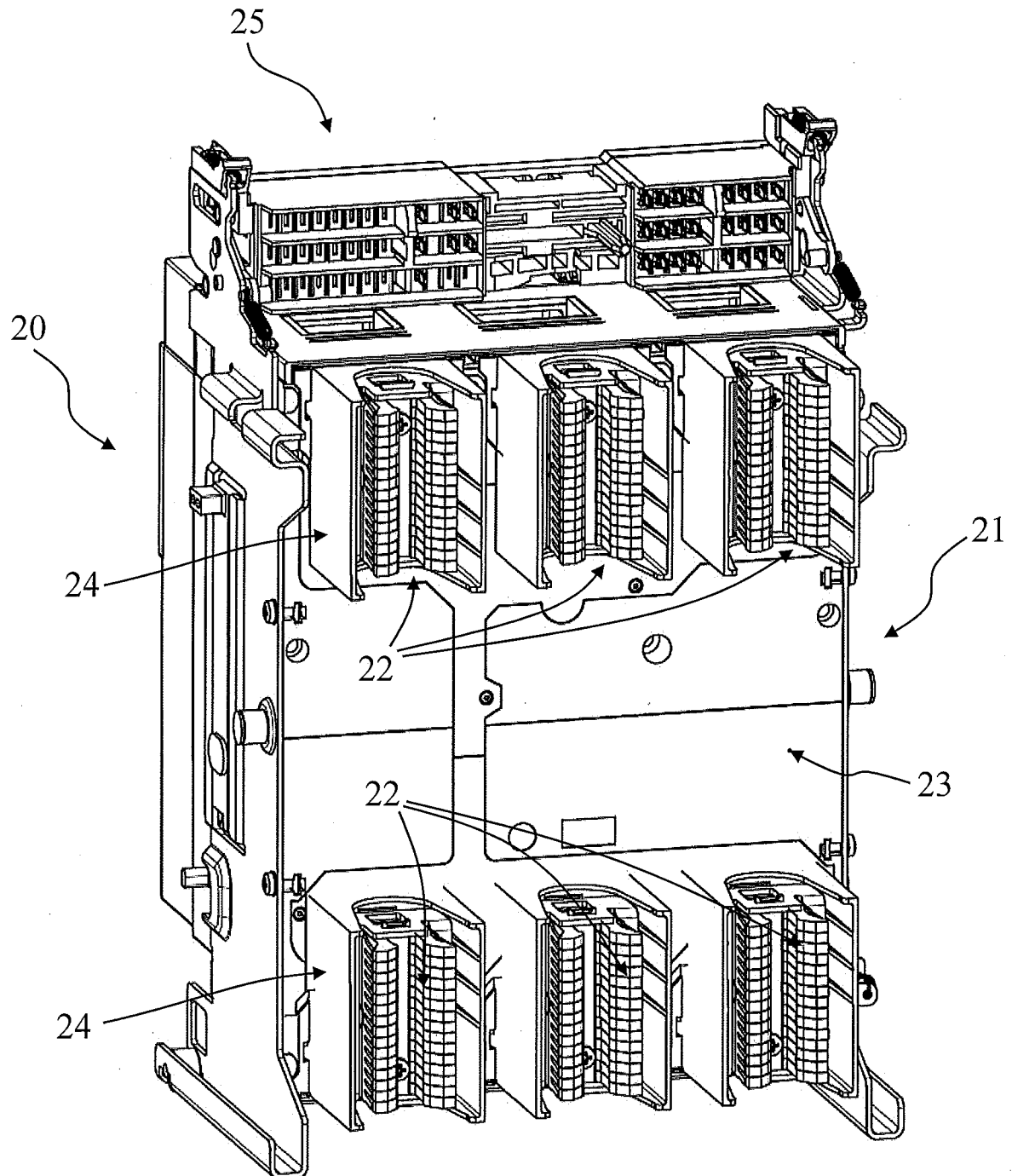


Fig. 4

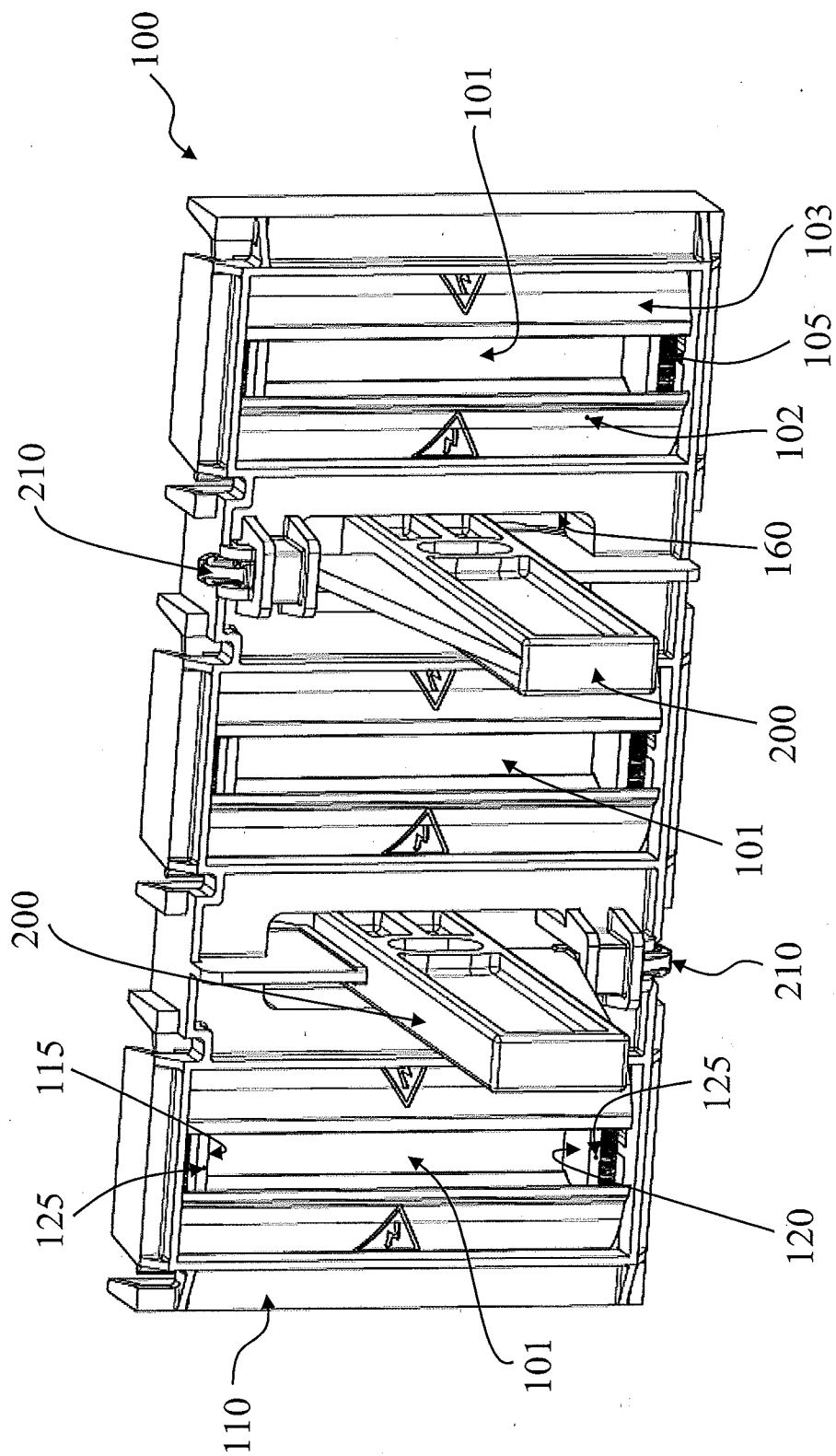


Fig. 5

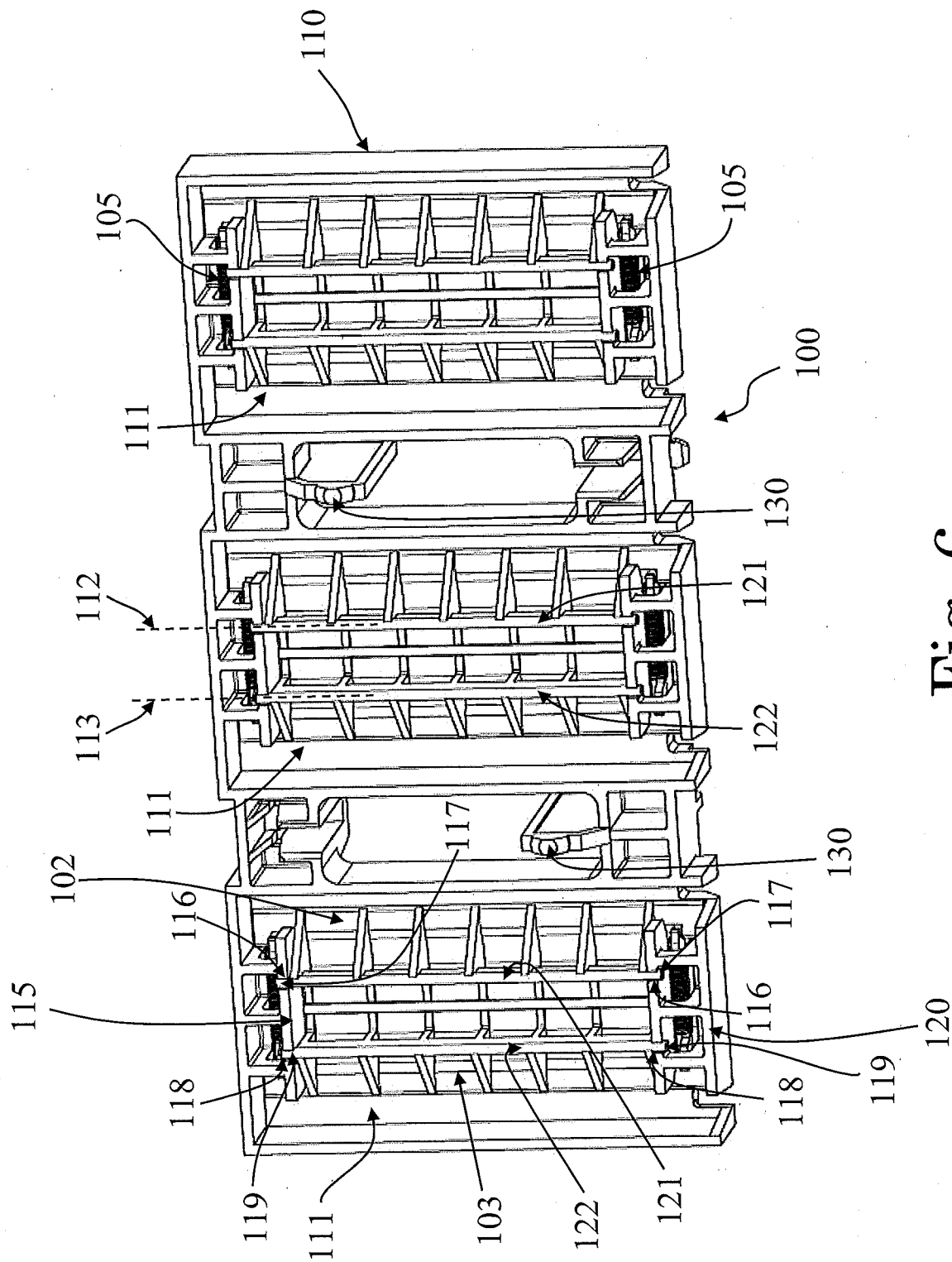


Fig. 6

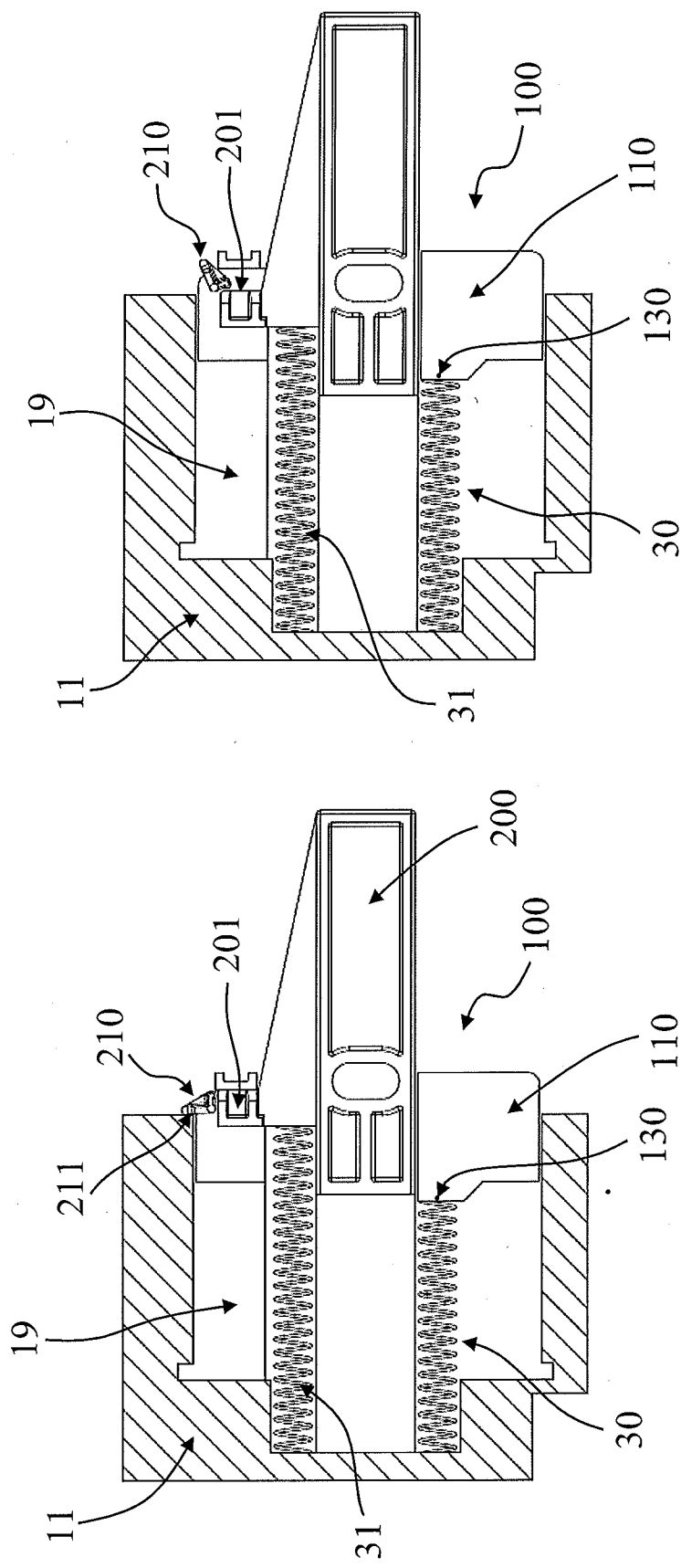


Fig. 8

Fig. 7

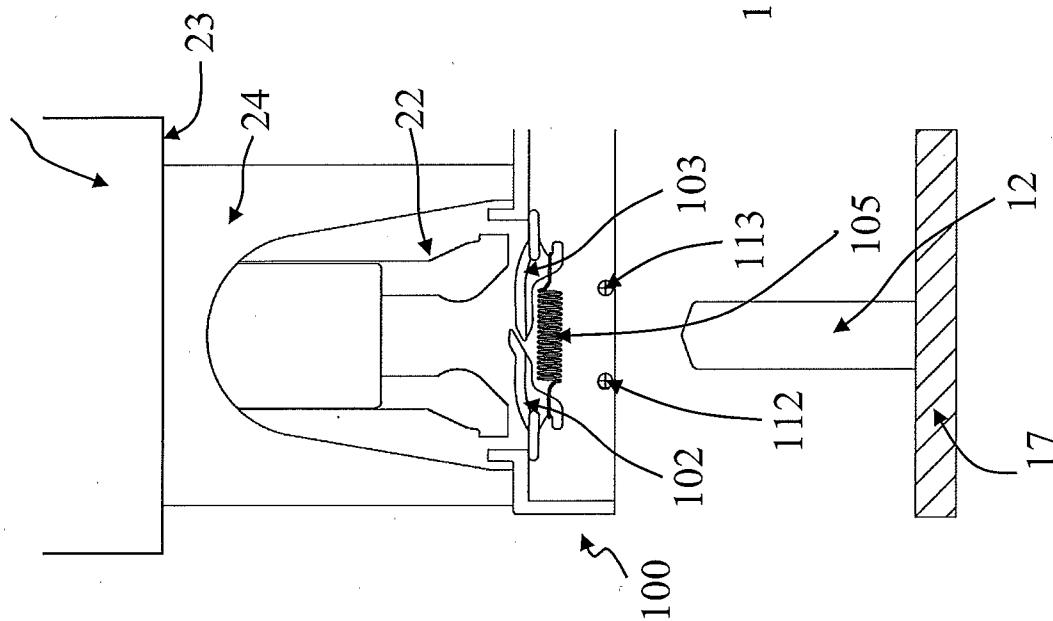


Fig. 9

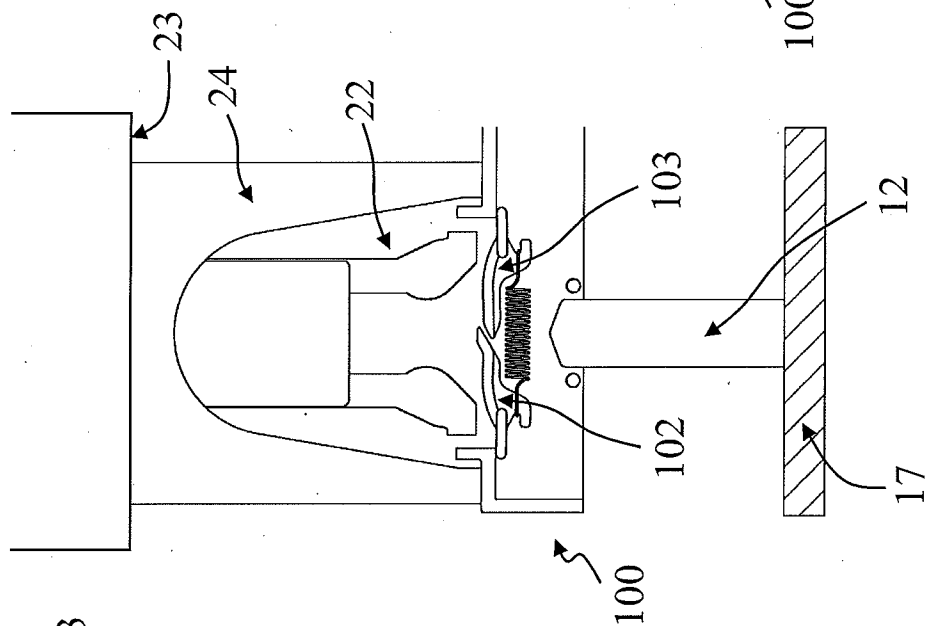


Fig. 10

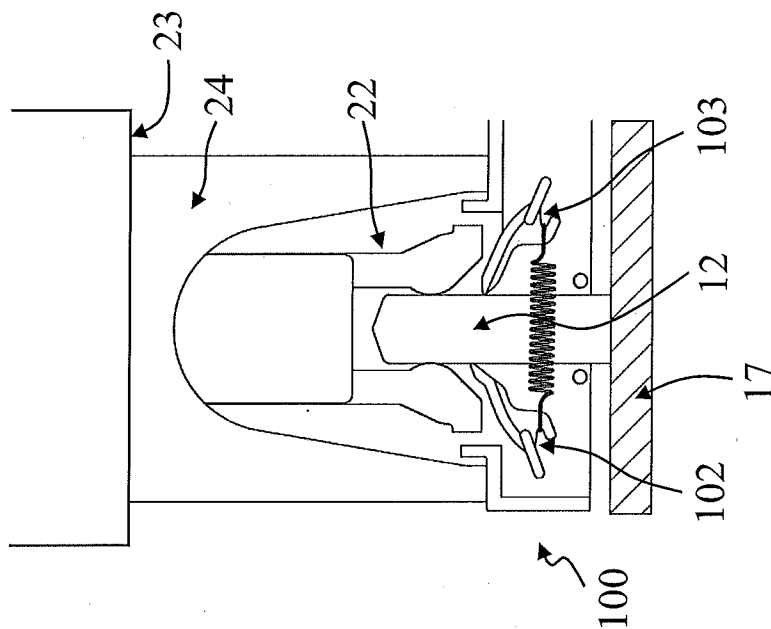


Fig. 11

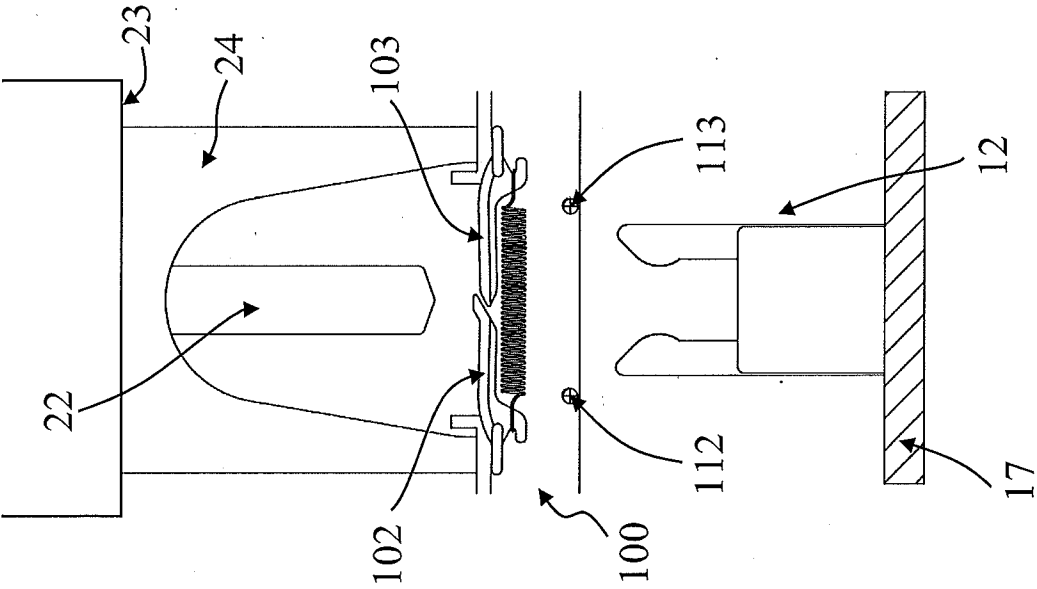


Fig. 12

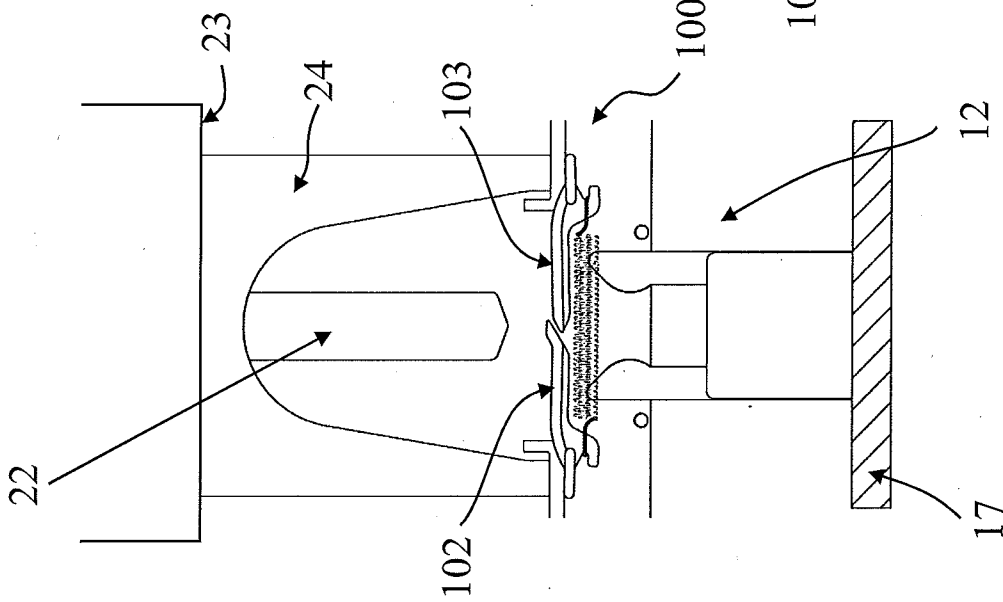


Fig. 13

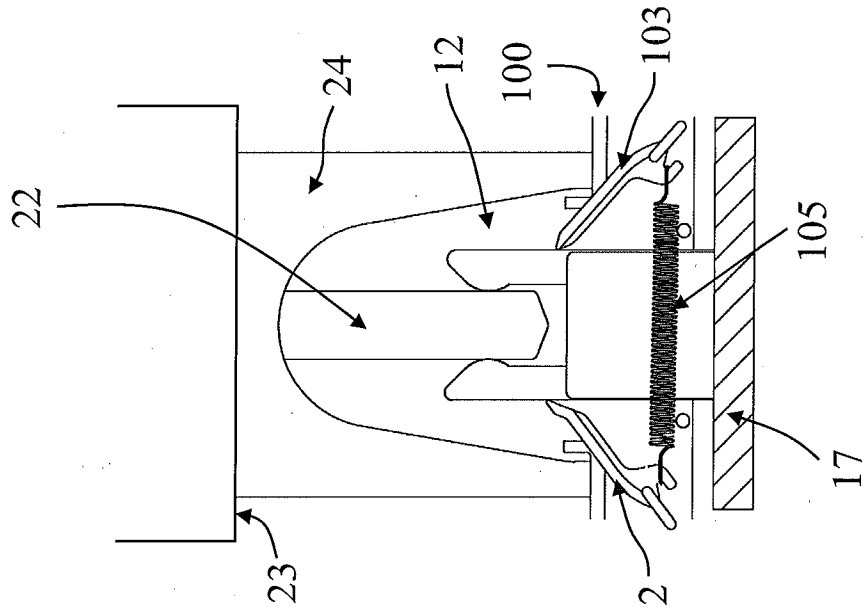


Fig. 14

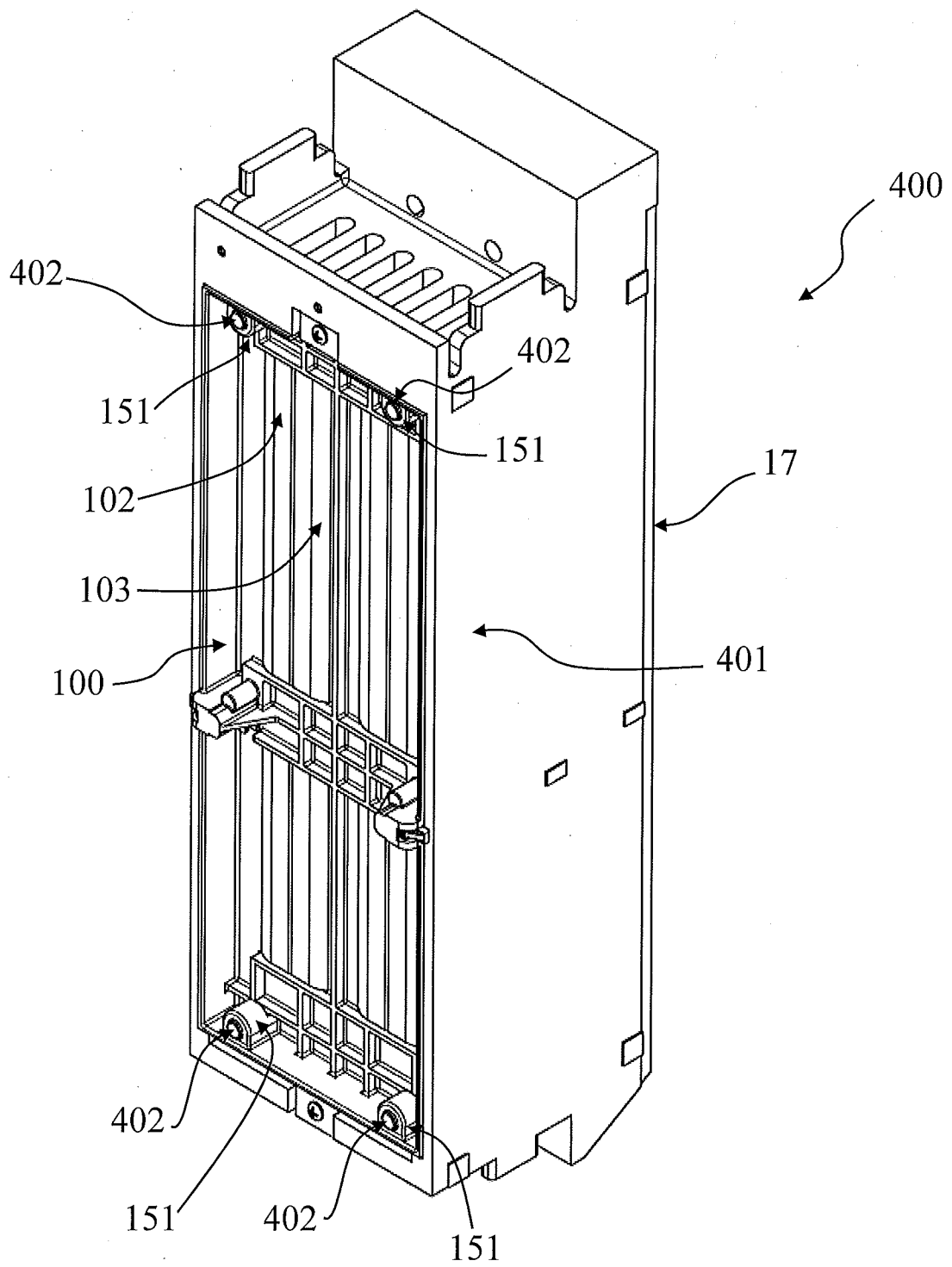


Fig. 15

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/061272

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02B11/24
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	figures	13-15
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

16 January 2015

Date of mailing of the international search report

23/01/2015

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Starck, Thierry

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/061272

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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International application No

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