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(54) **MODULAR ENCAPSULATED ELECTRICAL DEVICE FOR POWER DISTRIBUTION NETWORKS**

(57) The invention is applied in electric power distribution installations such as for instance electricity transformation centres, distribution centres, substations, etc., comprising a series of elements, amongst them, operating means (2) for executing the cutoff-connection-sectioning-grounding functions, encapsulated in the same insulating body (1). The body (1) encapsulates in its interior one or at the most two operating elements (2a, 2b), operated by means of a single actuating element (3), by the operation of an actuation transmission element (10), encapsulated in an insulating head (13) joined to the body (1) and moving in relation to said body (1). Said body and head (1, 13) are integrated in an envelope (7), forming a module. Modularity permits the execution of installations that may be enlarged on one or more sides of the module according to various electrical schemas by means of appropriately arranged connecting elements (4, 6).

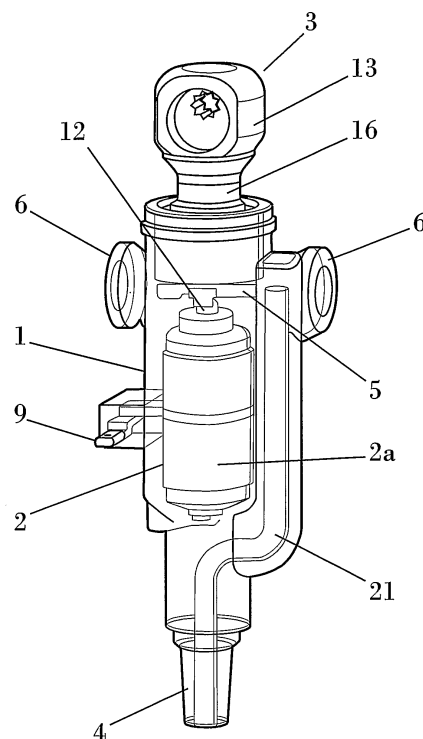


FIG. 1

Description

OBJECT OF THE INVENTION

[0001] The present invention has its field of application in electric power distribution facilities, such as for instance electricity transformation centres, distribution centres, substations, etc., for the protection and operation of electrical circuits in general and, in particular, it refers to an electrical unit that comprises encapsulating in an insulating body of a series of elements, including amongst others one or two operating elements that enable the electrical circuit cutoff-connection-sectioning-grounding operation functions to be performed, as well as acting as an envelope integrating said insulating body, forming a module that may be expanded by connecting it to others.

[0002] It is therefore the object of the invention to provide an insulated electrical unit in an insulating medium of high electrical strength and compact structure, thereby successfully reducing the insulation distance between the different elements making up the unit, the size of the installations and, in short, the costs.

BACKGROUND OF THE INVENTION

[0003] It is common knowledge today that the operating switchgear used in electric power distribution networks is usually installed in metallic envelopes, called cells. Such switchgear comprises operating elements which perform the installation cutoff-connection-sectioning-grounding functions. In this way, in the event for instance of a fault in the distribution line, a cut due to work, maintenance or load distribution optimization, such operating elements may be actuated to obtain the desired power distribution, prevent users being left without power or assure the protection of persons and such electrical equipment as transformers.

[0004] Conventionally, every one of said operating elements has its own element of actuation, which may be performed both under the control of a hand-operated mechanism and of a triggering mechanism in response to a fault current.

[0005] Furthermore, we are familiar with operating elements composed of vacuum switches, which consist of a bottle housing a pair of electrical contacts in its interior, one fixed and the other mobile, which is moved by the appropriate action pertaining to said switch in order to perform the cutoff - connection - sectioning - grounding functions of the respective electrical circuit.

[0006] The trouble with known vacuum switches is that the gap between the moving and fixed contacts in an open-circuit situation is not accepted, as it does not assure the sectioning function because the dielectric medium where they act is the bottle vacuum. The normal solution is to add, on the outside of the bottle, a section switch which opens/closes the circuit in order to execute said sectioning function effectively.

[0007] Furthermore, section switches are also used, which are further required to perform grounding functions. We know that section switches are made up of two contacts that may be joined to let current pass or to leave a physical gap that is laid down by the safety regulation or the manufacturer in order to prevent current flow. Said section switches, however, are not able to perform the functions of a switch, i.e. to cut off the current when the circuit is under load or in the event of an overcurrent failure.

[0008] Accordingly, the operating switchgear has both breakers and section switches with separate actuating means.

[0009] It is common for part of this switchgear to be encapsulated in solid insulation, such as insulating resin for instance, using vacuum or another fluid as the dielectric medium for performing the required operating functions mentioned above: cutoff-connection-sectioning-grounding executed respectively by section switches and breakers.

[0010] By way of example we may mention patent application WO 0150563, which concerns a plurality of insulating resin bodies encapsulating a number of vacuum switches: some, corresponding to the connection-sectioning-grounding functions, are encapsulated in an insulating body along with their respective actuating mechanisms, while another different insulating body encapsulates the vacuum switch, which performs the cutoff-connection functions together with the respective actuating mechanism. Likewise, the distribution bypass terminal and the main circuit busbars are also encapsulated in separate insulating bodies. Every one of these separate insulating bodies is installed inside a different compartment of the cell, said insulating bodies being connected by means of bushings which are part of the actual insulating bodies.

[0011] One of the drawbacks of the invention described in WO 0150563 is that for each of the cutoff-connection-sectioning-grounding functions it is necessary to make use of a different module with its respective operating mechanism and if we add this to the need to encapsulate more than one operating element in each of the modules and to integrate said modules in different compartments within a cell, it entails enlarging the dimensions of the operating switchgear, thus creating problems of space in the electrical distribution installations. To this we have to add the high cost due to the large amount of resin that is needed in order to carry out the encapsulating processes and the lengthy manufacturing time.

[0012] Another example similar to the above is that described in document EP 1343233, with the difference that in this case it is possible to make use of just a single vacuum switch which performs the installation cutoff-connection-sectioning-grounding operating functions. But similarly to the WO 0150563 invention, each of the elements making up the switchgear (the main circuit busbars, the vacuum switch/es, the distribution bypass terminal, etc.) is encapsulated in an independent insulating

body. Apart from the drawbacks of the previous solution, this one entails a complex installation due to the fact that, in order to assure a secure connection between the different insulating bodies, it is necessary to make use of connecting elements that do not form part of the insulating bodies to be joined.

[0013] On the same lines we may mention the inventions contained in WO 02082606 and EP 0393733, where various operating elements are described that perform the connection-sectioning-grounding functions and other components, such as fuses, which perform the cutoff function in the event of a failure, all these being encapsulated in an insulating body integrated in the interior of a compartment in the cell, while another different compartment of said cell houses the transmission element for the actuation of each of the operating elements required.

[0014] In these last two solutions, the problem recurs of having to use a number of operating elements to perform the different cutoff-connection-sectioning-grounding functions, so that the cells incorporating the switchgear tend to be bulky. What is more, the disadvantage of the cells being bulky is exacerbated by the fact that the transmission elements for the actuating mechanisms for such operating elements are integrated in different compartments from those housing the operating elements, thus increasing the number of compartments in the cells, their size and, therefore, that of said operating switchgear in the electrical distribution network.

DESCRIPTION OF THE INVENTION

[0015] The present invention is designed to resolve the afore-described problems, in every single one of the different aspects mentioned, constituting a modular electrical unit for installation and connection to other electrical equipment items in electricity transformation centres, distribution centres, substations, etc. which carries out at least cutoff-connection-sectioning-grounding operating functions in a single encapsulating.

[0016] More specifically, the electrical unit or module comprises at least one solid insulating body inside which there are encapsulated the following components:

- operating means consisting of only one or two operating elements, which may be an on-load cutoff switch (one which cuts off the rated current) or an automatic switch (differential, which cuts out faults) and a section switch/grounding section switch, where the dielectric medium in which the cutoff-connection-sectioning-grounding operating functions are performed may be a gas, a liquid or vacuum;
- one or more connecting elements to join it to a main electrical distribution network supply circuit and to other modules in different electrical schemas, such as for instance those known in the electrical distribution network as "ring main unit" and subscriber

schemas;

- a main circuit busbar and a current bypass busbar, and
- at least one grounding terminal.

[0017] In this way, an initial advantage of the invention on using a single insulating body for encapsulating the operating means, which perform at least the cutoff-connection-sectioning-grounding functions, is to considerably reduce the dimensions of the electrical unit, the amount of material needed and the cost of encapsulating, as well as its execution time, as the following savings are made:

- the need to use several independent operating elements to perform each one of the above-mentioned operating functions,
- the use of more than one body or insulating piece for the separate encapsulating of the different operating elements, connecting elements, main circuit and bypass busbars, etc. which make up the electrical unit,
- the use of separate elements for joining to the insulating bodies or pieces.

[0018] The operating means have their respective electrical contacts which are moving under the direct action of at least one busbar which acts as an element for transmitting the actuation of said operating means, there being a single actuating element adapted to trigger by itself either the cutoff-connection function or connection-sectioning-grounding function.

[0019] That single actuating element is encapsulated in another solid body or insulating head, joined to the above-mentioned insulating body. The actuating element acts on one or more (actuation) transmission busbar, although a drive spindle transverse to the actuating element encapsulated in the insulating head may play a part in that transmission.

[0020] The joint of the solid body and head is insulated by means of an elastic insulating element which permits relative movement between both. The two parts may be rigid or elastic and made from an insulating polymer material, for example, epoxy resin, silicone, polyurethane, NBR, etc. In turn, all the encapsulating, which may be coated with a conductive layer, is integrated in an envelope.

[0021] Thanks to the integration of the element for the actuation and transmission of said actuation in the interior of the same envelope as the rest of the components of the electrical unit, the dimensional problem is reduced even further, only one compartment or envelope being required for the location of the whole set of elements, with the result that a compact, small-sized cell is

achieved.

[0022] To obtain a three-phase configuration, the electrical unit may be composed not only of a single three-pole insulating body in which all the components of the electrical unit referring to the three phases are encapsulated, but also of an assembly formed of the union of three single-phase insulating bodies. The different single-phase insulating bodies of the three-pole assembly may be connected by means of metal parts or plates which are partly encapsulated in the insulating bodies, which at the same time permit the grounding of the electrical unit. These grounding plates are connected to the operating elements. The plates may be accessible from the outside of the envelope or else be completely in the interior of said envelope which integrates the three-pole assembly.

[0023] The operating means are preferably implemented according to one of the three alternatives described below:

- There is a single operating element, which may consist of a vacuum switch where all the cutoff-connection-sectioning-grounding functions are carried out, acting both as a section switch/grounding section switch or a load cutoff breaker, or else as an automatic breaker and section switch/grounding section switch.
- There is a first operating element that performs the cutoff-connection functions, which may either be a load cutoff switch or else an automatic breaker, plus a second operating element responsible for the connection-sectioning-grounding functions which may be a section switch/grounding section switch. The first operating element may consist of a vacuum bottle containing a fixed contact joined to the main circuit busbar and a moving contact. This same moving contact is in turn one of the contacts of the section switch/grounding section switch and is provided with means for its maintenance in the cutoff function. The second operating element may consist of a housing with a dielectric medium, either gas or liquid, where the connection-sectioning-grounding functions are carried out. It further comprises a ground contact and a third contact, connected to the bypass busbar, this latter contact being optionally either linear sliding or bucket type. The movement of the third contact due to the action of the transmission busbar, also connected to same, brings about the execution of the connection-sectioning-grounding functions, the effectiveness of the sectioning function being accepted as vacuum is not used as the dielectric medium in this second operating element.
- There are two operating elements and both are vacuum switches. The first operating element may consist of a vacuum bottle which performs the functions of a switch, with a fixed contact joined to the main

circuit busbar and a moving contact fitted with means for maintaining it in the cutoff function. The second operating element may consist of another vacuum bottle where the ground connection function is performed, which has a fixed contact joined to a ground contact and a second moving contact. The sectioning functions are performed by the actuation of the transmission busbar displacing said second moving contact, which is provided with position locking means for holding it in the sectioning function. The moving contacts of each of the bottles are thus moved appropriately by means of the action of the actual transmission bar.

[0024] The implementation possibilities proposed constitute a module, so that by means of the connecting elements which are accessible on the outside on one or more sides of the envelope, it is possible to enlarge the installation on one or more sides of the envelope, joining various modules by way of coupling means that depend on the sealing of the envelopes. For example, embodiments may be found in which the dielectric fluid between the envelope and the insulating body is air and, therefore, the coupling between modules may be carried out for instance by means of collars, bushings or a link box like that is described in Invention Patent ES 2037590. In particular, if the housing is sealed, the coupling between the modules is done with a link box, so that in the event of a fault or failure of an electrical unit, this module may be easily replaced with a new one.

[0025] Thus, a last but not least important advantage is that it is a compact modular electrical unit that may be easily replaced with a new one in the event of a possible deterioration of the same. In the installation of the three-pole insulating body or three insulating bodies which make up a three-pole assembly inside an envelope, which may contain a dielectric fluid and be sealed when the three-pole assembly is not coated with a conductive layer for the control of the electrical field, insulation between the bodies and prevention of internal defects, the distance is reduced between the envelope and the three-pole assembly, thereby achieving a compact operating switchgear.

[0026] Optionally, all the possible forms of implementation of the electrical unit proposed, such as the examples that are described below, may comprise means capable of providing electrical voltage and current strength measuring functions, detection of the presence/absence of voltage, control, automation, etc.

DESCRIPTION OF THE DRAWINGS

[0027] To supplement the description that is being given and in order to assist in a clearer understanding of the features of the invention, in accordance with a preferred practical embodiment of same, a set of drawings is adjoined as an integral part of said description, wherein there is represented on an informative and non-restrictive

basis the following:

Figure 1.- It shows a perspective view of the modular electrical unit that is the object of the invention according to a possible embodiment, encapsulated in an insulating body integrated in an envelope (not represented), which corresponds to an electrical phase.

Figure 2.- It shows a sectional view of the insulating body corresponding to an electrical phase, which presents the electrical unit according to the embodiment in the previous figure.

Figure 3.- It shows a perspective view of the electrical unit according to a possible three-phase configuration, made up of three insulating bodies forming a three-pole assembly, presented outside the corresponding envelope.

Figure 4.- It shows a perspective view of the three-pole assembly illustrated in figure 3, already installed in the envelope forming a module, with connecting elements accessible from the outside for joining up to other electrical unit modules, some of these connecting elements being disposed vertically.

Figure 5.- It shows a perspective view of the three-pole assembly illustrated in figure 3, already installed in the envelope forming a module, with connecting elements accessible from the outside for joining to other electrical unit modules, some of these connecting elements being disposed horizontally.

Figure 6.- It shows a perspective view of the three-pole assembly illustrated in figure 3, already installed in the envelope forming a module, with connecting elements accessible from the outside and others consisting of cable connecting terminals arranged inside said envelope.

Figure 7.- It shows a sectional view of the insulating body according to another possible embodiment of the invention, distinguishing two operating elements, where one is a vacuum bottle and the other a section switch/linear ground connection section switch.

Figure 8.- It shows a sectional view of the insulating body according to another alternative embodiment of the modular electrical unit, with two operating elements which both consist of vacuum bottles, representing the first operating element in the connecting function.

Figure 9.- It shows a sectional view of insulating body according to the embodiment option represented in the previous figure, with two vacuum bottles as operating elements, representing the first operating element in the cutoff function and the second operating

element in the ground connection function.

PREFERRED EMBODIMENT OF THE INVENTION

[0028] In the light of the afore-mentioned figures, we may describe some preferred embodiments of the present invention applicable in electric energy distribution networks, such as for instance electricity transformation centres, distribution centres or substations, constituting a modular electrical unit which comprises at least one insulating body (1) constructed with a polymeric insulating material, which may be rigid or elastic.

[0029] In its interior the insulating body (1) encapsulates operating means (2) to carry out the cutoff-connection-sectioning-grounding functions, represented in figures 1-9 according to various possible implementations. Essentially, the encapsulated operating means (2) in said insulating body (1) may consist of:

- a single first operating element (2a), as shown in figures 1-6, in order to execute by itself all the cutoff-connection-sectioning-grounding functions; or else,
- two operating elements (2a, 2b), with the first operating element (2a) performing the cutoff-connection functions and a second operating element (2b) is responsible for the connection-sectioning-grounding functions, in accordance with the different practical constructions as illustrated in figures 7-9.

[0030] In particular, the form of embodiment of the invention as shown in figures 1-6 presents a first operating element (2a) which consists of an on-load cutoff switch and an automatic switch and a section switch/grounding section switch, as may be the case, for instance, of a vacuum switch, consisting of a vacuum bottle with two electrical contacts (11, 12), one being a fixed contact (11) and the other a moving contact (12). In this configuration all the cutoff-connection-sectioning-grounding operating functions are carried out by means of the single operating element (2a), reducing the size of the insulating body (1) where it is encapsulated and, therefore, the dimensions of the installations, as well as the amount of encapsulating material, encapsulating execution time and its costs.

[0031] The insulating body (1) shown in figure 1 and, in greater detail, its interior in figure 2, encapsulates the operating element (2a) associated with main circuit busbars (5) and current bypass busbars (21). As shown in figure 2, the moving contact (12) of said operating element (2a) is joined to the bypass busbar (21) which is accessible by way of a first connecting element (4), while the fixed contact (11) is joined to the main circuit busbar (5) which may have at least a second connecting element (6). These connecting elements (4, 6) are a component part of the insulating body (1) and they may consist of bushing of a female type, male type or their combinations, as shown in figures 1-5, or else an overhead cable connection, as implemented in the first connecting elements

(4) in the example in figure 6.

[0032] Returning to figure 2, the moving contact (12) encapsulated in the insulating body (1) is in turn joined to an element (3) for actuating the operating means (2), by means of a busbar which acts as an actuating transmission element (10) fixed to the moving contact (12) by a joining piece (25). The actuating element (3) is encapsulated in an insulating head (13), made in polymeric insulating material, and it is adapted to actuate by itself either the cutoff-connection function or the connection-sectioning-grounding function. A drive spindle (17) transverse to the axis of symmetry of the insulating head (13) plays a part in the transmission of the actuation of the operating means (2).

[0033] The joint between the insulating body (1) and the insulating head (13) is insulated by means of an elastic insulating element (16), for example, a rubber neck, as may be seen in figures 1, 2 and 3, which also permits the relative movement in a recess (15) between both the insulating body (1) and head (13) of the encapsulated unit.

[0034] To implement a three-phase configuration, as illustrated in figure 3, the electrical unit may be formed of three single-phase insulating bodies (1) which are joined by way of plates (9) partly embedded in each insulating body (1), thereby forming a three-pole assembly (8). The drive spindle (17) passes through each insulating head (13) thereby joining its respective elements (3) for actuating the operating means (2) so that they act in conjunction. As shown in figures 4-6, said three-pole assembly (8) may be installed, for instance, inside a metallic envelope (7), which, in the event of being sealed, incorporates a dielectric fluid between this three-pole assembly (8) and the envelope (7) for the insulation between both and to prevent internal defects.

[0035] Only the connecting elements (4, 6) are accessible from the outside of the envelope (7), the former connecting elements being optionally disposed either horizontally or vertically, except when said connecting elements (4) consist of overhead cable connections, in this case with their connecting elements remaining inside the envelope (7) in order to carry out the connections with a bypass circuit in its interior. In this way, we obtain a module (14) composed of the three-pole assembly (8) and the envelope (7), with the connecting elements (4, 6) remaining on the outside of one or more sides of same.

[0036] This modularity enables enlargements to be carried out on one or more sides of said module (14), in accordance with the options of figures 4, 5 and 6. In short, it is a case of an insulated electrical unit in a high electrical strength insulation medium and a compact unit, thereby successfully reducing the insulation distance between different elements making up the electrical unit and the size of the installations.

[0037] By means of the joining assemblies (18), represented in figure 6, the connecting elements (4, 6) enable the installation to be enlarged by joining together various modules (14) and producing different electrical

schemas, such as for instance a "ring main unit" or a subscriber schema. In this respect, the first module (14), which acts as a service connection, may have second connecting elements (6) at the sides, being provided on one of the sides with male type bushings to which the supply cable terminals are coupled, while on the other side it has female type bushings, joining this first module (14) to the next one by way of the female type bushings (14) and by means of joining assemblies (18). At both sides, the intermediate modules (14), in turn, have second connecting elements (6), which are female type bushings. The last module (14) may have second connecting elements (6) on one or more sides of the envelope (7); so that, in the event of their being provided on various sides, the second connecting elements (6) which remain free are sealed by means of plug to assure insulation, whereby the installation may be enlarged in the future.

[0038] The dielectric fluid introduced between the envelope (7) and the three-pole assembly (8) considerably reduces the insulation distances, thereby preventing any internal defect that might damage the insulating body (1) in order to obtain a reliable compact electrical unit, and by using the joining assembly (18) as a means of coupling between various modules (14) the sealing of the set of said modules (14) is assured.

[0039] Furthermore, besides being able to make the union of various modules in order to form a set (8), as shown in figures 3-6, the insulating body (1) plates (9) act as a terminal for grounding the operating means (2), as shown in figures 1-9. In this way, by means of encapsulating all the live parts making up electrical unit, maintenance expenses are cut and insulation distances between each of the phases are reduced, thereby achieving a compact unit.

[0040] A second way of conformation of the encapsulated electrical unit is that shown in figure 7, where the insulating body (1) encapsulates operating means (2) of two operating elements (2a) and (2b). The first operating element (2a) consists of an automatic switch or on-load cutout switch, such as for instance a vacuum switch, and enables cutout-connection functions to be performed. As regards the second operating element (2b), it is the case of a section switch/grounding section switch for executing the connection-sectioning-grounding operating functions, in which the dielectric medium where said functions are executed may be, for instance, a gas or a liquid.

[0041] As observed in this figure 7, the first operating element (2a) comprises a fixed contact (11) joined to the main circuit busbar (5) and to the moving contact (12). The moving contact (12) also forms part of the second operating element (2b), which is provided with a third linearly moving contact (19) joined by means of a flexible connection (20) to the bypass busbar (21). This third contact (19) is also joined on another side to the actuation transmission element (10), which causes said linear contact (19) to move, establishing one operating function or another depending on the direction and advance of said

linear movement.

[0042] The movement of the third contact (19) in one direction brings about the joining with the moving contact (12), with the second operating element (2b) remaining in the connecting function. The continuation of this movement in the same direction generates the movement of the moving contact (12) up to its joining with the fixed contact (11), with the operating element (2a) remaining in the connecting function.

[0043] The movement of the actuation transmission element (10) in the opposite direction brings about the separation of the fixed (11) and moving (12) contacts of the first operating element (2a), leaving this in the cutoff function. Between the first (2a) and the second operating element (2b) there are locking means (22) fitted with springs (23) that assist in the separation and in the maintenance of the position of the contacts (11, 12) of the first operating element (2a) in the cutoff function. Continuing with the movement of third contact (19) of the second operating element (2b) in the latter direction, the separation of the contacts (19, 12) of said second operating element (2b) takes place, determining the sectioning function. The second operating element (2b) also has a grounding contact (24) which sets it in the ground function, in conjunction with the third contact (19).

[0044] Another alternative embodiment of operating means (2), consisting of two operating elements (2a) and (2b), is that represented in figures 8 and 9, each composed of vacuum bottles. Thus, the first operating element (2a) may consist of a vacuum switch, this being either an on-load cutoff breaker or automatic breaker, provided with a fixed contact (11) joined to the main circuit busbar (5) and a moving contact (12). The operating element (2b) is also another vacuum switch, but it constitutes a section switch/grounding section switch, comprising in turn a second fixed contact (27) joined to the grounding plate (9) and a second moving contact (26). The moving contacts (12, 26) of both switches or operating elements (2a, 2b) are moved by the action of the transmission busbar (10), which is common to both. The actuation transmission element (10) is joined to the bypass busbar (21) by way of the flexible connection (20). Each of the moving contacts (12) and (26) of the two operating elements (2a, 2b) is also provided with locking means (22) with springs (23), which assist in the separation and in the maintenance of the position of said moving contacts (12, 26) in the cutoff function and in the sectioning function, respectively.

[0045] To recap, the numerical references used in this text and indicated in the figures mentioned represent the following components of the electrical unit that is the object of the present invention:

- 1.- Insulating body
- 2.- Operating means
- 2a.- First operating element
- 2b.- Second operating element
- 3.- Actuating element

- 4.- First connecting element
- 5.- Main circuit busbar
- 6.- Second connecting element
- 7.- Envelope
- 8.- Three-pole assembly
- 9.- Grounding plate
- 10.- Actuation transmission element
- 11.- Fixed contact
- 12.- Moving contact
- 13.- Insulating head
- 14.- Electrical unit module
- 15.- Gap between the insulating body (1) and head (13)
- 16.- Elastic insulating element
- 17.- Drive spindle
- 18.- Joining assembly
- 19.- Third contact (moving, linearly sliding)
- 20.- Flexible connection
- 21.- Bypass busbar
- 22.- Means for locking the position of the pairs of contacts
- 23.- Springs
- 24.- Grounding contact
- 25.- Joining piece between the actuation transmission element (10) and moving contact (12)
- 26.- Second moving contact
- 27.- Second fixed contact (grounding)

[0046] The invention is not limited to the specific embodiments that have been described but also comprises the multiple combinations and versions that may be executed by an average expert on the subject (for example, as regards the choice of materials, dimensions, components, configuration, etc.), without departing from the scope of the invention, within what may be deduced from the claims set forth below.

Claims

1. Modular encapsulated electrical unit for electrical distribution networks, suitable for being connected to a main supply circuit of an electrical distribution network which comprises:

- a main circuit busbar (5) and a bypass busbar (21)
- at least one grounding terminal,
- operating means (2)

characterised

by comprising at least one solid insulating body (1) in the interior of which at least said bypass busbar (21), said main circuit busbar (5), said at least one grounding terminal and said operating means (2) are encapsulated, and in that said insulating body (1) comprises at least a first connecting element (4), by which the bypass

- busbar (21) is accessible, and at least a second connecting element (6), by which the main circuit busbar (5) is accessible,
and in that the operating means (2) are equipped to carry out at least the cutoff-connection-sectioning-grounding functions,
and by comprising an actuating element (3) for actuating said operating means (2) which is adapted to actuate both the cutoff-connection function and the connection-sectioning-grounding function.
2. Electrical unit according to claim 1, **characterised in that** the actuating element (3) is embedded in a solid insulating head (13), movable in relation to the insulating body (1), the insulating head (13) being joined to the upper portion of the insulating body (1) by means of an elastic insulating element (16).
 3. Electrical unit according to claim 2, **characterised in that** the actuating element (3) is joined to the operating means (2) by means of an actuation transmission element (10).
 4. Electrical unit according to claim 3, **characterised by** further comprising a drive spindle (17) transverse to the insulating head (13) which cooperates with the actuation transmission element (10).
 5. Electrical unit according to any of claims 1 to 4, **characterised in that** the operating means (2) consist of a single operating element (2a) configured to perform at least the cutoff-connection-sectioning-grounding functions.
 6. Electrical unit according to any of claims 1 to 4, **characterised in that** the operating means (2) consist of two operating elements (2a, 2b), a first operating element (2a) to perform the cutoff-connection functions and a second operating element (2b) to perform the connection-sectioning-grounding functions.
 7. Electrical unit according to claim 5, **characterised in that** the first operating element (2a) consists of a vacuum bottle which houses a fixed contact (11) joined to the main circuit busbar (5) and a moving contact (12) joined to the transmission busbar (10) and the bypass busbar (21).
 8. Electrical unit according to claim 7, **characterised in that** the operating element (2a) is an on-load cutoff switch and a section switch/grounding section switch.
 9. Electrical unit according to claim 7, **characterised in that** the operating element (2a) is an automatic switch and a section switch/grounding section switch..
 10. Electrical unit according to claim 6, **characterised in that** the first operating element (2a) is selected between an on-load cutoff switch and an automatic switch and the second operating element (2b) consists of a linear section switch/grounding section switch insulated in a dielectric fluid.
 11. Electrical unit according to claim 10, **characterised in that** the first operating element (2a) consists of a vacuum bottle that houses a fixed contact (11) joined to the main circuit busbar (5) and a first moving contact (12) which forms part of the second operating element (2b), said second operating element (2b) having a third linear movement contact (19) joined to the transmission busbar (10) and to the bypass busbar (21) by means of a flexible connection (20).
 12. Electrical unit according to claim 11, **characterised in that** the second operating element (2b) has a grounding contact (24) which in the linear movement of the third contact (19) in a given direction is connected to said third contact (19) to perform the grounding function.
 13. Electrical unit according to claim 6, **characterised in that** the first operating element (2a) consists of a vacuum bottle that houses a fixed contact (11) joined to the main circuit busbar (5) and a first moving contact (12), and **in that** the second operating element (2b) consists of another vacuum bottle which houses a fixed contact (27) joined to the grounding terminal (9) and a second moving contact (26).
 14. Electrical unit according to claim 13, **characterised in that** the first operating element (2a) is selected between an on-load cutoff switch and an automatic switch, and the second operating element (2b) consists of a section switch/grounding section switch.
 15. Electrical unit according to claim 13 or 14, **characterised in that** the first moving contact (12) and the second moving contact (26) are actuated by the actuation transmission element (10) common to both contacts, said actuation transmission element (10) being joined to the bypass busbar (21) by means of a flexible connection (20).
 16. Electrical unit according to any of claims 2 to 15, **characterised in that** the insulating body (1) and the insulating head (13) are of polymeric insulating material.
 17. Electrical unit according to claim 16, **characterised in that** the insulating body (1) and the insulating head (13) are rigid.
 18. Electrical unit according to claim 16, **characterised in that** the insulating body (1) and the insulating head

- (13) are elastic.
19. Electrical unit according to any of claims 16 to 18, **characterised in that** the insulating body (1) and the insulating head (13) are coated with a conductive layer.
 20. Electrical unit according to any of claims 16 to 19, **characterised in that** the insulating body (1) and the insulating head (13) are integrated inside an envelope (7).
 21. Electrical unit according to any of the preceding claims, **characterised in that** the grounding terminal consists of a plate (9) partly embedded in the insulating body (1).
 22. Electrical unit according to claims 20 and 21, **characterised in that** the plate (9) is wholly in the interior of the envelope (7).
 23. Electrical unit according to claims 20 and 21, **characterised in that** the plate (9) is accessible from the outside of the envelope (7).
 24. Electrical unit according to claim 20, **characterised in that** the envelope (7) is metallic.
 25. Electrical unit according to any of claims 20 to 24, **characterised in that** the envelope (7) is sealed and contains a dielectric fluid.
 26. Electrical unit according to any of the preceding claims, **characterised in that** the first connecting element (4) and the second connecting element (6) are accessible from the outside of the envelope (7).
 27. Electrical unit according to any of the preceding claims, **characterised in that** the first connecting element (4) and the second connecting element (6) are bushings that are selected from female type, male type and their combinations.
 28. Electrical unit according to any of claims 1 to 27, **characterised in that** the first connecting element (4) and the second connecting element (6) are overhead cable connecting terminals.
 29. Electrical unit according to any of the preceding claims, **characterised in that** the first connecting element (4) is situated below the second connecting element (6).
 30. Electrical unit according to claim 29, **characterised in that** the second connecting element (6) is situated horizontally and the first connecting element (4) is vertical.
 31. Electrical unit according to claim 29, **characterised in that** the first connecting element (4) and the second connecting element (6) are situated horizontally.
 32. Electrical unit according to any of the preceding claims, **characterised in that** it is joined to another electrical unit by means of the first connecting element (4) and the second connecting element (6) according to different electrical schemas.
 33. Electrical unit according to any of the preceding claims, **characterised in that** the insulating body (1) is three-pole.
 34. Electrical unit according to any of claims 1 to 32, **characterised in that** the insulating body (1) is single-phase.
 35. Electrical unit according to claims 20, 21 and 34, **characterised in that** three insulating bodies (1) are joined by the respective plate (9) of each said insulating bodies (1) so as to form a three-pole assembly (8), each plate (9) carrying out the grounding of the operating means (2) and the envelope (7).
 36. Electrical unit according to any of the preceding claims, **characterised in that** the operating means (2) comprise locking means (22) fitted with springs (23) for holding said operating means (2) in the cutoff and sectioning functions.
 37. Electrical unit according to any of the preceding claims, **characterised in that** the insulating body (1) houses main circuit voltage and current strength measuring means, electrical voltage presence and absence detection means, and control and automation means encapsulated in its interior.

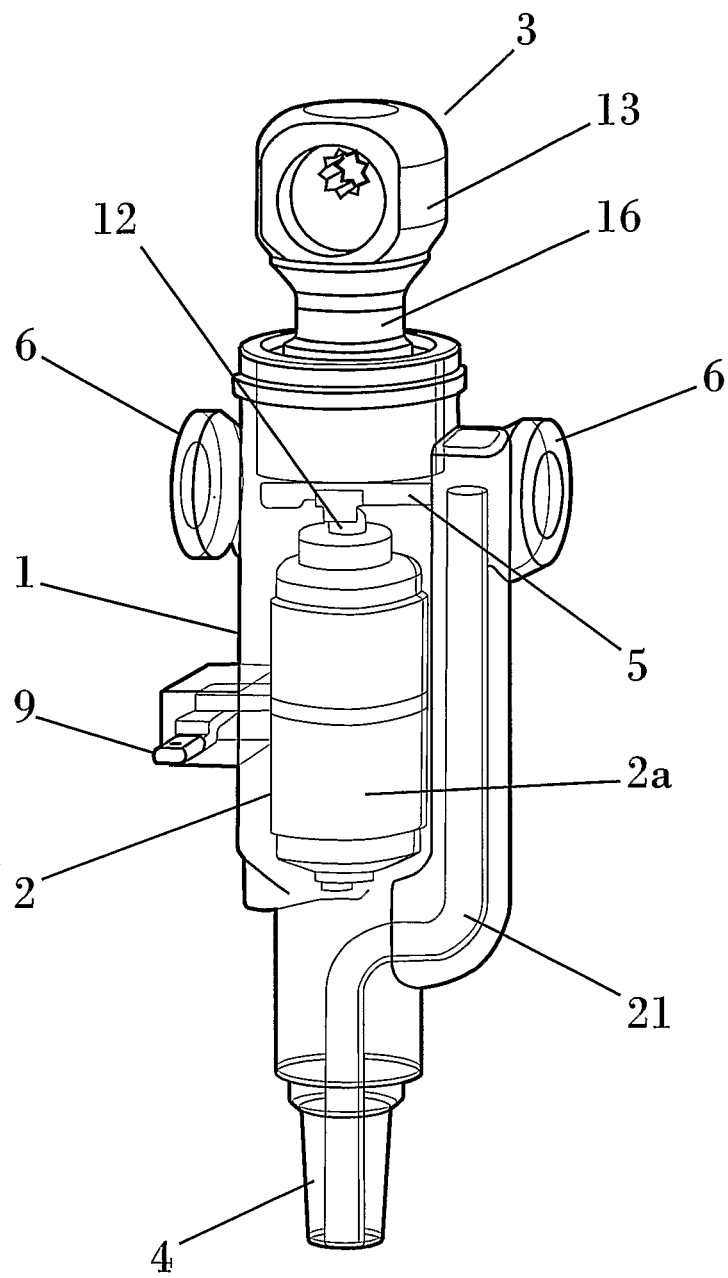


FIG. 1

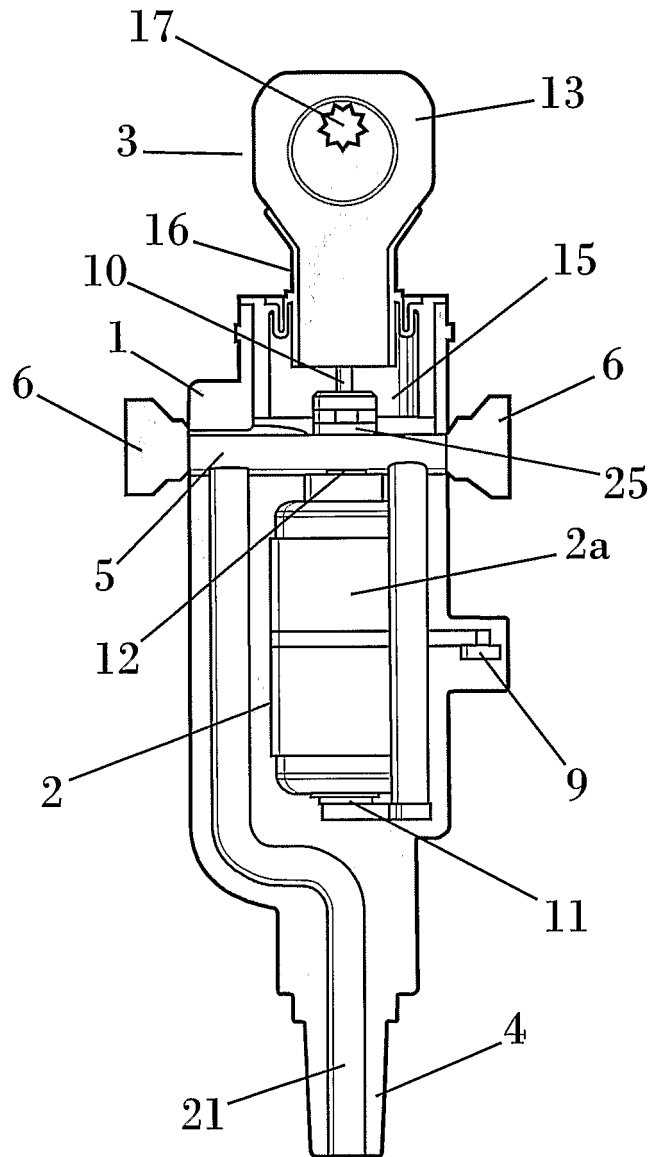


FIG. 2

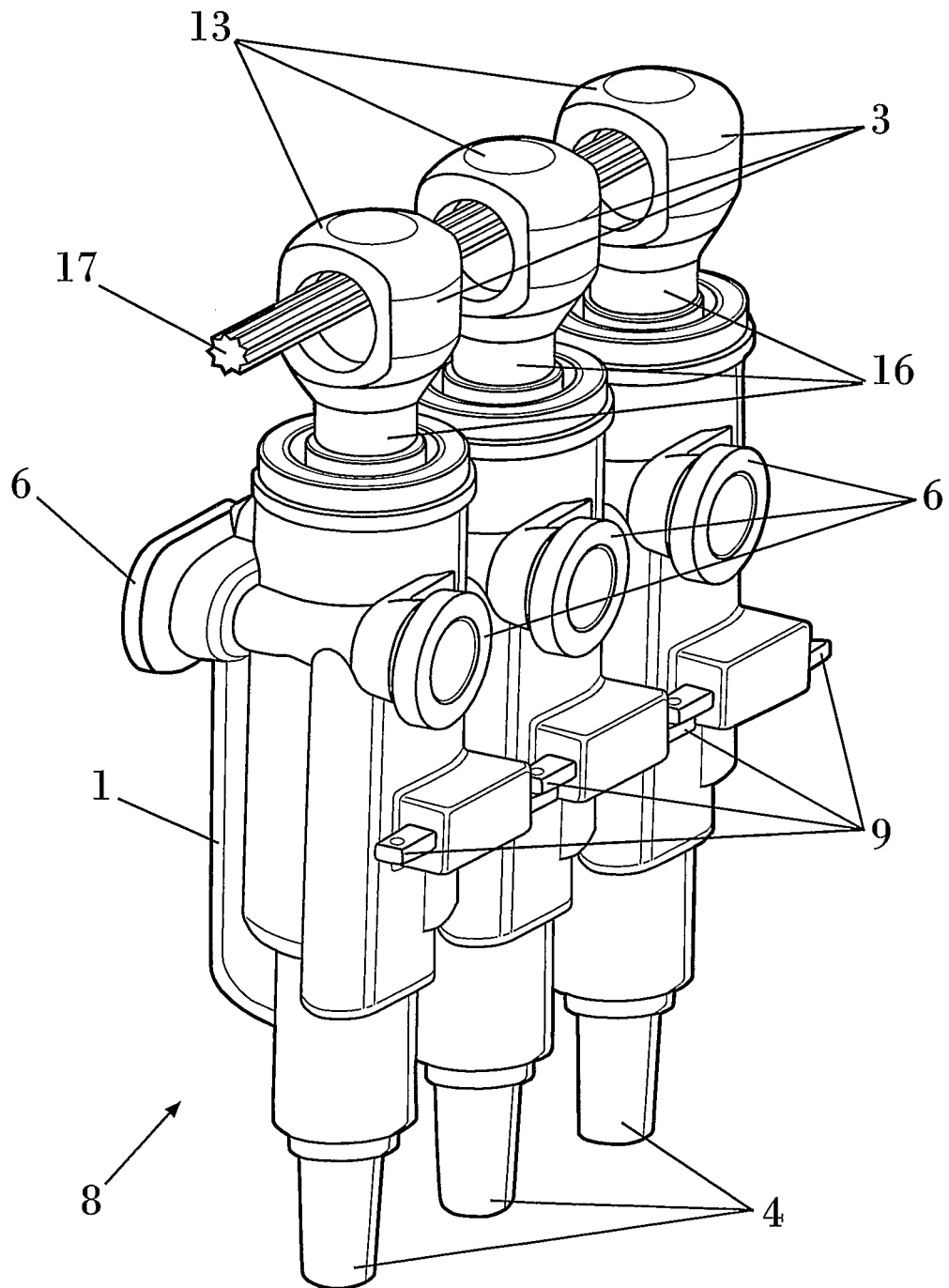


FIG. 3

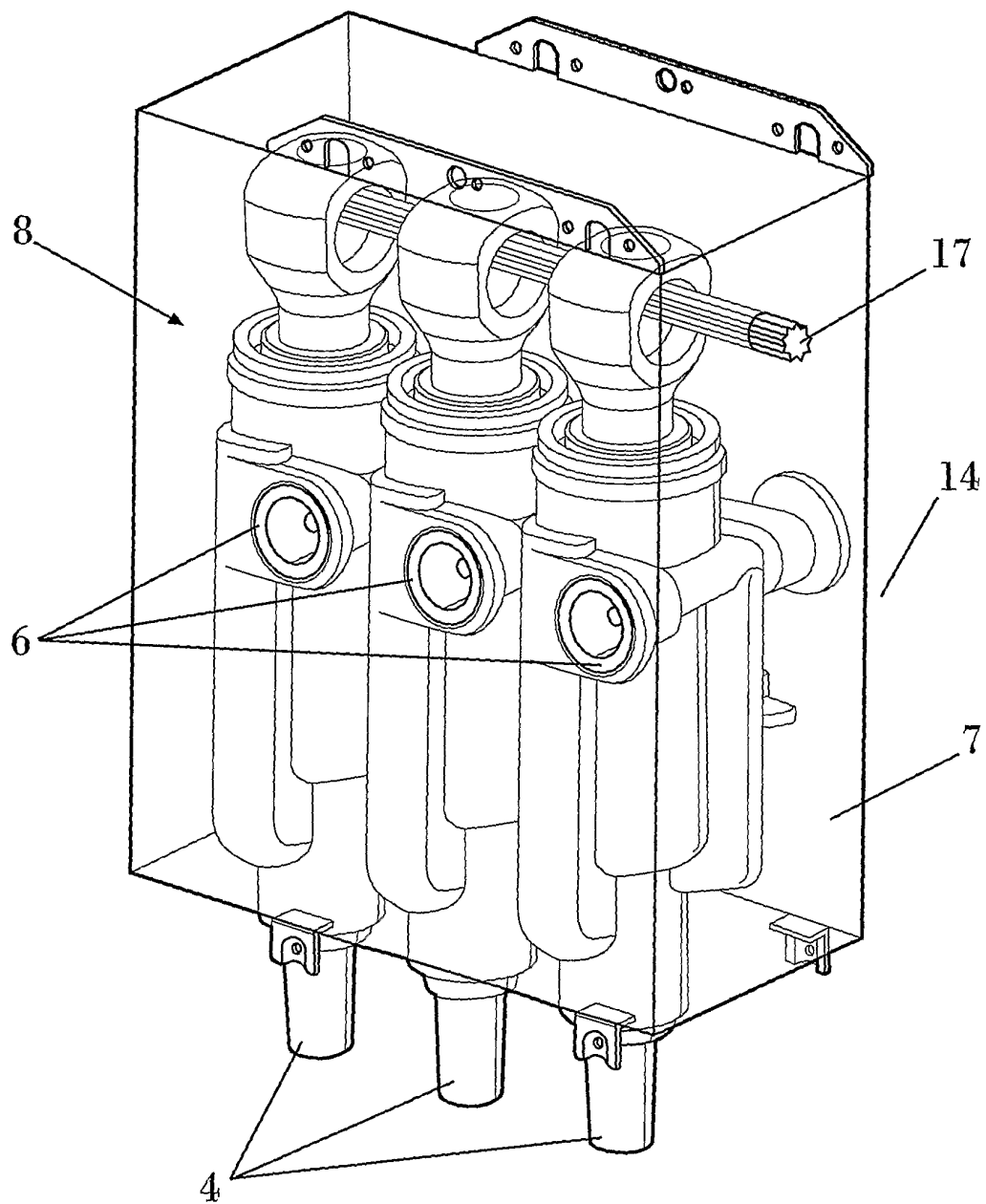


FIG. 4

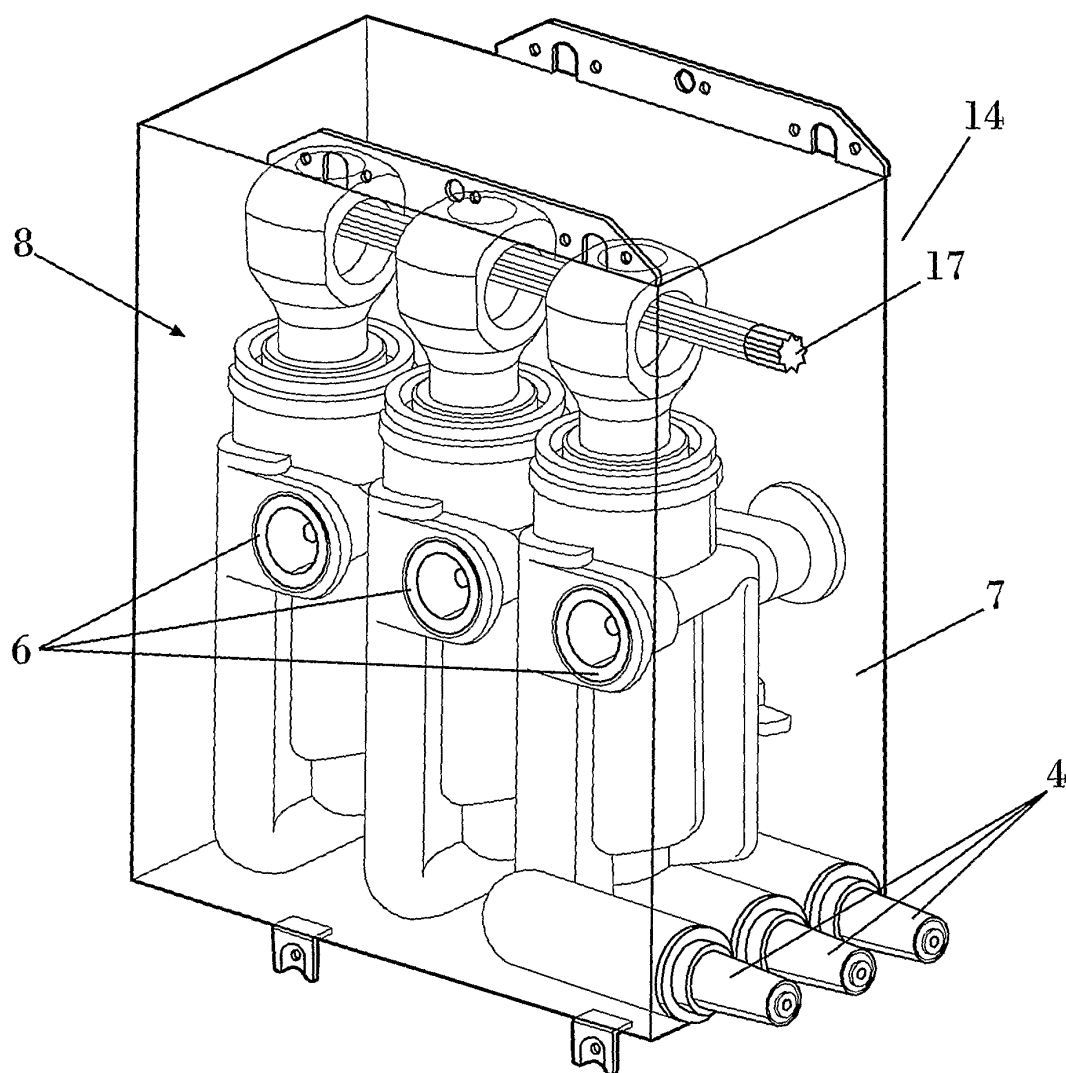


FIG. 5

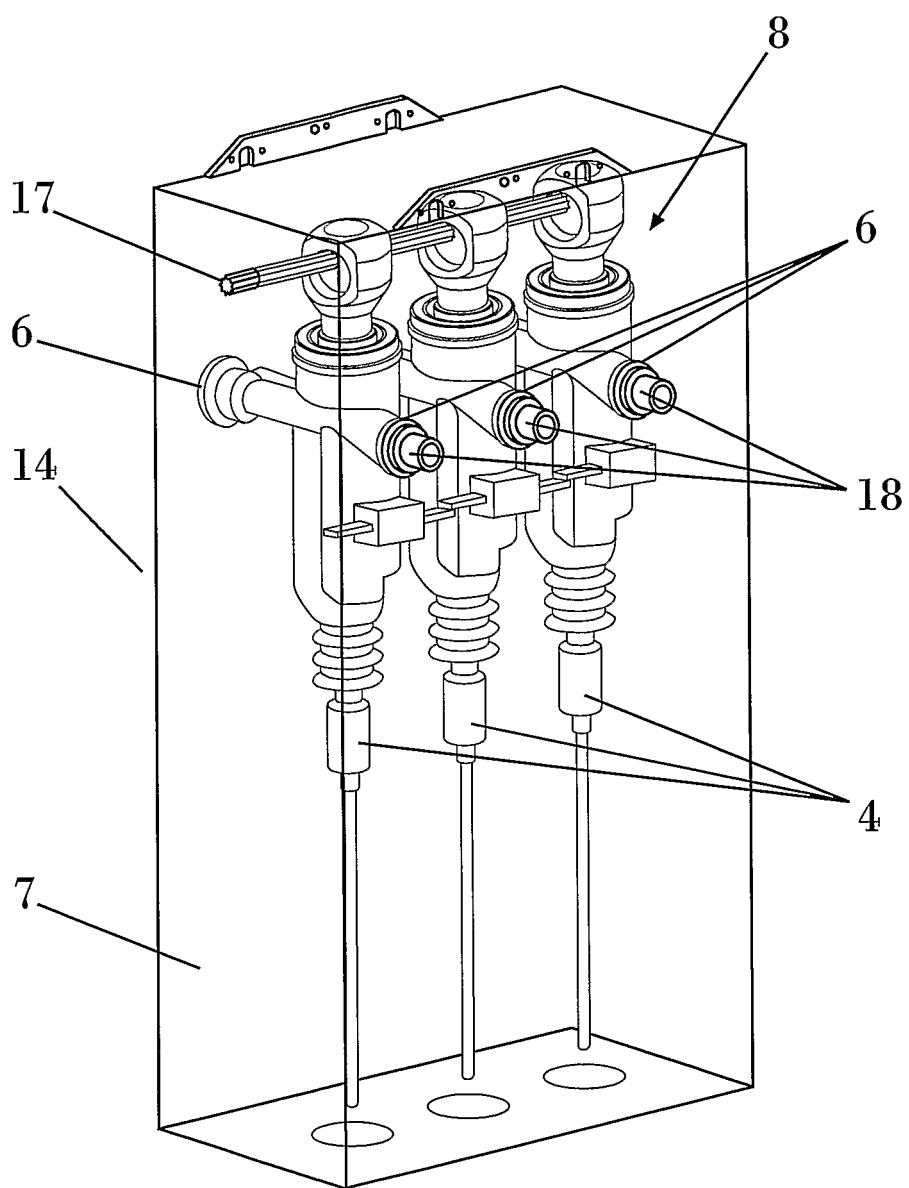


FIG. 6

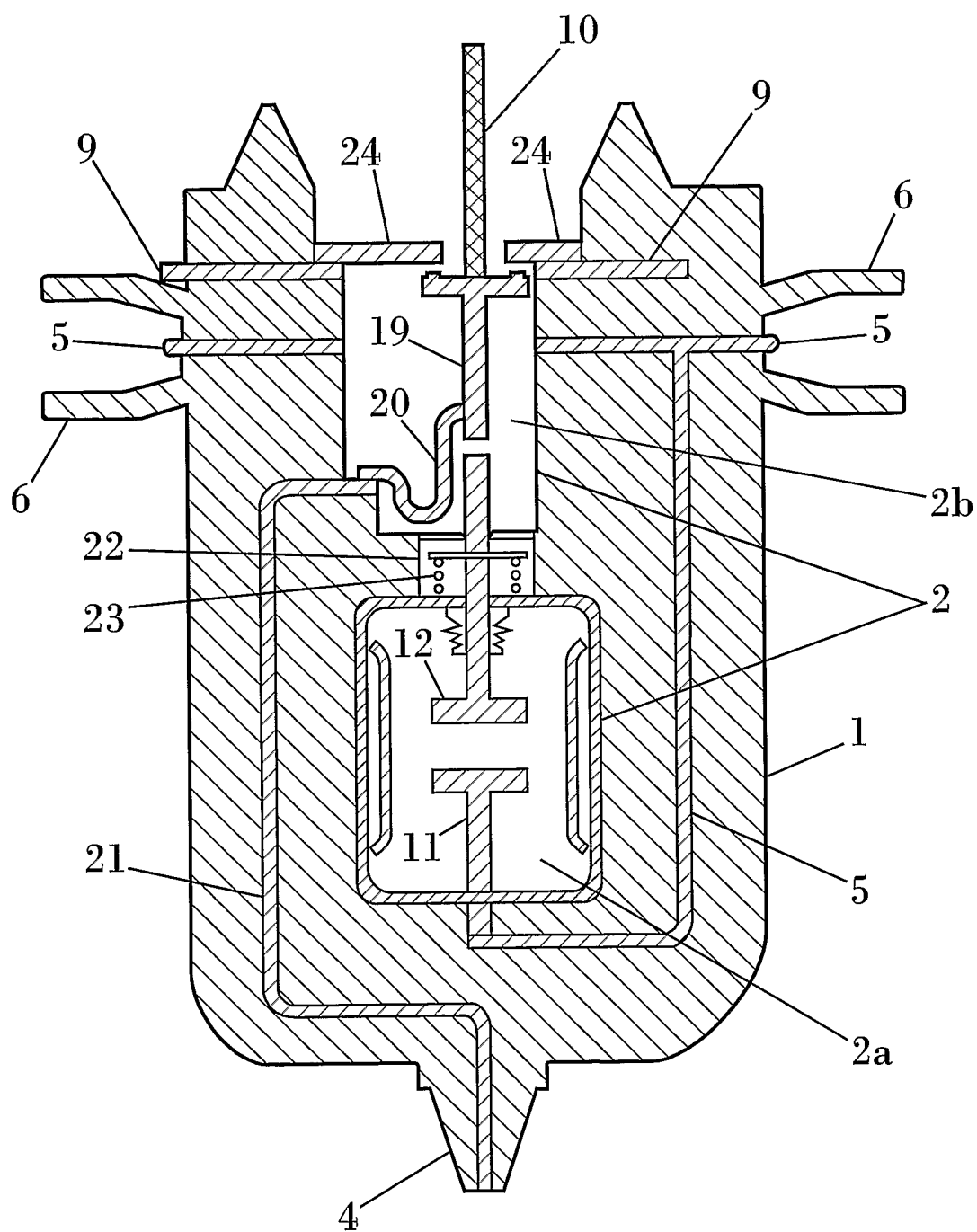


FIG. 7

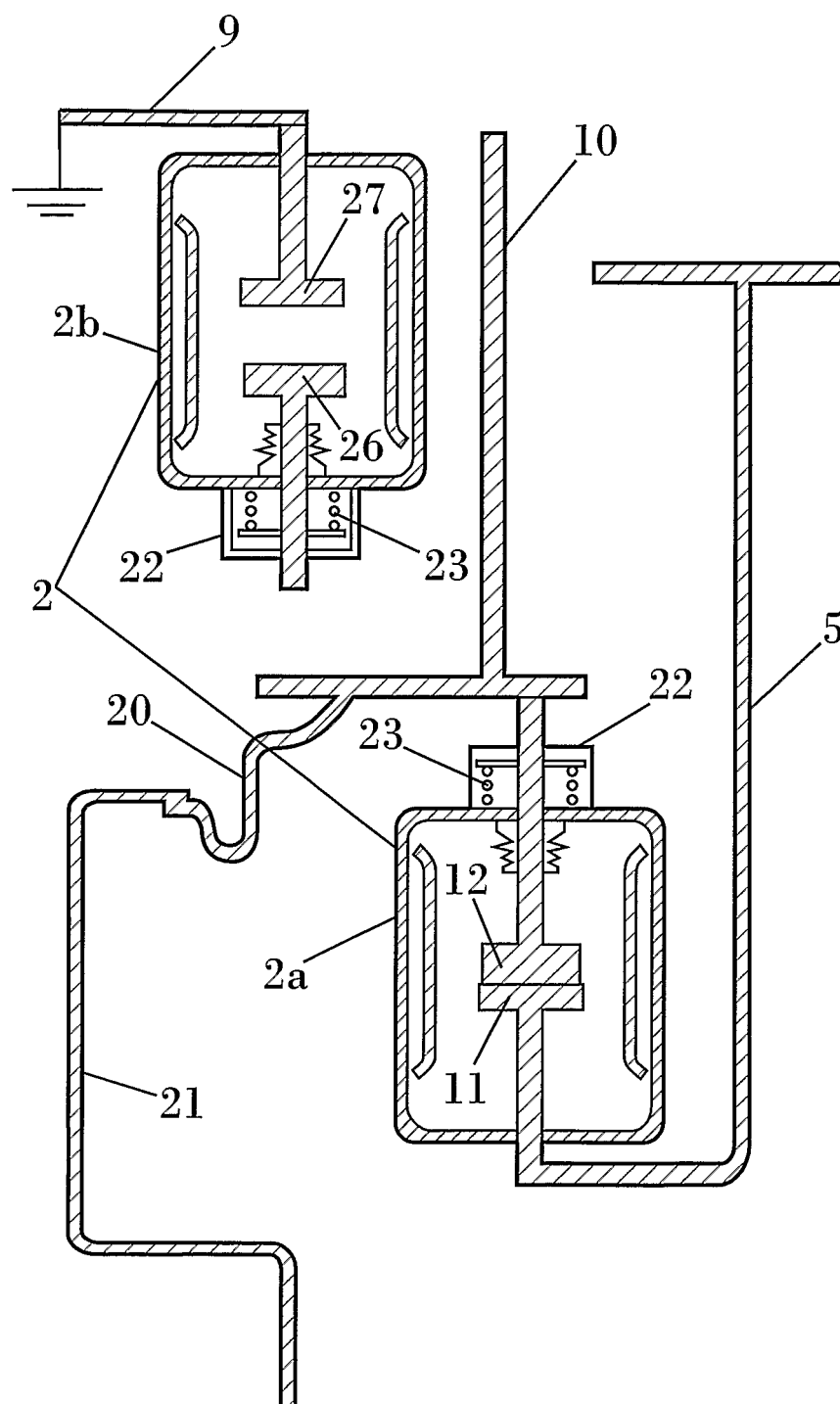


FIG. 8

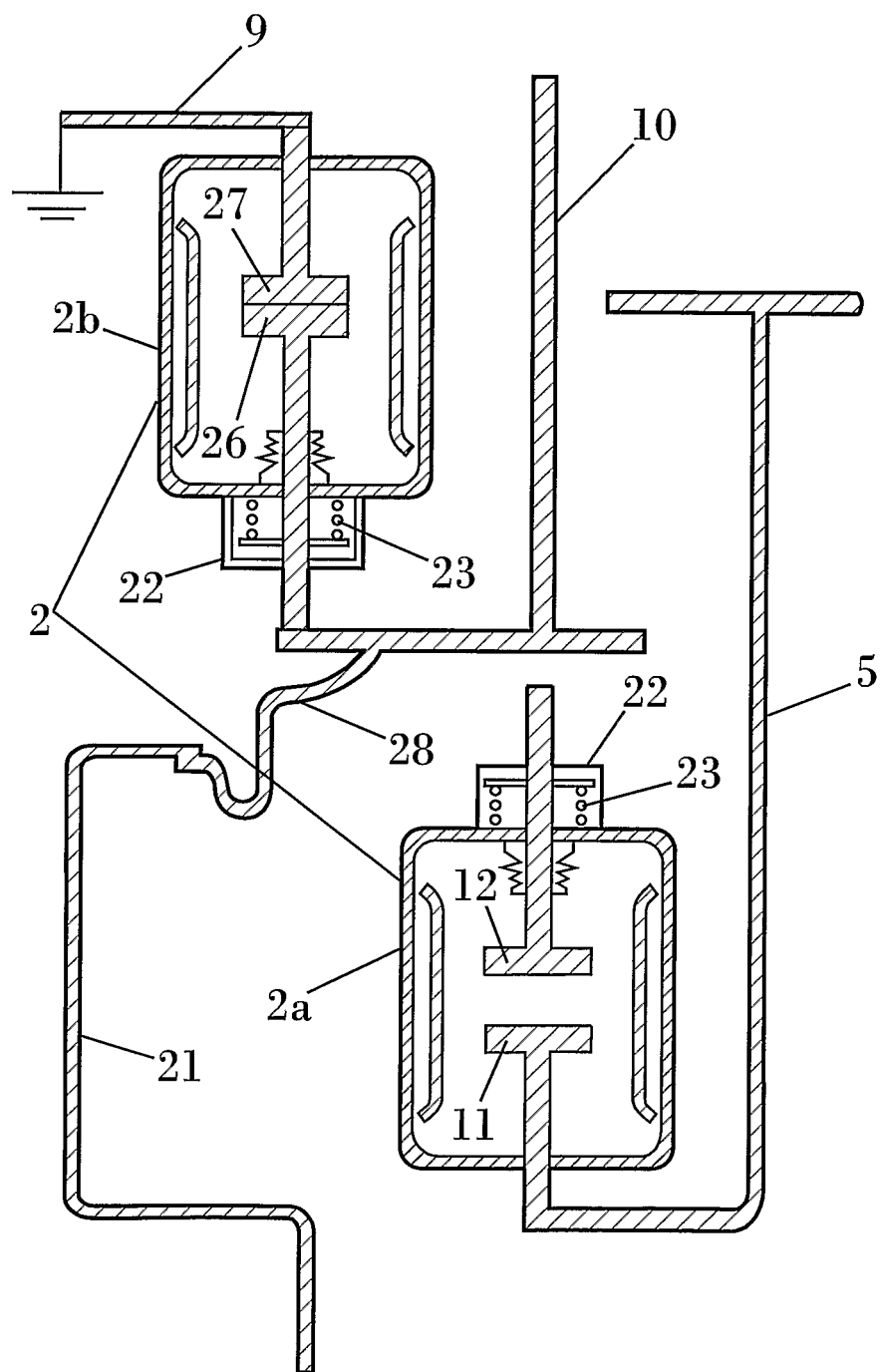


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/ES2006/000404

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01H33/666

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)
H01H

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 1 047 169 A (MITSUBISHI ELECTRIC CORP [JP]) 25 October 2000 (2000-10-25)	1, 6, 10, 21, 25-34, 36
Y	paragraph [0052] - paragraph [0068]; figure 6	2-4, 11-20, 22-24, 35
X	EP 0 766 277 A2 (HITACHI LTD [JP]) 2 April 1997 (1997-04-02)	1, 5, 7-9, 21, 27-34, 36, 37
	column 3, line 40 - column 5, line 12; figures 1-4	
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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

26 March 2007

Date of mailing of the international search report

04/04/2007

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MAEKI-MANTILA, M

INTERNATIONAL SEARCH REPORT

International application No
PCT/ES2006/000404

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Y	column 4, line 18 - column 5, line 45; figures 1-3	16-18
Y	DE 102 14 202 A1 (SIEMENS AG [DE]) 6 November 2003 (2003-11-06) column 3, line 1 - line 41; figure 1	2-4,20, 22-24
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Form PCT/ISA/210 (continuation of second sheet) (April 2005)

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Information on patent family members

International application No

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