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(54) **GROUNDING DEVICE FOR HIGH VOLTAGE ELECTRICAL SWITCHGEAR**

(57) **The** grounding device (8) ensures protection against overloads and short circuits in electrical equipment and is used in electrical equipment installed in an enclosure (1) and is made up of a conductive elastic element (9) and a conductive contact (10), which are installed in the casing (4) of the protection element (3) and connected between the operating means (2) and the shunt bar (7) of the electrical circuit. During the removal of the protection element (3), the contact (10) moves towards the second electrical connection point (6) of the casing (4), which ensures that the electrical circuit between the operating means (2) and the casing (4) is grounded. When the protection element (3) is inserted, the contact (10) moves back until it comes to a stop with the first connection point (5), which guarantees that no section of the electrical circuit remains floating.

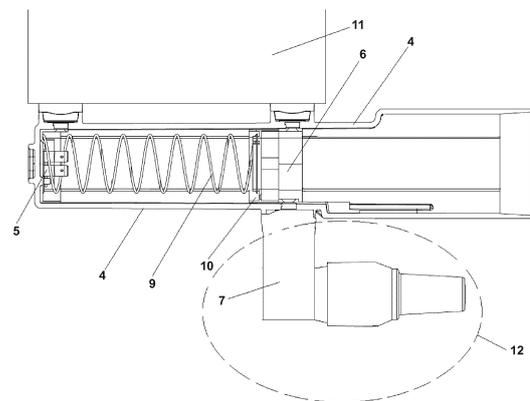


FIG. 6

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Description

OBJECT OF THE INVENTION

[0001] The field of application of the present invention is electrical power distribution systems, in particular, it relates to an automatic grounding device for high voltage electrical switchgear, which is built into an enclosure that comprises in turn, a series of elements, among others, at least one operating means that allows to carry out the functions of breaking/making, disconnecting and grounding of the electrical circuit, as well as at least one protection element against overloads and short circuits built into a casing.

[0002] The purpose of the device of the invention is to connect to ground both the upstream side of the casing that incorporates the protection element and the downstream side of said casing during the operation for removing the protection element from the casing and while the operating means is in the grounding position.

BACKGROUND OF THE INVENTION

[0003] Nowadays, the high-voltage electrical switchgear used in electricity distribution networks is installed in usually metallic enclosures, called cells. Said electrical switchgear includes operating means, such as switches, which perform the functions of breaking/making, disconnecting and grounding of the system. In this way, in cases where there is, for example, a fault in the distribution line, a disconnection due to works, maintenance or optimization of load distribution, such operating means can be activated to obtain the desired electrical energy distribution, avoid that consumers remain without voltage or guarantee the protection of people and electrical equipment, such as transformers.

[0004] In addition to the operating means, the electrical switchgear also includes protection elements against overloads and short circuits, such as fuses. The great advantage of fuses is the speed of action in the event of a short circuit. Consequently, they effectively protect electrical switchgear and electrical equipment, such as distribution transformers, against the dynamic and thermal effects of short-circuit. Therefore, an enclosure that incorporates the electrical switchgear can comprise at least one operating means, such as a load break switch that performs the functions of breaking/making, disconnecting and grounding, and at least one protection element such as a fuse. The protection element is installed inside a casing or also known as a fuse-holder tube, housed in a removable fuse holder base. Generally, the operating means is installed between at least one main circuit bar and the casing that incorporates the protection element, while said casing of the protection element is installed between the operating means and at least one shunt bar.

[0005] Switches that include a pair of fixed contacts and a mobile contact that can be electrically connected to

said fixed contacts can sometimes also include a third fixed grounding contact, so that in this case the switch would have three operating positions (breaking/making, disconnecting and grounding). The electrical switchgear comprising this type of switch with three operating positions and a series fuse installed downstream of the switch, as shown in figure 1, when the switch is in the grounding operating position, both ends of the casing that incorporates the fuse are connected to ground, that is, the electrical circuit both upstream and downstream of the fuse is connected to ground, so the operator can safely access that section of the electrical circuit that is grounded on both sides, for example to carry out the work of replacing the fuse when the latter has blown due to an electrical fault.

[0006] In this sense, figure 1 shows a switch (2) with three operating positions (breaking/making, disconnecting and grounding) incorporated in an enclosure (1), where the switch (2) is in the grounding position, thus connecting to ground the electrical circuit both upstream (11) and downstream (12) of the fuse (3).

[0007] There are other solutions that in order to connect to ground on both sides, upstream and downstream the fuse, it is necessary to add a grounding switch in addition to the switch with three operating positions, as can be seen in figure 2, wherein said added grounding switch is installed downstream the fuse. This type of solution implies other associated mechanisms or forwarding between internal mechanisms that make the electrical circuit of the electrical switchgear more complex, as well as the increase in dimensions of the electrical switchgear due to the use of one more element, specifically the added grounding switch.

[0008] In this way, in figure 2 a switch (2) with three operating positions (breaking/making, disconnecting and grounding) can be seen incorporated in an enclosure (1), wherein the switch (2) is located in the grounding position, thus connecting the upstream part (11) of the fuse (3) to ground, while in order to connect the downstream part (12) of the fuse (3) to ground, it is necessary to add a grounding switch (14).

[0009] Other solutions, such as rotary operating means, that is, rotary switches that comprise a pair of fixed contacts arranged diametrically opposite each other and a mobile contact with rotary movement that can electrically connect the pair of fixed contacts to each other, can also comprise a third grounding operating position, for which they include a third fixed contact that is connected to ground. The main advantage of this type of switch is that a point other than the one connected in service can be grounded, in this case grounding the downstream part of the fuse, which is a point susceptible to being energized, and at the same time the most accessible point of the fuse housing. In this sense, in the electrical switchgear that includes a rotary switch with three operating positions (breaking/making, disconnecting and grounding) and a series fuse installed downstream said switch, as shown in figure 3, under normal

service conditions, when the switch is in the grounding operating position, both sides of the fuse are connected to ground (both sides of the housing that incorporates the fuse), but when the fuse blows and must be replaced by removing it from the casing that incorporates it and by inserting a new one, the switch is brought to the grounding position and one end of the casing that incorporates the fuse is connected to ground, but not the other end, that is, only the side of the electrical circuit that is downstream the blown fuse is connected to ground, but not the side of the electrical circuit that is upstream the blown fuse. Specifically, the section of electrical circuit between the switch and the blown fuse remains floating, at an indeterminate potential as there is no continuity in the fuse because it is blown. In the event that it is possible to access that floating section of the electrical circuit, and that it had also been charged with voltage, it could be a risk of electrical contact for the operators.

[0010] In this sense, Figure 3 shows a rotary type switch (2) that is in the grounding position, thus connecting to ground the side of the electrical circuit that is downstream (12) the fuse (3), but not the side of the electrical circuit that is upstream (11) the fuse (3).

DESCRIPTION OF THE INVENTION

[0011] The present invention refers to a grounding device for application in electrical power distribution systems such as, for example, electrical transformation centers, distribution centers, substations, etc., specifically for application in electrical switchgear that is installed in enclosures or cells, wherein the electrical switchgear includes at least one operating means inside the enclosure, such as a rotary three-position load break switch (breaking/making, disconnecting and grounding) and at least one element for protection against overloads and short circuits, such as a fuse incorporated in a fuse-holder casing or tube, the operating means and the protection element being installed in series between at least one main circuit bar and at least one shunt bar.

[0012] The grounding device of the invention solves each and every one of the problems mentioned above, and therefore, the device allows grounding downstream as well as upstream the fuse, it even allows grounding the electrical circuit section between the switch and the housing that incorporates the fuse when the fuse is removed from said housing. When the operating means is in the grounding operating position, the point of the downstream fuse is connected to ground, which in turn is the point of the fuse casing closest to the operator and, at the same time, the output of the electrical switchgear, this being the point from where the voltage can come from. Then, when the operator removes the fuse from the casing, the grounding device automatically connects to ground the other point of the fuse casing furthest away from the operator, so that any operator can access both the upstream and downstream sides of the casing safely without being exposed to electrical risks.

[0013] The grounding device is installed inside the casing of the protection element and this casing comprises at least one electrical connection point that is arranged between the operating means and the shunt bar of the electrical circuit. The grounding device comprises at least one elastic element, such as a spring made of conductive material, and an electrically conductive contact, wherein the elastic element is connected at one of its ends to the first electrical connection point, in such a way that the contact of the grounding device can move between the first connection point and the second connection point of the casing that incorporates the protection element.

[0014] In an operation for removing the protection element from the casing, with the operating means in the grounding position, the elastic element decompresses and pushes the contact of the grounding device towards the second electrical connection point of the casing, so that once the contact of the grounding device comes to a stop with said second electrical connection point, the section of electrical circuit between the operating means and the casing that incorporates the protection element is automatically connected to ground, that is, the side of the electrical circuit upstream the casing of the protection element is grounded. The side of the electrical circuit downstream the protection element casing is grounded at the moment when the operating means is in the grounding position.

[0015] On the other hand, when inserting the protection element into the casing, the elastic element is compressed and the contact of the grounding device moves back towards the first connection point of the casing.

DESCRIPTION OF FIGURES

[0016]

Figure 1.- Shows a schematic diagram of the state of the art referring to an electrical switchgear that includes an operating means with three operating positions, equipped with a pair of fixed contacts and a mobile contact that can be electrically connected to said fixed contacts, which is in the grounding position installed in series with a protection element.

Figure 2.- Shows a single-line diagram of the state of the art referring to an electrical switchgear that includes an operating means with three operating positions and an added grounding switch installed in series and downstream a protection element.

Figure 3.- Shows a schematic diagram of the state of the art referring to an electrical switchgear that includes a rotary-type operating means in the grounding position installed in series with a protection element.

Figure 4.- Shows a perspective view of the grounding device comprising an elastic element and a contact.

Figure 5.- Shows a perspective view of the grounding device of figure 4 of the invention inside the casing at the time of removing the protection element.

Figure 6.- Shows a perspective view of the grounding device of figure 4 inside the casing once the protection element has been removed.

Figure 7.- Shows a perspective view of the grounding device of figure 4 inside the casing when the protection element is fully inserted.

Figure 8.- Shows a schematic diagram referring to an electrical switchgear that includes a rotary-type operating means in the grounding position installed in series with a protection element and also includes the grounding device of figure 4.

PREFERRED EMBODIMENT OF THE INVENTION

[0017] An example of a preferred embodiment is described below, making reference to the aforementioned figures, without this limiting or reducing the scope of protection of the present invention.

[0018] The grounding device (8) of the present invention is applicable to electrical switchgear that is installed in an enclosure (1), wherein the electrical switchgear includes at least one operating means (2) inside the enclosure (1), such as a rotary load break switch with three positions (breaking/making, disconnecting and grounding) and at least one protection element (3) against overloads and short circuits, such as a fuse incorporated in a casing (4), with the operating means (2) and the protection element (3) installed in series between at least one main circuit bar (13) and at least one shunt bar (7), as shown in figure 8.

[0019] As shown in figures 4 and 5, the grounding device (8) comprises at least one elastic element (9), such as a spring, made of conductive material and a contact (10) also made of conductive material. The grounding device (8) is installed inside the casing (4) of the protection element (3), as can be seen in figures 5 to 8, and said casing (4) comprises at least one electrical connection point (5, 6) that is arranged between the operating means (2) and the shunt bar (7) of the electrical circuit.

[0020] On the other hand, the elastic element (9) of the grounding device (8) is joined at one of its ends to the first electrical connection point (5), as shown in figures 5 to 7, in such a way that the contact (10) of the grounding device (8) is movable between the first connection point (5) and the second connection point (6) of the casing (4) that incorporates the protection element (3).

[0021] Thus, in an operation for removing the protection element (3) from the casing (4), with the operating

means (2) in the grounding position, the elastic element (9) decompresses and pushes the contact (10) of the grounding device (8) towards the second electrical connection point (6) of the casing (4), as shown in figure 5, so that once the contact (10) of the grounding device (8) abuts said second electrical connection point (6), the section of electrical circuit between the operating means (2) and the casing (4) that incorporates the protection element (3) is automatically connected to ground, as shown in figure 6 wherein the protection element (3) has already been fully removed, that is, the side (11) of the electrical circuit upstream the casing (4) of the protection element (3) is grounded. The side (12) of the electrical circuit downstream the casing (4) of the protection element (3) is grounded at the moment that the operating means (2) is in the grounding position.

[0022] On the contrary, as shown in figure 7, in an operation for inserting the protection element (3) in the casing (4), the elastic element (9) is compressed and the contact (10) of the grounding device (8) recedes until it comes to a stop with the first connection point (5) of the casing (4), so that no section of the electrical circuit is floating during the insertion of the protection element (3).

Claims

1. Grounding device (8) for a high-voltage electrical switchgear equipped with an enclosure (1) that includes at least one operating means (2) inside it with functions of breaking/making, disconnecting and grounding, as well as at least one protection element (3), the protection element (3) being incorporated inside a casing (4) that includes two electrical connection points (5, 6) and that is arranged between the operating means (2) and at least one shunt bar (7), **characterized in that** the grounding device (8) comprises at least one elastic element (9) and a movable contact (10) between the first connection point (5) and the second connection point (6), so that the elastic element (9) decompresses and pushes the contact (10) in an operation for removing the protection element (3) from the casing (4), while in an operation for inserting the protection element (3) in the casing (4), the elastic element (9) is compressed and the contact (10) moves back towards the first connection point (5).
2. Grounding device (8) according to claim 1, **characterized in that** the elastic element (9) is made of a conductive material.
3. Grounding device (8) according to claim 2, **characterized by** the fact that the elastic element (9) comprises one end connected to the first electrical connection point (5) and the other end connected to the electrically conductive contact (10).

4. Grounding device (8) according to claim 3, **characterized in that** the first electrical connection point (5) is connected to the operating means (2) and the second electrical connection point (6) is connected to the shunt bar (7), so that in the grounding position of the operating means (2) the removal of the protection element (3) from the casing (4) supposes the grounding of a side (11) upstream the casing (4) as well as a side (12) downstream the casing (4).

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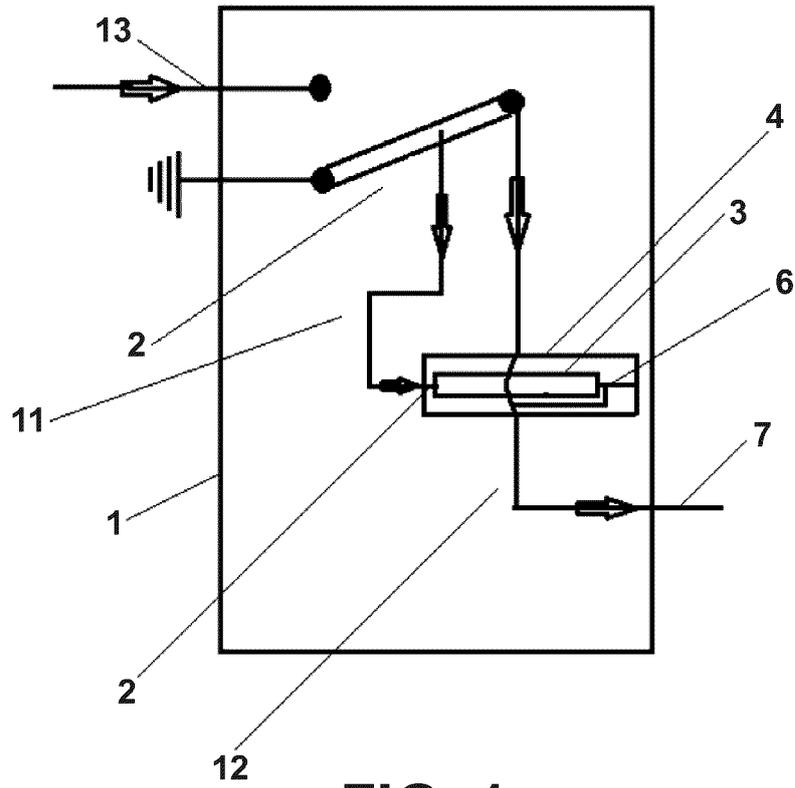


FIG. 1

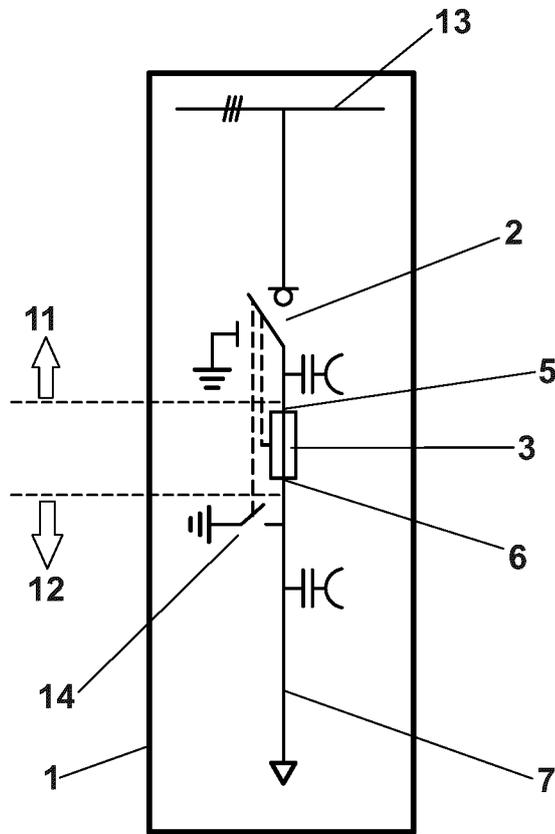


FIG. 2

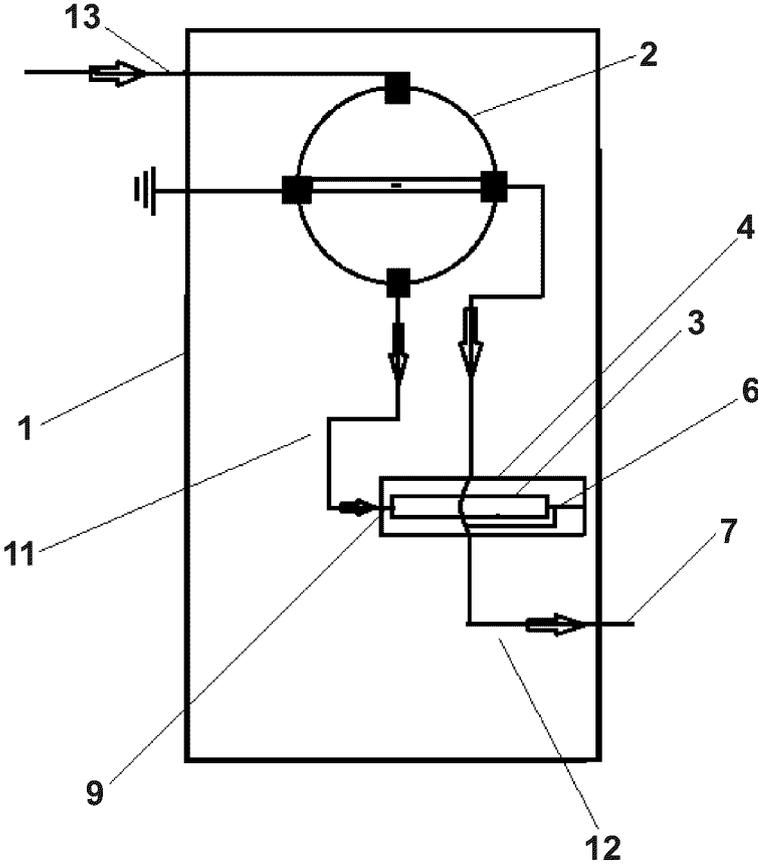


FIG. 3

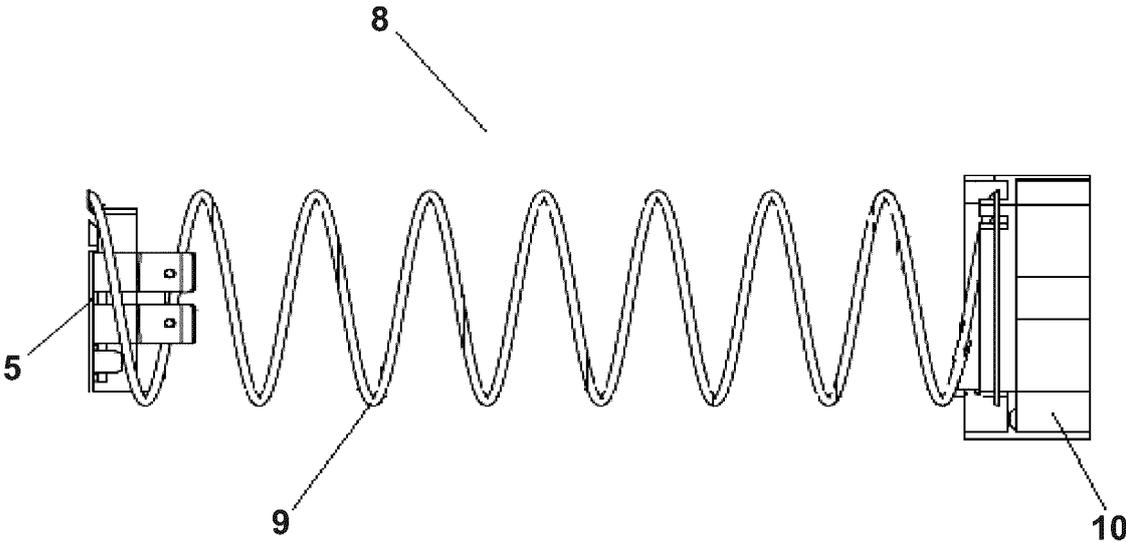


FIG. 4

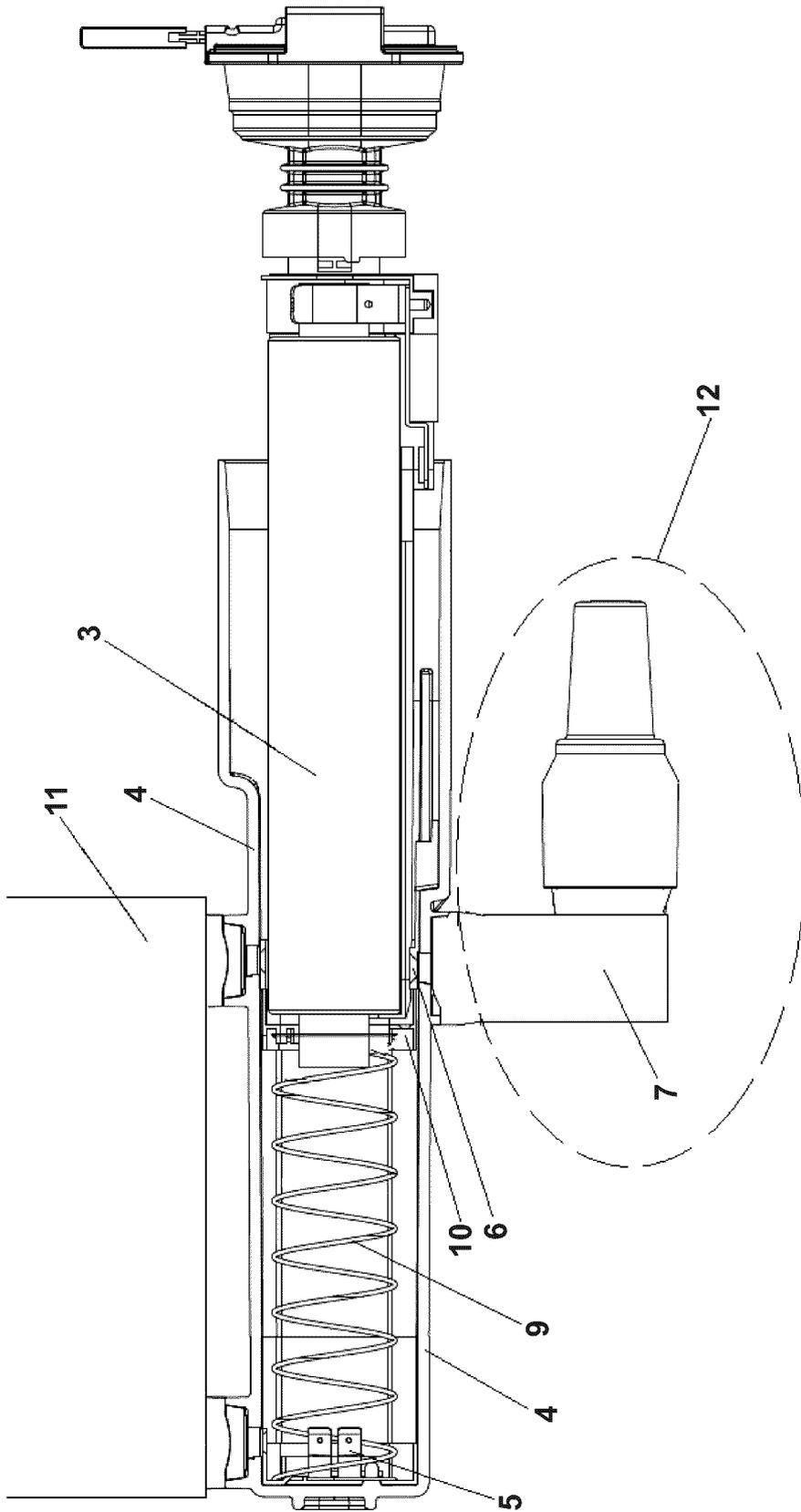


FIG. 5

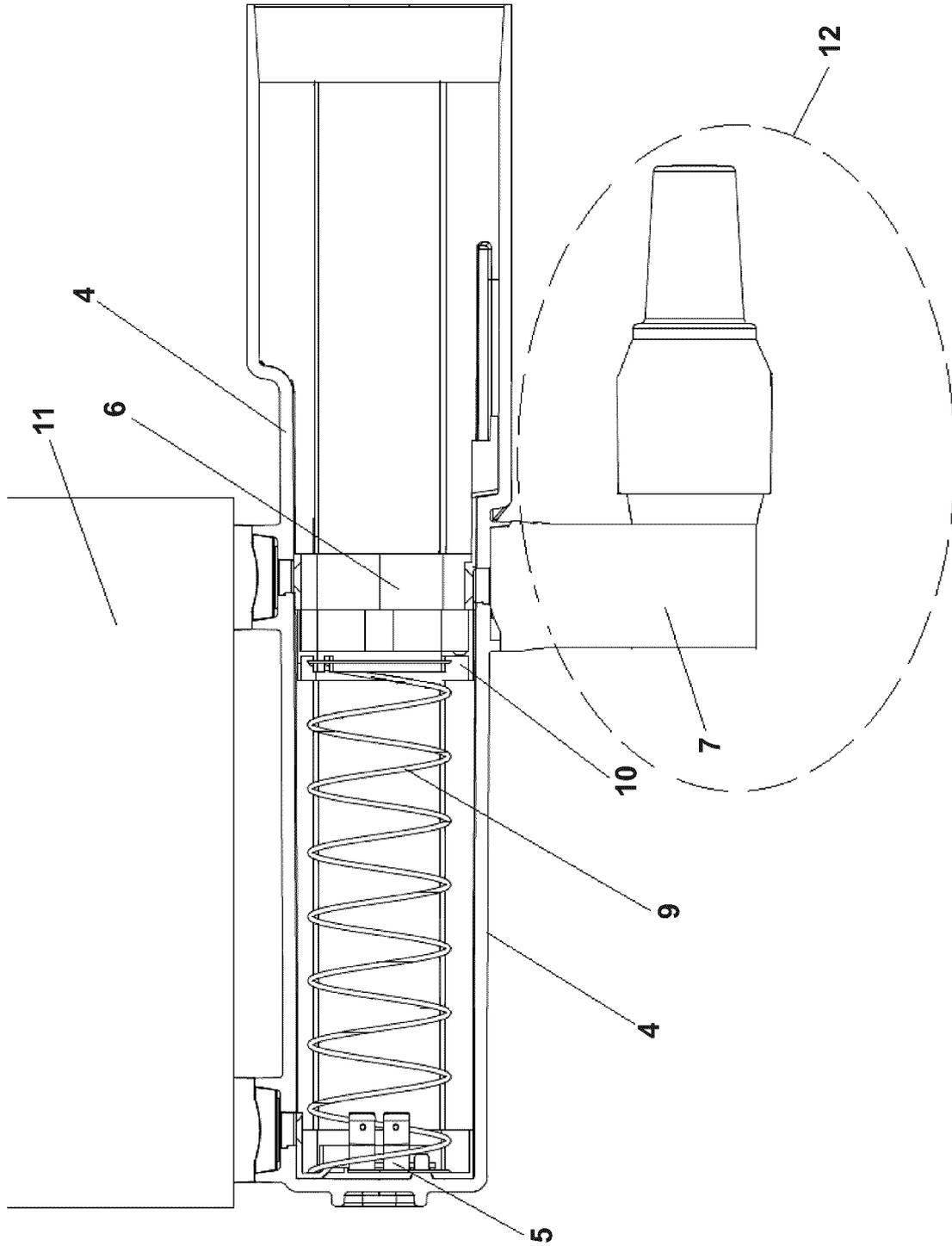


FIG. 6

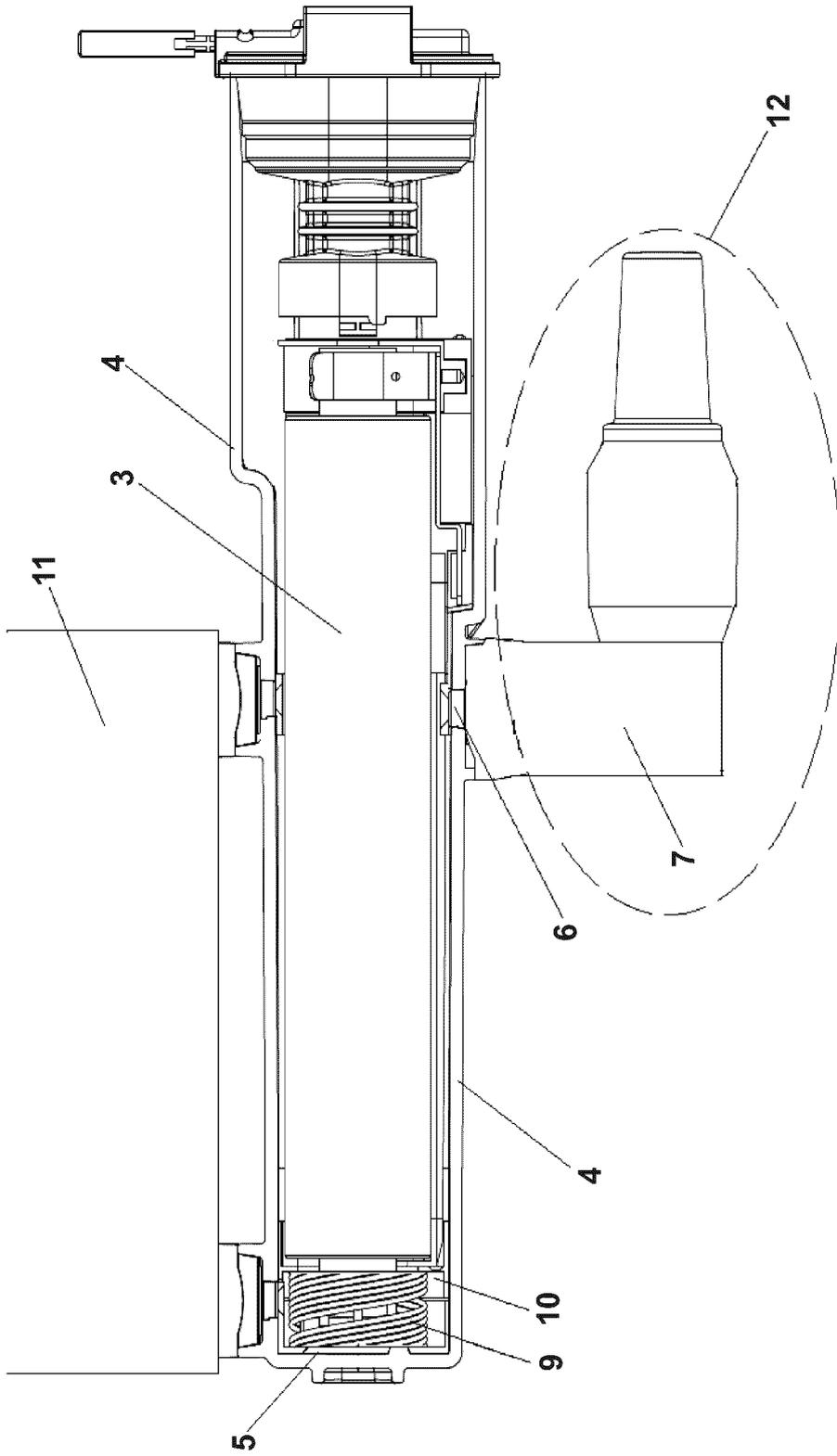


FIG. 7

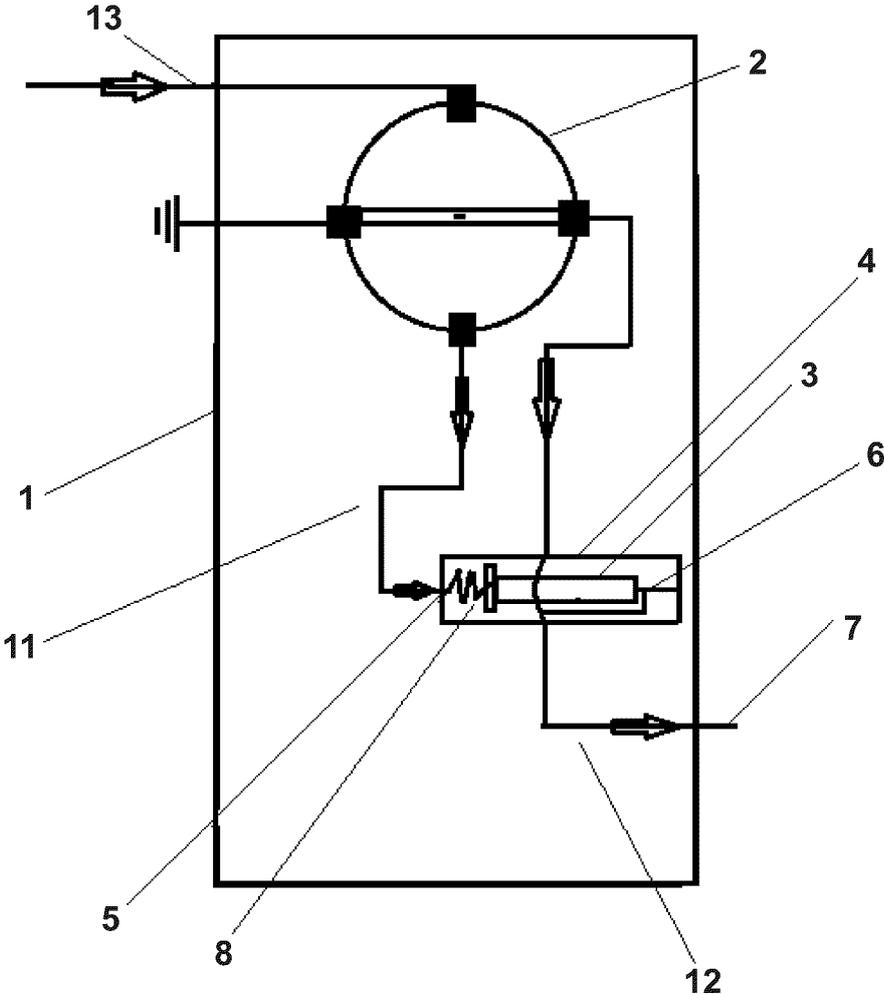


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/ES2023/070250

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A. CLASSIFICATION OF SUBJECT MATTER
INV. H01H31/00 H01H31/12
ADD.

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

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01H H02B

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

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 0 224 051 A1 (ALSTHOM [FR]) 3 June 1987 (1987-06-03) figure 1 -----	1

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Further documents are listed in the continuation of Box C. See patent family annex.

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* Special categories of cited documents :

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Date of the actual completion of the international search 2 August 2023	Date of mailing of the international search report 10/08/2023
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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