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(54) **Double contacts control unit for electric plants and electric control device comprising the unit**

(57) A double-contact control unit for electric plants, which is adapted to be anchored to a fixed or movable support element of an electric plant, comprises an insulating support (4) having a longitudinal axis (L) and a predetermined axial length (1), two pairs of fixed contacts (5, 5'; 6, 6') mounted to the support (4) in longitudinally offset positions and adapted to be connected to corresponding electric circuits associated with the plant to cooperate with respective pairs of movable contacts (13, 13'; 14, 14') for opening/closing the electric circuits, each of the fixed contacts (5, 5'; 6, 6') being associated with a respective electrical connection terminal (7, 7'; 8, 8'). The terminals (7, 7'; 8, 8') of each pair of fixed contacts (5, 5'; 6, 6') are located in symmetric positions with respect to the longitudinal axis (L), at distances and inclination angles (α) differing from those of the terminals (7, 7'; 8, 8') of the other pair of fixed contacts (5, 5'; 6, 6') and at least partially transversely aligned therewith to reduce the longitudinal offset of the pairs of fixed contacts (5, 5'; 6, 6') and the axial length (1) of the support (4).

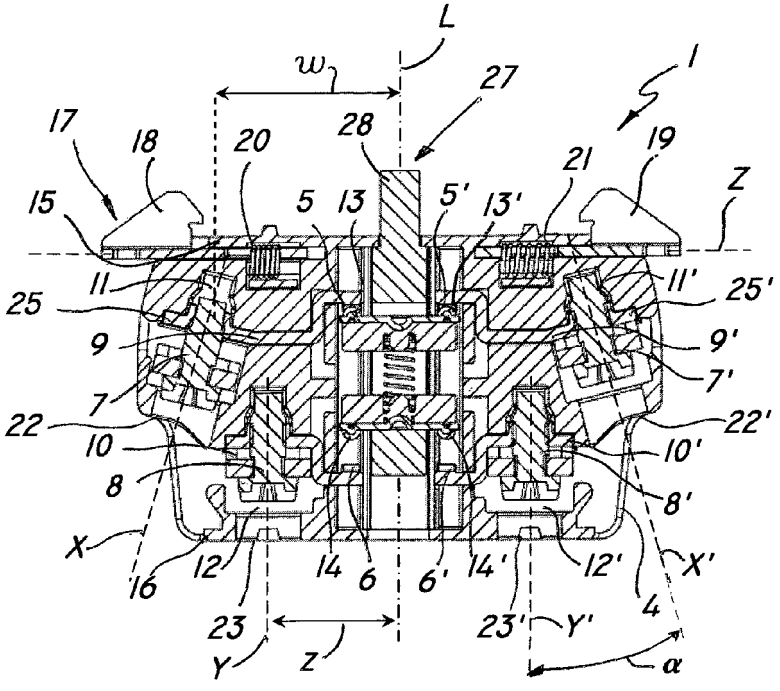

FIG. 1

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Description

DESCRIPTION

Field of the invention

[0001] The present invention generally finds application in the field of electric control devices and particularly relates to a double-contact control unit for electric plants.

[0002] The invention further relates to an electric control device comprising such control unit.

Background art

[0003] Various forms of control units with movable contacts are known in the art, which are adapted to be connected to electric plants, namely to control starting and stopping of safety devices, such as warning, alarm or emergency devices.

[0004] Generally, the simplest control units, known as single contact units, which essentially operate as switches, comprise an insulating support which is designed to be housed in an electrical protection box, which is adapted to be anchored to a fixed or movable part of a plant.

[0005] Two pairs of mutually movable electric contacts are housed in the support, the first pair being generally fixed and connected to the terminals of an electric circuit to be switched, the second pair being attached to an actuator that causes it to move toward/away from the first pair.

[0006] The support has a pair of projections designed for snap-fitting into a seat that is specially formed in the bottom wall of the electrical box.

[0007] In more complex applications, the control unit may be designed for simultaneous management of multiple electric circuits connected to different devices of the plant, e.g. to trigger a safety circuit at the same time as the main circuit is opened.

[0008] For this purpose, two pairs of movable contacts are provided in the support, and are adapted to selectively interact with respective pairs of fixed contacts, and in this case the control unit is generally referred to as "double-contact" type.

[0009] In prior art solutions, two separate pairs of fixed contacts are housed in the support in offset positions along the movable contact actuation axis.

[0010] One example of a double-contact control unit as described above, having all the features of the preamble of claim 1, is disclosed in DE102005033166.

[0011] Accordingly, double-contact control units generally have a significantly larger axial dimension than single-contact control units, and require the provision of relatively bulky electrical boxes.

[0012] Conversely, the control unit is anchored to a fixed part of the plant by coupling elements designed for snap engagement of corresponding seats of a fastening bracket or panel.

[0013] Nevertheless, these solutions do not provide adequate protection of the control units and do not allow modular mounting of two or more control units to a common support, possibly by associating double-movable contact control units with single-contact units.

[0014] WO90/01784 discloses a switch device having an enclosure containing two microswitches located on opposite sides and in symmetric positions with respect to the actuation axis of an actuator.

[0015] Nevertheless, the two microswitches are already assembled and connected to terminals that form extensions of the connections in the microswitches contained in the enclosure, hence they have no fixed contacts.

Disclosure of the invention

[0016] The object of the present invention is to overcome the above drawbacks, by providing a double-contact control unit that achieves high efficiency and relative cost effectiveness.

[0017] A particular object is to provide a double-contact type control unit that has substantially the same axial dimension as a single-contact pair type control unit.

[0018] A further object of the present invention is to provide a double-contact control unit for electric plants that can be installed in modular fashion in an electrical box.

[0019] Yet another object is to provide a control device for electric plants that allows one or more double-contact control units to be inserted in an electrical box typically sized to contain single-contact control units.

[0020] These and other objects, as better explained hereafter, are fulfilled by a double-contact control unit for electric plants, as claimed in claim 1, which is designed to be anchored to a fixed or movable support element of an electric plant, wherein the control unit comprises an insulating support having a longitudinal axis and a predetermined axial length, two pairs of fixed contacts mounted to said support in longitudinally offset positions and adapted to be connected to corresponding electric circuits associated with the plant to cooperate with respective pairs of movable contacts for opening/closing said electric circuits, each of said fixed contacts being associated with a respective electrical connection terminal, wherein the terminals of each of said pairs of fixed contacts are located in symmetric positions with respect to said longitudinal axis, at distances and inclination angles differing from those of the terminals of the other of said pairs of fixed contacts and at least partially transversely aligned therewith.

[0021] With this particular arrangement, the longitudinal offset of these pairs of fixed contacts and the axial length of said support may be reduced.

[0022] Namely, the length of the support is reduced and substantially compatible with that of common single-contact pair control units, possibly allowing accommodation in an electrical box typically formed to contain single-contact pair control units.

[0023] In a further aspect of the invention, a control device is provided, as set forth in claim 8, which comprises an electrical box and one or more double-contact control units of the present invention.

[0024] Advantageous embodiments of the invention are obtained in accordance with the dependent claims.

Brief description of the drawings

[0025] Further features and advantages of the invention will be more apparent from the detailed description of preferred, non-exclusive embodiments of the control unit and the device of the invention, which are described as non-limiting examples with the help of the annexed drawings, in which:

FIGS. 1 and 2 are sectional views of a control unit of the invention in a first preferred configuration;
FIGS. 3 and 4 are sectional views of a control unit of the invention in a second preferred configuration;
FIG. 5 is a sectional view of a control unit of the invention in a third preferred configuration and in an actuation sequence;
FIG. 6 is a perspective exploded view of a control device of the invention according to a first preferred configuration;
FIG. 7 is a perspective view of a portion of a control device of the invention according to a second preferred configuration;
FIG. 8 is a lateral broken-away view of a control device of the invention according to a third preferred configuration;
FIG. 9 is a perspective view of a portion of a control device of the invention according to a fourth preferred configuration;
FIG. 10 is a front bottom view of a control device of the invention according to a fifth preferred configuration;
FIG. 11 is a lateral broken-away view of the control device of Fig. 10.

Detailed description of a preferred embodiment

[0026] Referring to the above figures, a control unit of the invention, generally designated by numeral 1, may be mounted to one or more electric circuit of an electric plant, not shown in the accompanying drawings and known per se, to control opening and closing thereof in a selective and controlled manner.

[0027] For example, the control unit 1 may be simultaneously connected to a main power supply circuit for powering a movable part of the plant and to an auxiliary safety circuit, such as a warning, emergency or alarm circuit, to trigger the latter at the same time as the main circuit is opened, thereby ensuring the requested safety.

[0028] Particularly, the control unit 1 may be connected to the stationary part of the electric plant through a support element, such as an electrical box 2 or an anchor panel 3.

[0029] As particularly shown in Figs. 1 and 3, a double-contact control unit 1 of the invention comprises an insulation support 4 which is adapted to be removably anchored to a particular support element 2, 3 and has a longitudinal axis L and a predetermined axial length 1.

[0030] First and second pairs of fixed electric contacts, 5, 5' and 6, 6', are arranged in the insulation support 4, and are associated with respective electric terminals 7, 7'; 8, 8' through respective substantially transverse conductive plates 9, 9'; 10, 10' for electric connection to respective electric circuits of the plant.

[0031] Furthermore, each terminal 7, 7'; 8, 8' is accommodated in a respective seat 11, 11'; 12, 12', which is formed in the support 4 and has a substantially elongate shape in a main direction of extension X, X'; Y, Y'.

[0032] The support 4 also houses first and second pairs of movable electric contacts, 12, 12' and 14, 14' which are spaced at a predetermined maximum axial distance d and are adapted to be selectively moved to contact with the fixed contacts 5, 5'; 6, 6' of a respective pair, in any manner known to the skilled person.

[0033] According to a peculiar feature of the invention, the terminals 7, 7' of one of the pairs of fixed contacts 5, 5' are located in symmetric positions with respect to the longitudinal axis L, at distances and inclination angles α differing from those of the terminals 8, 8' of the other pair of fixed contacts 6, 6' to be at least partially transversely aligned therewith to reduce the longitudinal offset of the pairs of fixed contacts 5, 5'; 6, 6' and the axial length 1 of the support 4.

[0034] Particularly, the plates 9, 9' of the pair associated with one of the pairs of fixed contacts 5, 5' have a transverse dimension w that is larger than the transverse dimension z of the plates 10, 10' of the other pair, such that their respective terminals 7, 7' may be arranged at a longer distance from the longitudinal axis L, as compared with the other pair of terminals 8, 8'.

[0035] Furthermore, the housing seats 11, 11' of the electric terminals 7, 7' associated with the conductive plates 9, 9 having the larger transverse dimension w have respective directions of extension inclined to the longitudinal axis L.

[0036] Thus, such housing seats 11, 11' are at least partially transversely aligned with the seats 12, 12' of the terminals 8, 8' connected to the other pair of fixed contacts 6, 6'.

[0037] This particular configuration will reduce the longitudinal offset of the pairs of fixed contacts 5, 5'; 6, 6' and, as a result, the maximum axial distance d between the pairs of movable contacts 13, 13'; 14. 14' to obtain a support 4 having a relatively small length 1, substantially comparable to the length of the insulation supports that are typically used for the control units having a single pair of movable contacts, thereby allowing them to be accommodated in an electrical box 2.

[0038] As shown in the figures, the support 4 substantially has a box-like shape and is symmetric with respect

to the longitudinal axis L, with an upper front face 15 and a lower front face 16, which are substantially flat, opposed and parallel to each other.

[0039] Particularly, one of such front faces 15, 16 is equipped with snap anchor means 17 which are adapted to be removably connected to respective seats, appropriately formed in the support element 2, 3 as described below.

[0040] For instance, as shown in Figs. 1 and 2, the anchor means 17 may be associated with the upper face 15. Such configuration is preferred if the control unit 1 is designed to be anchored to a fixation panel 3, as shown in Figs. 10 and 11, described below in greater detail.

[0041] Here, even when the unit 1 is not designed to be housed in an electrical box, there will be the undoubted advantage that the control unit 1 is more compact and has lower space requirements.

[0042] Figs. 3 and 4 show a control unit 1 having the anchor means 17 associated with the lower face 16 of the support 4 for removable anchorage of the bottom wall of an electrical box 3, as shown in Figs. 6 to 9, also described in greater detail below.

[0043] In both configurations, according to a preferred non-limiting embodiment of the invention, the snap anchor means 17 may include a pair of coupling elements 18, 19 moving along the same transverse axis Z in opposite directions.

[0044] Particularly, each coupling element 18, 19 slides transversely against a respective return spring 20, 21 or the like, housed in the support 4 and adapted to force the corresponding coupling element 18, 19 toward the closed position.

[0045] An a further particularly advantageous aspect, the seats 11, 11'; 12, 12' for the terminals 7, 7'; 8, 8' may have respective holes 22, 22'; 23, 23' for access to respective terminals 7, 7'; 8, 8'.

[0046] Such access holes 22, 22'; 23, 23' are formed in the support 4 at the front face 15, 16 with no anchor means 17, to facilitate insertion of a tool, such as a screwdriver or the like, for tightening or removing the corresponding terminal 7, 7'; 8, 8'.

[0047] The conductive plates 9, 9' with the larger transverse dimension w have first end portions 24, 24' equipped with respective fixed contacts 5. 5' and second end portions 25, 25' equipped with respective terminals 7, 7'.

[0048] The second end portions 25, 25' are appropriately inclined to the longitudinal axis L at equal and opposite inclination angles for the respective terminals 7, 7' to be arranged substantially parallel to the directions of extension X, x' of the corresponding housing seats 11, 11'.

[0049] Thus the seats 11, 11' for the terminals 7, 7' can be easily accessed by an operator using an appropriate tool, although the support 4 is very compact, in both longitudinal and transverse directions.

[0050] By way of example and without limitation, the inclination angle of the second end portions 25, 25' of the conductive plates 9, 9' may range from 10° to 85°, more preferably from 60° to 80°.

[0051] Therefore, the inclination angle α of the terminals 7, 7' is complementary to the inclination angle of the second end portions 25, 25'.

[0052] The conductive plates 9, 9' having the larger transverse dimension w may be appropriately shaped with a first end portion 24, 24' substantially transverse and orthogonal to the longitudinal axis L and a substantially longitudinal intermediate portion connecting the two end portions 24, 25; 24', 25'.

[0053] The second end portion 25, 25' may also have a substantially transverse section that connects the inclined section to the intermediate portion.

[0054] Conversely, the conductive plates 10, 10' having the smaller transverse dimension z are appropriately shaped with end portions substantially transverse and orthogonal to the longitudinal axis L and a substantially longitudinal intermediate portion connecting the two end portions.

[0055] This configuration will allow the terminals 7, 7'; 8, 8' to be accommodated in the support 4 such that the latter may still have a compact size while allowing simple access to the former as the access holes 22, 22'; 23, 23' are transversely offset from each other.

[0056] In a preferred configuration of the invention, the control unit 1 comprises substantially longitudinal actuating means 27 associated with the first and the second pairs of movable electric contacts 13, 13'; 14, 14', to move the latter along a substantially longitudinal common actuation axis, e.g. coincident with the axis of symmetry L.

[0057] This particular configuration allows use of actuator means having a high degree of safety, complying with the standards in force.

[0058] The actuating means 27 may be known per se and include, by way of example, a slider 28 sliding in a longitudinal guide 29 formed at the center of the support 4.

[0059] The slider 28 has an upper end 30 adapted to interact with a pushbutton for actuating the control device to which the unit 1 is mounted, e.g. the emergency mushroom pushbutton 31 as shown in Fig 6.

[0060] On the other hand, the lower end 32 of the slider 28 is associated with a pair of bridges 33, 34, each having one of the pairs of movable contacts 13, 13'; 14, 14'.

[0061] Particularly, the two contact-holding bridges 33, 34 are housed in a cavity 35 formed in the slider 28 ad the lower bridge 34 connected to the second pair of movable contacts 14, 14' is integrated with the lower end 32 of the slider 28 to translate integral therewith.

[0062] On the other hand, the slider 28 is designed to only engage the upper bridge 33 once it has covered a first length of its maximum longitudinal stroke.

[0063] Fig. 5 shows a further configuration of a control unit 1 of the invention, in which one of the fixed contacts 50 of one of the pairs is stably electrically connected to one of the fixed contacts 6' of the other pair, e.g. by a connecting bridge 52 for electrical connection of the two

corresponding bridges 7', 8', to define a self-monitored contact unit 1, which is designed to electrically warn, by opening the circuit, that the actuating pushbutton 31 has moved away from the contact unit 1, e.g. in case of improper mounting, or improper assembly of the box 2.

[0064] Fig. 5 also shows an operating sequence for said self-monitored control unit 1, indicating that, once a first length of the longitudinal stroke of the slider 28 has been covered, the second pair of movable contacts 14, 14' is only caused to move, whereas the first pair of movable contacts 13, 13' remains in contact with the corresponding first pair of fixed contacts 5, 5'.

[0065] After contact of the second pair of movable contacts 14, 14' with the second pair of fixed contacts 6, 6', the slider 28 will engage the upper bridge 33 to pull it along the longitudinal actuation axis L and cause the corresponding circuit to open.

[0066] As is known in the art, two elastic counteracting elements are provided, one of which, referenced 36, will act upon the slider 28 to counteract its longitudinal sliding motion, and the other, referenced 37, will be interposed between the contact-holding bridges 33, 34.

[0067] Fig. 6 shows a first configuration of a control device for electric plants as disclosed by the invention, generally referenced 38, which comprises the control unit 1 as described above and shown in Figs. 3 and 4.

[0068] Particularly, the device 38 comprises an electrical box 2 having an inner housing 39 of predetermined height h which is adapted to accommodate one or more control units 1.

[0069] Particularly, the electrical box 2 is composed of an upper half-shell 40 and a lower half-shell 41, which are designed to be connected together, e.g. by screw means 42.

[0070] The inner housing 39 has an upper wall 43 with one or more passages 44 formed therein to receive respective control pushbuttons, such as an emergency mushroom pushbutton 31, actuating pushbuttons, selectors or the like, and a bottom wall 45 configured for removable anchorage of one or more control units 1 to be associated with respective control pushbuttons.

[0071] Appropriately, the axial length 1 of the support 4 of the control unit 1 is substantially similar or slightly smaller than the height h of the inner housing 39, as more clearly shown in Fig. 7, thereby allowing insertion of the control unit 1 of the invention having two pairs of movable contacts 13, 13'; 14, 14' into the electrical box 2.

[0072] The support 4 is equipped with a pair of connection elements 18, 19 as described above at its lower front face 16, to allow removable coupling with the bottom wall 45 of the housing 39.

[0073] The latter in turn comprises at least one pair of holding members 46, 47, adapted for snap engagement by respective coupling elements 18, 19 of the support 4.

[0074] Particularly, the bottom wall 45 may have a plurality of pairs of holding members 46, 47, which are adapted to be selectively and modularly engaged by corresponding coupling elements 18, 19 of one or more respective control units 1, 1', 1".

[0075] The control units 1, 1', 1" adapted to be inserted into a common electrical box 2 may also differ from each other, e.g. be all according the present invention as shown in Fig. 7.

[0076] Alternatively, one or more single-contact pair control units 1"' may be provided in addition to one or more control units 1 of the present invention, as shown in Fig. 8.

[0077] Fig. 9 shows a further configuration for the electrical box 2, designed for use in common control pushbutton panels.

[0078] Finally, Figs. 10 and 11 shows a further variant of the control device of the invention, generally referenced 49, having a control unit 1 as shown in Figs. 1 and 2, i.e. having the anchor means 17 associated with the upper front face 15.

[0079] Here, the device 48 will comprise a support element defined by a fastening panel 4 having both a central passage 49 for receiving a control pushbutton, e.g. an emergency mushroom pushbutton 50, and one or more seats 51 for mounting and removable anchorage of corresponding control units 1, 1"', not necessarily all according to the present invention. Such seats 51 are appropriately arranged at the periphery of the central passage 49.

[0080] The above disclosure clearly shows that the invention fulfills the intended objects and particularly meets the requirement of providing a double-contact control unit for electric plants, e.g. of the type having two pairs of movable contacts and two pairs of fixed contacts, that is particularly compact, allowing insertion thereof into standard electrical boxes, as typically used with control units having single pairs of fixed and movable contacts.

[0081] The unit and device of the invention are susceptible to a number of changes and variants, within the inventive concept disclosed in the appended claims. All the details thereof may be replaced by other technically equivalent parts, and the materials may vary depending on different needs, without departure from the scope of the invention.

[0082] While the control unit and device have been described with particular reference to the accompanying figures, the numerals referred to in the disclosure and claims are only used for the sake of a better intelligibility of the invention and shall not be intended to limit the claimed scope in any manner.

Claims

1. A double contact control unit for electric plants, anchorable to a fixed or movable support element (2, 3) of an electric plant, wherein the control unit comprises:

    - an insulating support (4) having a longitudinal axis (L) and a predetermined axial length (1);

- two pairs of fixed contacts (5, 5'; 6, 6') mounted on said support (4) in longitudinally offset positions and connectable to corresponding electrical circuits associated to the plant to cooperate with respective pairs of movable contacts (13, 13'; 14, 14') for opening/closing said electrical circuits, each of said fixed contacts (5, 5'; 6, 6') being associated to a respective electric connection terminal (7, 7'; 8, 8');
wherein the terminals (7, 7'; 8, 8') of each of said pairs of fixed contacts (5, 5'; 6, 6') are positioned symmetrically relative to said longitudinal axis (L), with distances and inclination angles (□) different with respect of the terminals (7, 7'; 8, 8') of the other of said pairs of fixed contacts (5, 5'; 6, 6') in positions at least partially transversally aligned therewith in such a manner to reduce the longitudinal offset of said pairs of fixed contacts (5, 5'; 6, 6') and the axial length of said support (4).

2. Control unit as claimed in claim 1, wherein the fixed contacts (5, 5'; 6, 6') of each of said pairs are stably connected to respective terminals (7, 7'; 8, 8') by means of substantially transverse conductive plates (9, 9'; 10, 10'), the plates (9, 9') of one of said fixed contacts (5, 5') having respective transverse dimension (w) larger than the transverse dimension (z) of the plates (10, 10') associated to the other pairs of said fixed contacts (6, 6').

3. Control unit as claimed in claim 2, wherein the plates (9, 9') with larger dimension (w) have first end portions (24, 24') provided with respective fixed contacts (5, 5') and second end portions (25, 25') provided with respective terminals (7, 7') and inclined with respect of said longitudinal axis (L) with equal and opposite inclination angles to incline the respective terminals (7, 7') with the corresponding inclination angle (□).

4. Control unit as claimed in any preceding claim, wherein said support (4) is substantially box-like with substantially transverse opposite upper front face (15) and lower front face (16) parallel with each other, one of said front faces (15, 16) being provided with snap anchoring means (17) adapted to removably couple with respective seats of the support element (2, 3).

5. Control unit as claimed in claim 4, wherein each of said terminals (7, 7'; 8, 8') is housed in a respective housing seat (11, 11'; 12, 12') having an entry hole (22, 22'; 23, 23') made into said support (4) at the front face (15, 16) having no anchoring means (17).

6. Control unit as claimed in any preceding claim, wherein substantially longitudinal actuation means (27) are provided which are associated to said pairs of movable contacts (13, 13'; 14, 14') to move them along a same substantially longitudinal actuation axis (L).

7. Control unit as claimed in any preceding claim, wherein one (5') of said fixed contacts of one of said pairs is stably electrically connected to one (6') of said fixed contacts of the other of said pairs to define a self-monitored control unit (1).

8. A control device for electrical plants, comprising:

- an electric box (2) with an inner housing (39) with predetermined height (h) having an upper wall (43) and a bottom wall (45);
- one or more control units (1, 1', 1", 1"') housed into said inner housing (39) of said electric box (2) and connectable to a control circuit of an electric plant to control the opening and the closing thereof;
characterized in that said at least one or more of said control units (1, 1', 1", 1"') is in accordance with one or more of the preceding claims and includes an insulation support (4) removably anchored to said bottom wall (45) of said housing (39) and a predetermined axial length (1) substantially close to or slightly shorter than said predetermined height (h) of said housing (39).

9. Device as claimed in claim 8, **characterized in that** said support (4) of said at least one control unit (1, 1', 1", 1"') is substantially box-like with an upper front face (15) and a lower front face (16) provided with a pairs of anchoring members (18, 19) for removably coupling to said bottom wall (45) of said housing (39).

10. Device as claimed in claim 9, **characterized in that** said bottom wall (45) of said housing (39) comprises at least one pairs of holding members (46, 47) snap engageable with respective anchoring members (18, 19) of said support (4).

11. Device as claimed in claim 10, **characterized in that** said bottom wall (45) of said housing (39) has a plurality of said pairs of holding members (46, 47) selectively and modularly engageable with corresponding anchoring members (18, 19) of said one or more control units (1, 1', 1", 1"').

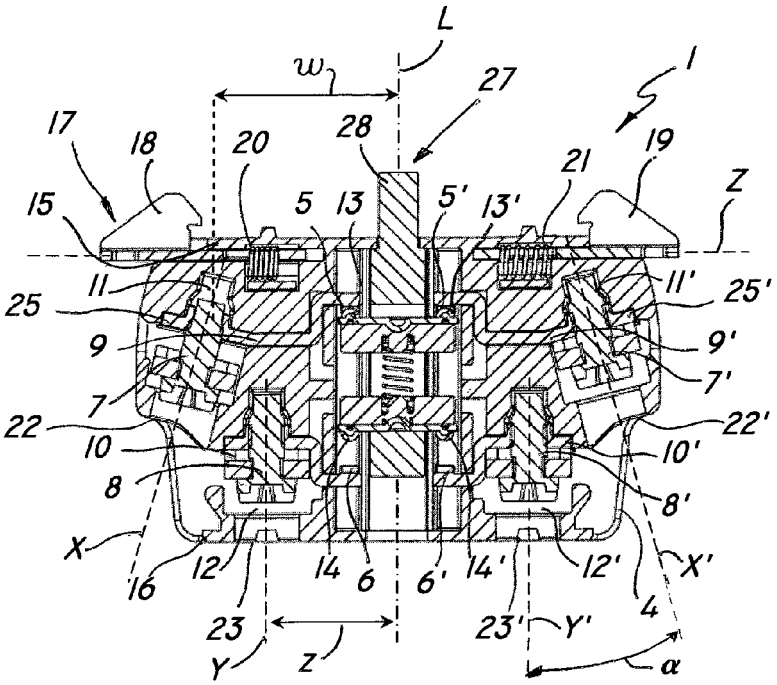

FIG. 1

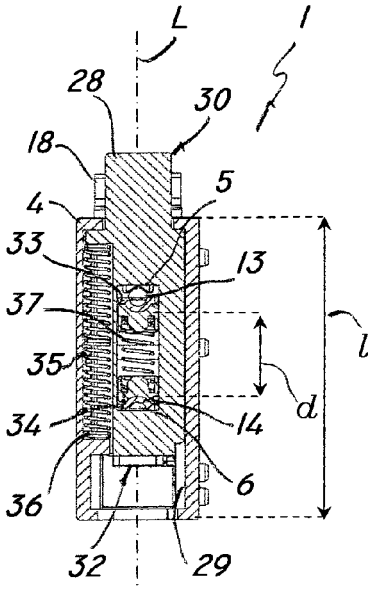

FIG. 2

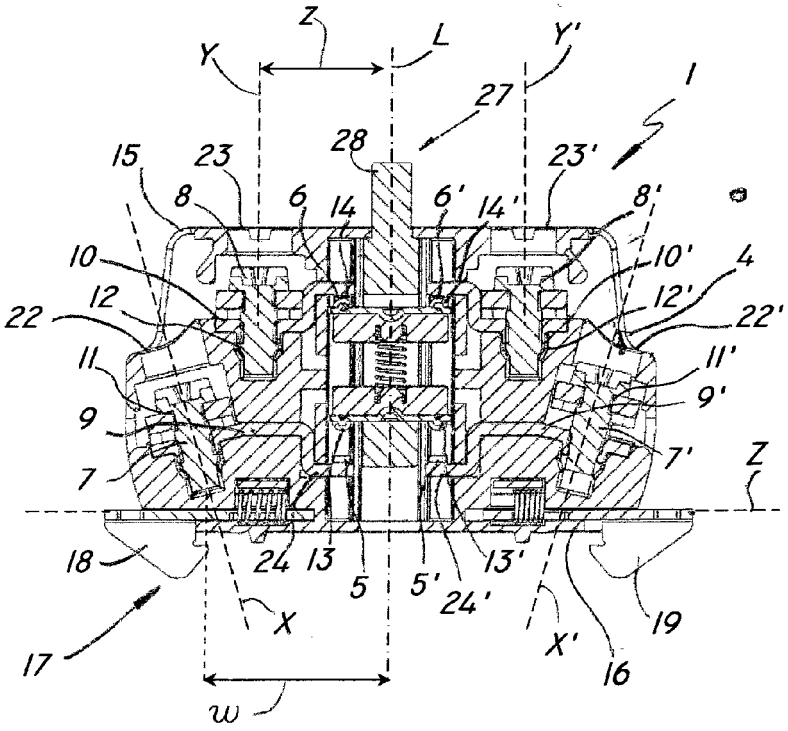

FIG. 3

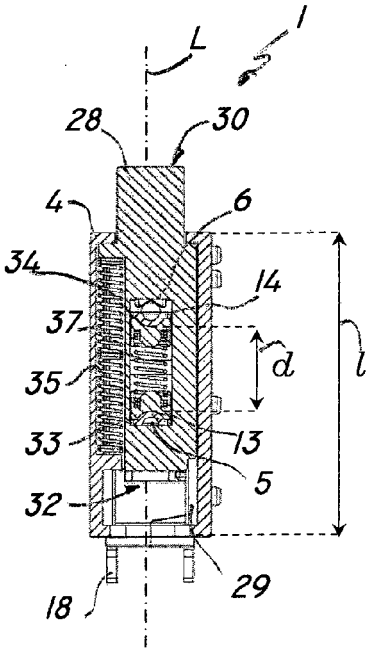

FIG. 4

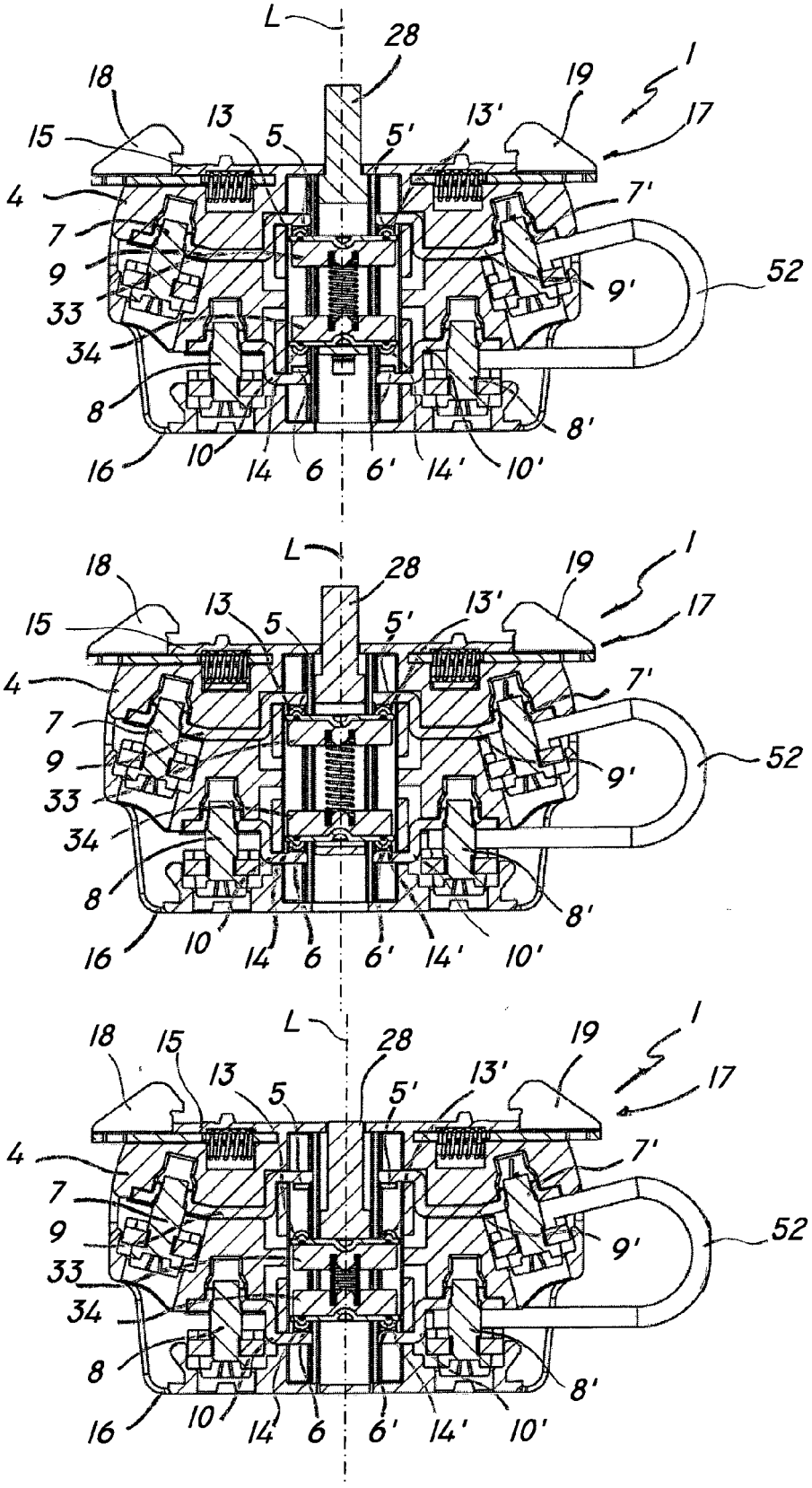

FIG. 5

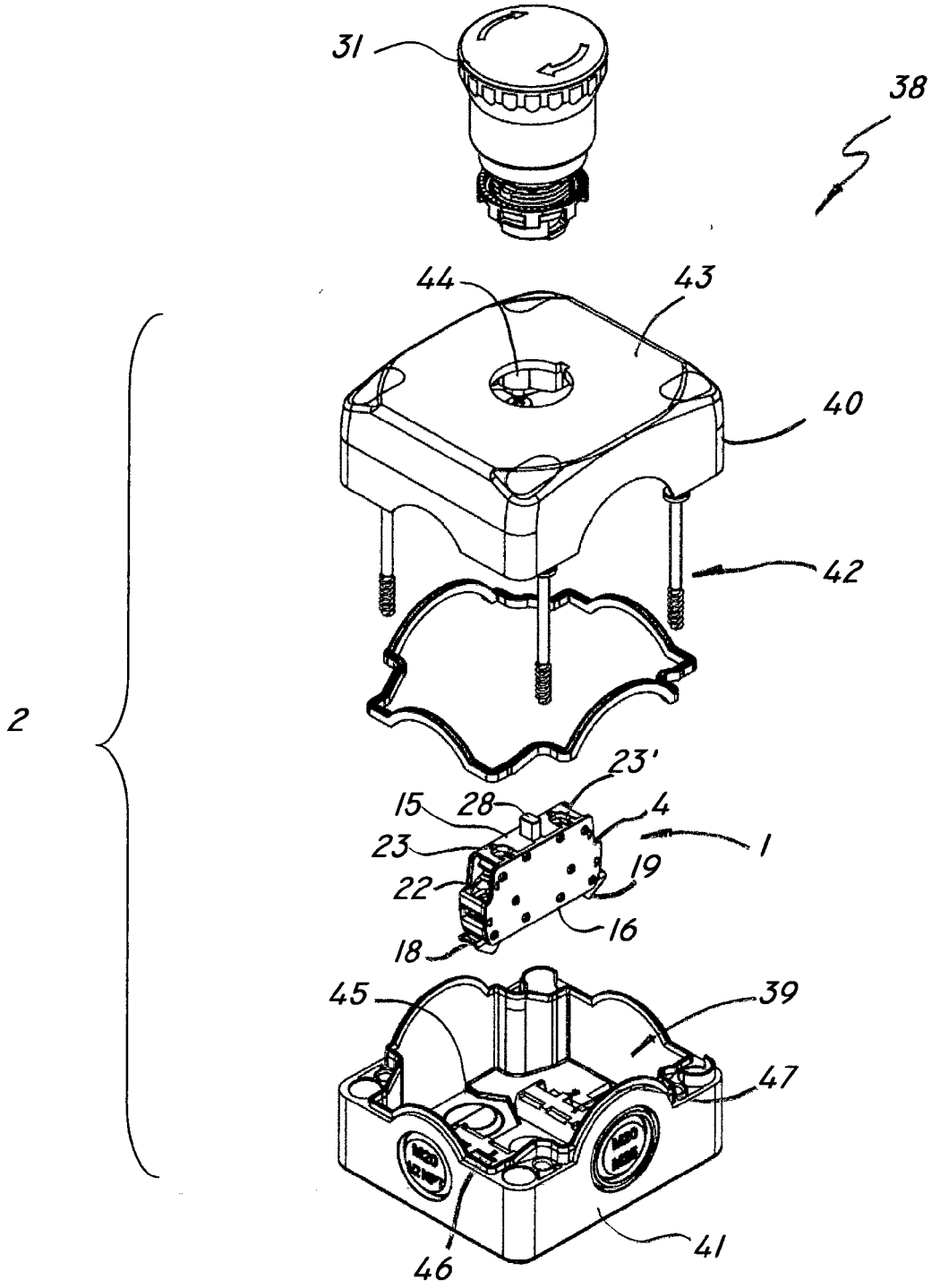

FIG. 6

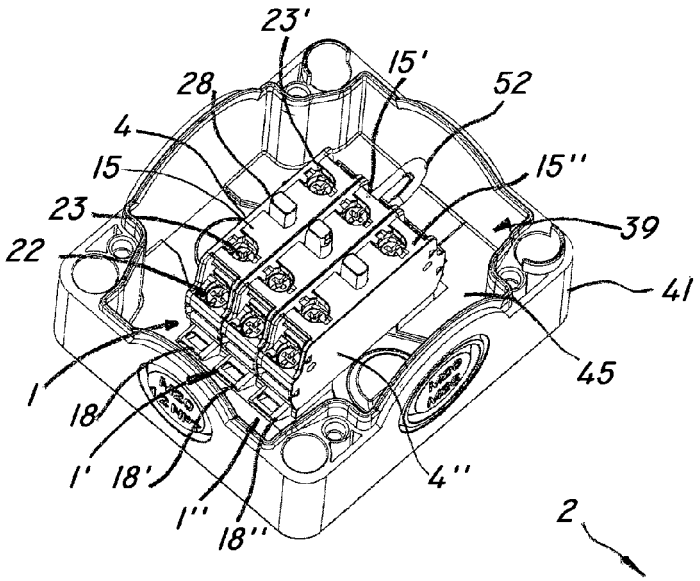

FIG. 7

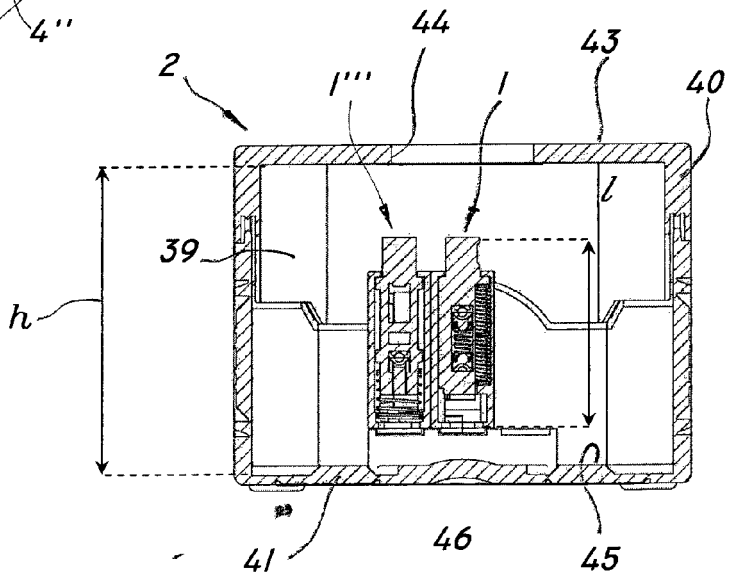

FIG. 8

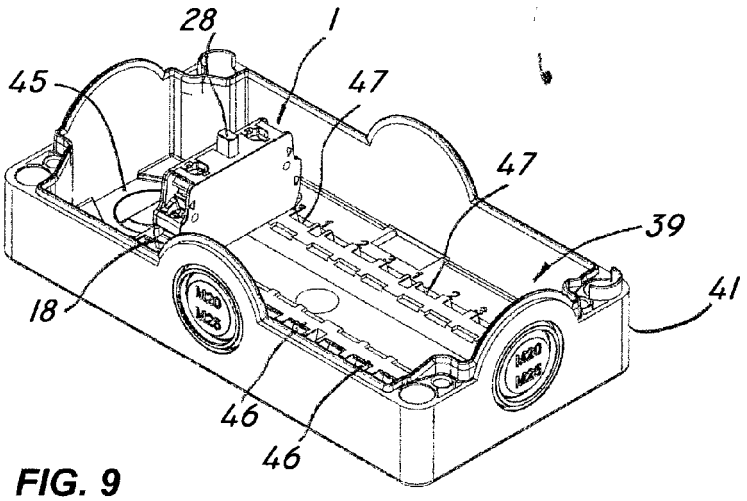

FIG. 9

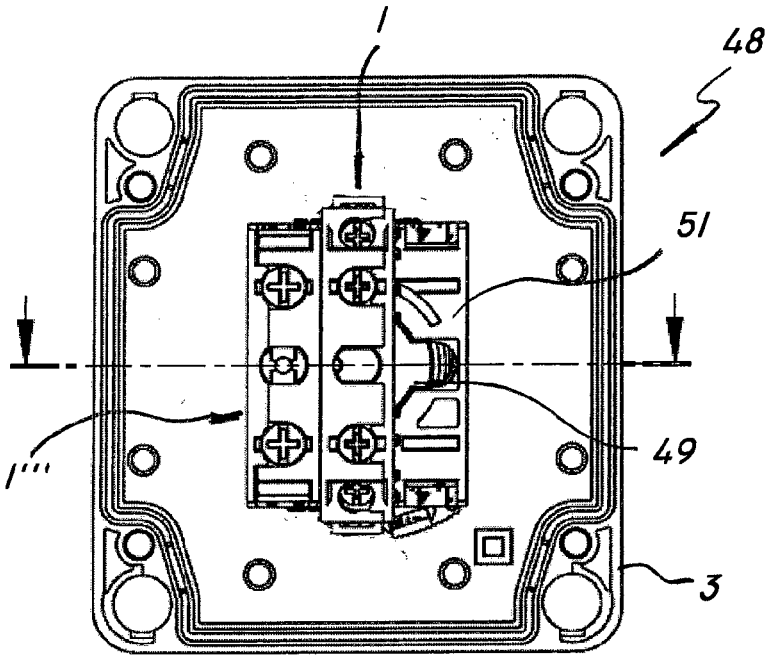

FIG. 10

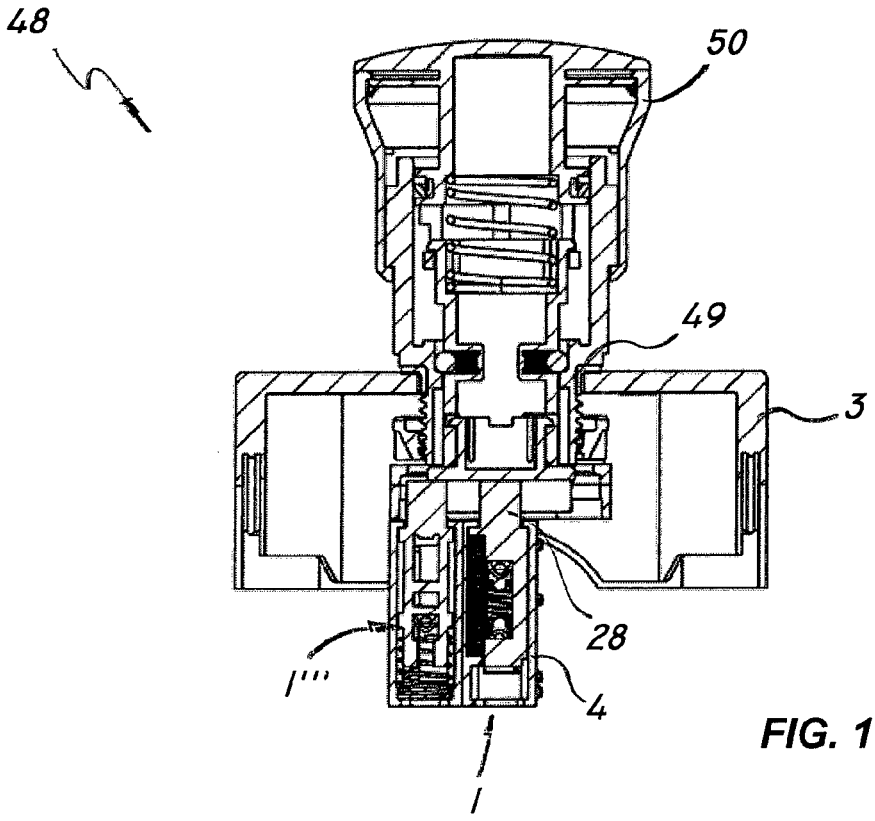

FIG. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 12 00 7819

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TECHNICAL FIELDS SEARCHED (IPC)

H01H
H02B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 March 2013	Simonini, Stefano

CATEGORY OF CITED DOCUMENTS

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