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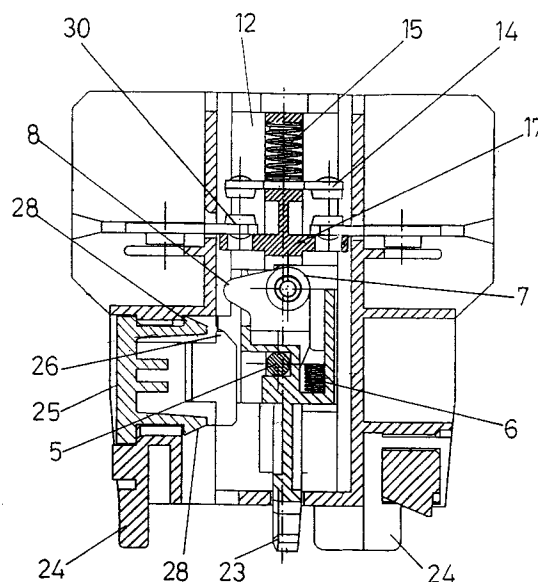
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(54) **Auxiliary contact device for connection to power factor correction contactors**

(57) An auxiliary contact device protects a power factor correction contactor from the high current peaks produced on connection of a capacitor battery. It has means of coupling and fastening (24) to the contactor and means of engagement (23) with the gear of the contactor (33). When the contactor is activated, the contacts (30, 14) of the device are closed. Then the contacts of the contactor are closed and the contacts (14, 30) are subsequently disconnected. The device has a frame (3) equipped with locking/unlocking means (4) and, independently, a slide (12) bearing moving contacts (14). It has means (8, 25, 26) for regulating the time it takes for disconnection of the contacts (14, 30), and means (15, 8, 25, 26) that increase the pressure of the moving contacts (14) on the fixed contacts (30), the longer the travel of the contactor. All of this makes possible the application of the device to the whole line of contactors for which it has been designed by means of a selector (25).



**FIG. 4**  
 A - A

## Description

**[0001]** This invention consists of an auxiliary contact device for connection to power factor correction contactors, in order to protect the contactor from the high current peaks occurring on its activation, for which purpose said activation first closes the contacts of the auxiliary contact device and then closes the contacts of the contactor, followed by disconnection of the auxiliary contact device after the contacts of the contactor are closed.

**[0002]** The invention is intended to make possible application thereof to a complete line of contactors, for which it has means of regulating the time that must elapse for disconnection to take place after closing of the contacts of the contactor.

**[0003]** In addition, the invention is intended to produce a greater pressure of the moving contacts on the fixed contacts, the greater the power of the contactor, a better passage of current being obtained.

**[0004]** The invention is fundamentally applicable to those contactors, activation of which connects a capacitor battery to an industrial installation, in order to correct the power factor.

**[0005]** In the state of the art, use is known of contactors for connecting a capacitor battery to an industrial installation, in order to correct the power factor.

**[0006]** Said contactors must be protected from the high current peaks that occur on connection of the contactor on the capacitor battery.

**[0007]** The need to protect the contactor is explained by the fact that the current peak produced on connection can reach up to 150 times the estimated current of use and a risk of soldering of the contacts of the contactor therefore exists.

**[0008]** In order to provide this protection, auxiliary contact devices are used, the moving contacts of which engage with the traction gear of the moving contacts of the contactor, the input and output phases of the contactor being connected to the input and output phases of the auxiliary contact device through resistors, so that when the contactor is activated, the contacts of the auxiliary contact device are closed first, the current peaks being limited by the resistors, and then the contacts of the contactor are closed.

**[0009]** To make possible the abovementioned engagement, the casing of the contactor and auxiliary contact device is equipped with means of coupling and fastening to each other.

**[0010]** While the contactor makes this connection, the contacts of the auxiliary device are also kept closed, and after cutoff or disconnection of the contactor, cutoff is carried out through the auxiliary contacts.

**[0011]** This type of contactor presents the following problems:

1. If the contacts of the contactor are fouled, they then offer additional resistance, so that, as the auxiliary contact device is also connected, the current

flows through it, the current circulating through the resistor, which causes the burning of same.

2. On disconnection of the contactor, the contactors of the auxiliary contact device remain joined, and the latter then disconnects, so that the current is cut off by the auxiliary contact device, which limits the electric lifetime of the auxiliary contact device, since it is not designed to cut off current. Furthermore, the fact that the auxiliary contact device cuts off current limits the power of use of the contactor, that is, the power admissible by the contactor depends on the cutoff capacity of the auxiliary contact device.

3. Consequently, the electric endurance of the contactor is determined by the electric endurance of the auxiliary contact device.

**[0012]** To avoid these problems, auxiliary contact devices were developed that disconnect after closing of the contacts of the contactor, so that the endurance and cutoff capacity directly depend on the contactor.

**[0013]** These auxiliary contact devices have the disadvantage that they disconnect after closing of the contacts of the contactor by means of slides with magnets, which present the problem of easy accumulation of dirt, so that they have to be overhauled more or less regularly, aside from the fact that shocks make them lose their properties, having to be replaced. In addition, they present difficulties at the time of assembly in the manufacturing process. Nor do they make it possible to regulate the time that must elapse for disconnection to take place after closing of the contacts of the contactor.

**[0014]** In both types of auxiliary contact devices, the contactors have a contact for discharge of the capacitors through discharge resistors, when the contactor is disconnected, so that the contacts are closed in successive operations on vacuum capacitors.

**[0015]** In order to solve the problems indicated above, the invention has developed a new auxiliary contact device in which, like the conventional ones, when the contactor is activated, in the first place, the contacts of said auxiliary contact device are closed, the current peaks being limited by the resistors, and then the contacts of the contactor are closed.

**[0016]** In addition, the auxiliary contact device has means for producing its disconnection after closing of the contacts of the contactor, so that, even if there is dirt on said contacts of the contactor, current does not circulate through the resistors, preventing the latter from burning, since current only circulates for a few milliseconds.

**[0017]** Furthermore, this fact means that the power of connection will not be limited by the auxiliary contactor device, but will be imparted by the contactor itself, which considerably increases the maximum power to be used and the electric lifetime, since the contactors are the components designed to withstand the power, and not the auxiliary contact devices.

**[0018]** In addition, the electric endurance is deter-

mined by the duration of the contacts of the contactor and not of the contacts of the auxiliary contact device.

**[0019]** The invention is characterized in that it has means for regulating the time it takes for the auxiliary contact device to be disconnected, after closing of the contacts of the contactor, in order to permit its application to the whole range of powers for which the contactors are designed.

**[0020]** In addition, the invention has means that increase the pressure of the moving contacts on the fixed contacts, the longer the time it takes for disconnection to be made, which makes possible a better passage of current, since the greater the power of the contactor, the longer the time it takes for disconnection to be made and, therefore, the greater the pressure exerted on the contacts.

**[0021]** The means for producing disconnection of the auxiliary contact device after closing of the contacts of the contactor are determined by a casing in which the fixed contacts of the device are included, as well as means of coupling and fastening to the contactor, and in which a center housing has been provided for positioning and guiding of a frame that includes the means of engagement to the traction gear of the contacts of the contactor.

**[0022]** The frame is endowed with means of locking/unlocking of a slide that includes the moving contact, which is also positioned and guided in the center housing of the frame, so that the fixed contacts are positioned on the path of the moving contacts provided in the casing.

**[0023]** The device of the invention has means of maintaining the slide in a position in which the moving contacts are separated from the fixed contacts, when the device is coupled to the contactor.

**[0024]** In addition, it also has means of maintaining the frame in an upper position that keeps it locked to the moving contact slide in the position in which the moving contacts are separated from the fixed contacts at a given distance, so that, on pulling of the contactor over the frame, the latter is moved together with the slide, connection of the fixed contacts being made with the moving contacts, to a position in which the slide is unlocked from the frame, the slide returning to its initial position, and the moving contacts being separated from the fixed contacts. In this situation, when the contactor stops pulling from the frame, the latter recovers its initial locked position with the slide, being ready for a new cycle.

**[0025]** The means of locking/unlocking of the frame are determined by a spring-assisted clamp that resists disassembly. The axis of rotation of the clamp is located in its lower zone, while in its upper zone it has a crosspiece on which a cylinder is located, which turns freely and in which a lower hook of the moving contact slide is retained.

**[0026]** In addition, the clamp is endowed with a lever-like extension on whose path a riblike projection has been provided, so that, on pressing the lever with the

projection, the angular displacement of the crosspiece and cylinder is produced, the hook of the moving contact slide being released. In this situation, when the contactor stops pulling on the frame, the latter regains its initial position, so that the lever stops pressing on the rib-like projection, the latter returning to its initial position until making contact with the hook of the slide, locking again taking place and the unit being ready for a new cycle.

**[0027]** These means described for disconnecting the auxiliary contact device after closing of the contacts of the contactor do not include magnets and have a simple and solid structure, which affords greater durability and low maintenance.

**[0028]** The means for regulating the time it takes to disconnect the auxiliary contact device after closing of the contacts of the contactor are determined by a selector, which is included in the casing and has parallel riblike projections situated at different heights, one of which constitutes the riblike projection already described, where it contacts the lever for tilting and unlocking, so that the time of disconnection or unlocking of the slide depends on the height at which the riblike projection situated on the frame-slide path is located.

**[0029]** The selected position of the selector for choosing the time of disconnection is fixed by means of a pin, which prevents the variation of its position and, therefore, its accidental or inadvertent disconnection. This chosen position depends on the size of the contactor.

**[0030]** In order to guide the slide in the center housing of the casing, the latter has fins running through longitudinal channels provided in said center housing.

**[0031]** In addition, the slide has a stop situated below the fixed contacts in order to limit the ascending travel of the slide.

**[0032]** The means of maintaining the slide in a position in which the moving contacts are separated from the fixed contacts are determined by a spring, fastened at the bottom of the center housing of the casing, and which runs through the frame in order to be housed in a cylindrical receptacle provided in the slide, so that when the slide descends, the spring is compressed, which, after unlocking takes place, forces the slide to rise to its initial position, until it makes contact with the stop provided in the casing.

**[0033]** The moving contact for discharge of the capacitors, described in the section on background of the invention, is characterized in that it is included in a recess forming part of the frame, which has an appendage projecting from the casing, the contact being retained in the recess by a spring that maintains pressure on the fixed contact during travel of the frame.

**[0034]** On the other hand, the means that increase the pressure of the moving contacts on the fixed contacts, the longer the time it takes for disconnection or unlocking, are determined by recesses provided in the slide, in which the spring-assisted moving contacts are located, which are compressed until unlocking takes place, exerting greater pressure, the longer the travel, in order

to achieve said unlocking of the frame-slide assembly.

**[0035]** Finally, it is to be indicated that the casing has a cover on top, fastened by means of interlocking tongues which, furthermore, make possible the removal of the cover, in order to access the center housing of the frame.

**[0036]** An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows an exploded view in perspective of the breakdown of the auxiliary contact device of the invention.

Figure 2 shows an elevation of the auxiliary contact device of the invention, in which all the parts mounted are found, except for the cover.

Figure 3 shows a plan view of the device of the foregoing figure.

Figure 4 shows a view along section A-A of Figure 2, in which the moving contacts are separated from the fixed contacts, which indicates that the contactor is idle.

Figure 5 shows a view equivalent to that of the foregoing figures, but with the moving contacts pressing on the fixed contacts, but before unlocking takes place.

Figure 6 shows a view equivalent to Figure 5, with the moving contacts pressing on the fixed contacts, before unlocking takes place, but with the lever slightly displaced.

Figure 7 shows the following step of operation of the foregoing figure, in which the lever is totally tilted and the slide is in its upper position.

Figure 8 shows a view along a partial section B-B of Figure 3.

Figure 9 shows a view along section C-C of Figure 2.

Figure 10 shows a view in perspective of the auxiliary contact device of the invention, on which all the components are mounted, except for the cover.

Figure 11 shows a partial view in perspective of the auxiliary contact device of the invention mounted on a contactor.

**[0037]** The auxiliary contact device of the invention is constituted from a casing 1 that is endowed with a center housing 2, in which a frame 3 is accommodated, which includes a clamp 4 at the bottom that is fastened by means of a pin determining the axis of revolution 5. In addition, the clamp 4 is assisted by a spring 6 and has a crosspiece at the top, on which is located a cylinder 7 that turns freely and a leverlike extension 8.

**[0038]** Furthermore, the frame 3 is endowed on the side with a pulsator 9, in which a recess has been provided for a moving contact 11 for discharge of capacitors, as will be subsequently explained, which is assisted by a spring 10.

**[0039]** In addition, in the center housing 2 and on the

frame 3, a slide 12 has been provided, which is endowed with recesses 13 accommodating moving contacts 14 assisted by a spring 15.

**[0040]** Furthermore, the slide 12 is endowed with fins 16 that are accommodated and guided in channels 19 provided in the center housing 2 of the casing 1.

**[0041]** The slide 12 is endowed with a hook 20 that is locked-unlocked in the cylinder 7 of the clamp 4 located in the frame 3, as will be subsequently explained.

**[0042]** The slide 12 is also endowed with a cylindrical receptacle 18 in which is inserted a spring 22 that runs through a hole machined in the frame 3 and is retained on a pin 34 provided at the bottom of the casing 1.

**[0043]** Fixed contacts 30 constituting the auxiliary contact together with the moving contacts 14 are retained and fastened in the casing 1.

**[0044]** The casing 1 also houses a fixed contact 31 that is complemented by the moving contact 11 for discharge of the capacitors.

**[0045]** In addition, the casing is endowed with a lateral housing 29 accommodating a selector 25 that is endowed with claws 28 for retention in the lateral housing 29 and further including riblike projections 26, the fundamental characteristic of which is that each of said riblike projections 26 has different lengths determining different heights of the ribs, one of which must be located on the path to be traveled by the lever 8, so that, by means of the selector 25, it is possible to select which of the ribs 26 is the one situated on the path of the lever 8, as will be subsequently explained.

**[0046]** To fix the position of the selector 25, a pin 27 has been provided, which fixes one of the positions A, B or C of the selector 25, whose position depends on the contactor to which the selector is applied (the fact that one of the three ribs 26 is located on the path of the lever 8 being selected).

**[0047]** In order to fix it by means of the pin 27, the lateral housing 29 is endowed with semicircular recesses 35 in which the pin 27 is retained, after selecting the proper position of the selector 25.

**[0048]** The casing 1 is closed at the top by means of a cover 21, for which it is endowed with tongues 32 that partially conceal the fixed contacts 30, so as to make possible the connection of the resistors.

**[0049]** Interlocking of the cover 21 on the casing 1 is carried out by means of small claws 36 provided on the end tongues housed in grooves 37 provided in the side walls of the casing 1.

**[0050]** Furthermore, it is to be pointed out that the slide 12 has two stops 17 situated below the fixed contacts 30 of the casing, so as to limit the ascending travel of the slide 12, as will be subsequently explained.

**[0051]** As was already explained in the specification of the invention, the auxiliary contact device of the invention is mounted on a contactor 33 and, through resistors, protects the contactor from the high current peaks produced on closing the contactor, the activation of which connects an industrial installation with a capac-

itor battery in order to correct the power factor, the auxiliary contact device having means of coupling and fastening to the contactor, means which, in the working example, are determined by tongues 24 provided in the casing 1. It also has means of engagement of the moving contacts 14 to the traction gear of the moving contacts of the connector 33, means determined by a coupling 23 provided on the frame 3.

**[0052]** The fixed contacts 30 are connected to the fixed contacts of the contactor 33 through resistors, not represented on the figures, in order to provide the protection previously discussed, for which, in idle state of the contactor and, therefore, of the contactor of the auxiliary contacts, the slide 12 is joined to the frame 3, a situation in which the hook 20 is retained in the cylinder 7 of the clamp 4, and the slide-frame assembly is in an upper position produced by the action of the spring 22, which position is defined by the stop 17 of the slide, when the latter makes contact with the fixed contacts 30 of the casing 1 and, more concretely, with the fixed contacts 30 located in the center.

**[0053]** When the contactor 33 is activated, it pulls on the coupling 23, so as to produce the descending displacement of the frame 3 and, therefore, of the slide 12 on being locked, as was explained.

**[0054]** In the descending movement, the moving contacts 14 make contact with the fixed contacts 30, from which point the springs 15 are compressed, so that the pressure of the moving contacts 14 is exerted on the fixed contacts 30. This pressure increases as the frame-slide assembly descends.

**[0055]** Furthermore, in the descending travel the spring 22 is compressed.

**[0056]** In the descending movement, a moment arrives in which the lever 8 makes contact with one of the riblike projections 26, previously positioned by means of activation of the selector 25, at which point the angular displacement of the clamp 4 is produced on its pin 5, thereby releasing the cylinder 7 from the hook 20 of the slide 12 and expanding the spring 22, pushing the slide to its top position, determined by the stops 17 on making contact with the center fixed contacts 30, the moving contacts 14 being separated from the fixed contacts 30, thereby disconnecting the auxiliary contact device.

**[0057]** Before this disconnection takes place, the fixed and moving contacts of the contactor 33 are joined, a connection which, as already explained in the specification of the invention, is made after connection of the moving contacts 14 with the fixed contacts 30 of the auxiliary contact device, so that the contactor 33 is protected from the high current peaks produced on starting and, on the other hand, once the auxiliary contact device is started, it is disconnected.

**[0058]** It is to be added to the foregoing explanation that the moving contact 11, as represented in Figure 7, is normally open and can be normally closed.

**[0059]** The selection of the position of the selector 25, in order to select which of the riblike projections 26 will

be positioned on the path of the lever 8, depends on the size and, therefore, on the power of the contactor to which the device of the invention is applied.

**[0060]** Thus, the greater the size of the contactor, the longer the travel, so that the rib 26 selected is the lowest one. In this case, the springs 15 exert a greater pressure of the moving contacts 14 on the fixed contacts 30, determining means that increase the pressure of the connection, the longer the time it takes for disconnection, which facilitates a better conduction of the current peaks generated on the connection.

**[0061]** Once disconnection of the contactor takes place, the latter stops pulling on the coupling 23 and produces the ascending movement of the frame 3 until the hook 20 is again locked on the cylinder 7, the unit again being ready for a new cycle.

**[0062]** Therefore, on the basis of the specification given, it is easily understandable that the selector 25 constitutes a means that regulates the time it takes to disconnect the auxiliary contact device after closing of the contacts of the contactor, in order to make possible their application to the whole range of powers for which the contactors 33 are designed, time further regulated by the pressure that must be exerted between the contacts, depending on the power of the contactor for achieving better conduction of the current peaks.

## Claims

1. Auxiliary contact device for connection to a power factor correction contactor, which protects the contactor (33) from the high current peaks produced on activation of the contactor, thereby connecting a capacitor battery to an industrial installation in order to correct the power factor, the auxiliary contact device having means of coupling and fastening (24) to the contactor (33) and means of engagement (23) of the moving contacts (14) to the traction gear of the moving contacts of the contactor, the input and output phases of the contactor being connected to the input and output phases of the auxiliary contact device through resistors, so that when the contactor is activated, the contacts of the auxiliary contact device are closed first, the current peaks being limited by the resistors, and then the contacts of the contactor are closed; and having means for producing disconnection of the auxiliary contact device, after closing of the contacts of the contact, and also having a contact for discharge of the capacitors through resistors when the contactor is disconnected, so that in successive operations the contacts are closed on the vacuum capacitors, the device comprising:

means for regulating the time it takes for the auxiliary contact device to be disconnected, after closing of the contacts of the contactor; and

means that increase the pressure of the moving contacts on the fixed contacts, the longer the time it takes for disconnection to be made, in order to make possible its application to the whole range of powers for which the contactors (33) are designed.

2. Auxiliary contact device according to Claim 1, wherein the means for producing disconnection of the auxiliary contact device after closing of the contacts of the contactor are determined by a casing (1) in which the fixed contacts (30) of the device are included, as well as means of coupling and fastening (24) to the contactor (33), and in which a center housing (2) has been provided for positioning and guiding of a frame (3) that includes the means of engagement (23) to the traction gear of the contacts of the contactor; and it has means of locking/unlocking of a slide (12) that includes the moving contacts of the contactor and is positioned and guided in the center housing (2) of the frame (1), so that the fixed contacts (30) are situated on the path of the moving contacts (14); and having means of maintaining the slide (12) in a position in which the moving contacts (14) are separated from the fixed contacts (30); and means of maintaining the frame (3) in an upper position that keeps it locked to the slide (12) in the position in which the moving contacts (14) are separated from the fixed contacts (30), so that, on pulling of the contactor over the frame (3), the latter is displaced together with the slide (12), connection of the moving contacts (14) being made with the fixed contacts (30), to a position in which the slide (12) is unlocked from the frame (3), the slide (12) returning to its initial position, and the moving contacts being separated from the fixed contacts; and when the contactor stops pulling on the frame (3), the latter returns to its initial locked position with the slide, being ready for a new cycle.

3. Auxiliary contact device according to Claim 2, wherein the means of locking/unlocking are determined by a clamp (4), assisted by a spring (6) that resists disassembly, the axis of rotation (5) of which is located in its lower zone, having on top a cross-piece on which a cylinder (7) is located, which turns freely and in which a lower hook (20) of the slide (12) is retained; further having the clamp (4) with a leverlike extension (8) on whose path the casing (1) has a riblike projection (26), so that, on pressing the lever (8) with the projection (26), angular displacement of the clamp (4) is produced, the hook (20) being released from the slide (12); and so that when the lever (8) stops pressing on a projection (26), the clamp (4) returns to its initial position until making contact with the hook (20) of the slide (12), locking taking place.

4. Auxiliary contact device according to claim 3, wherein the means for regulating the time it takes to disconnect the auxiliary contact device after closing of the contacts of the contactor are determined by a selector (25), which is included in the casing (1) and has riblike projections (26) situated at different heights according to size of the contactor, one of which constitutes the means where it presses the lever (8) to produce unlocking, so that the time of disconnection or unlocking of the slide (12) depends on the height at which the riblike projection (26) is located, being situated on the path of the frame-slide assembly by means of the selector (25).

5. Auxiliary contact device according to Claim 4, wherein the selected position of the selector (25) for choosing the disconnection time is fixed by means of a pin (27) that prevents displacement of the selector (25).

6. Auxiliary contact device according to Claim 2, wherein the slide in the casing (1) is guided through channels (19) provided in the center housing (2), in which fins (16) of the slide (12) are accommodated.

7. Auxiliary contact device according to claim 2, wherein the means of keeping the slide in a position in which the moving contacts (14) are separated from the fixed contacts (30) are determined by a spring (22) fastened at the bottom of the center housing of the casing and running through the frame in order to be accommodated in a cylindrical receptacle (18) provided in the slide (12).

8. Auxiliary contact device according to Claim 2, wherein the means that increase the pressure of the moving contacts on the fixed contacts, the longer the time it takes for disconnection to be made, are determined by recesses (13) provided in the slide (12), in which the moving contacts (14) are positioned, assisted by springs (15) that are compressed, until unlocking takes place, exerting greater pressure the longer the unlocking path of the frame-slide assembly.

9. Auxiliary contact device according to Claim 1, wherein the moving contact (11) for discharge of the capacitors is included in a recess provided in a pulsator (9) that forms parts of the frame and projects from the casing, the contact being retained in the recess by a spring (10) that maintains pressure on the fixed contact (31) during the travel of the frame.

10. Auxiliary contact device according to Claim 2, wherein the means of maintaining the frame (3) in an upper position are determined by the contactor (33).

11. Auxiliary contact device according to the claim 2, wherein the casing (1) has a cover (21) on top, which is endowed with tongues (32) that partially conceal the fixed contacts (30, 31).

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12. Auxiliary contact device according to claim 2, wherein the slide (12) has two stops (17) situated below the fixed contacts (30) of the casing, which limit the ascending travel of the slide (12) and, therefore, the ascending travel of the frame (3).

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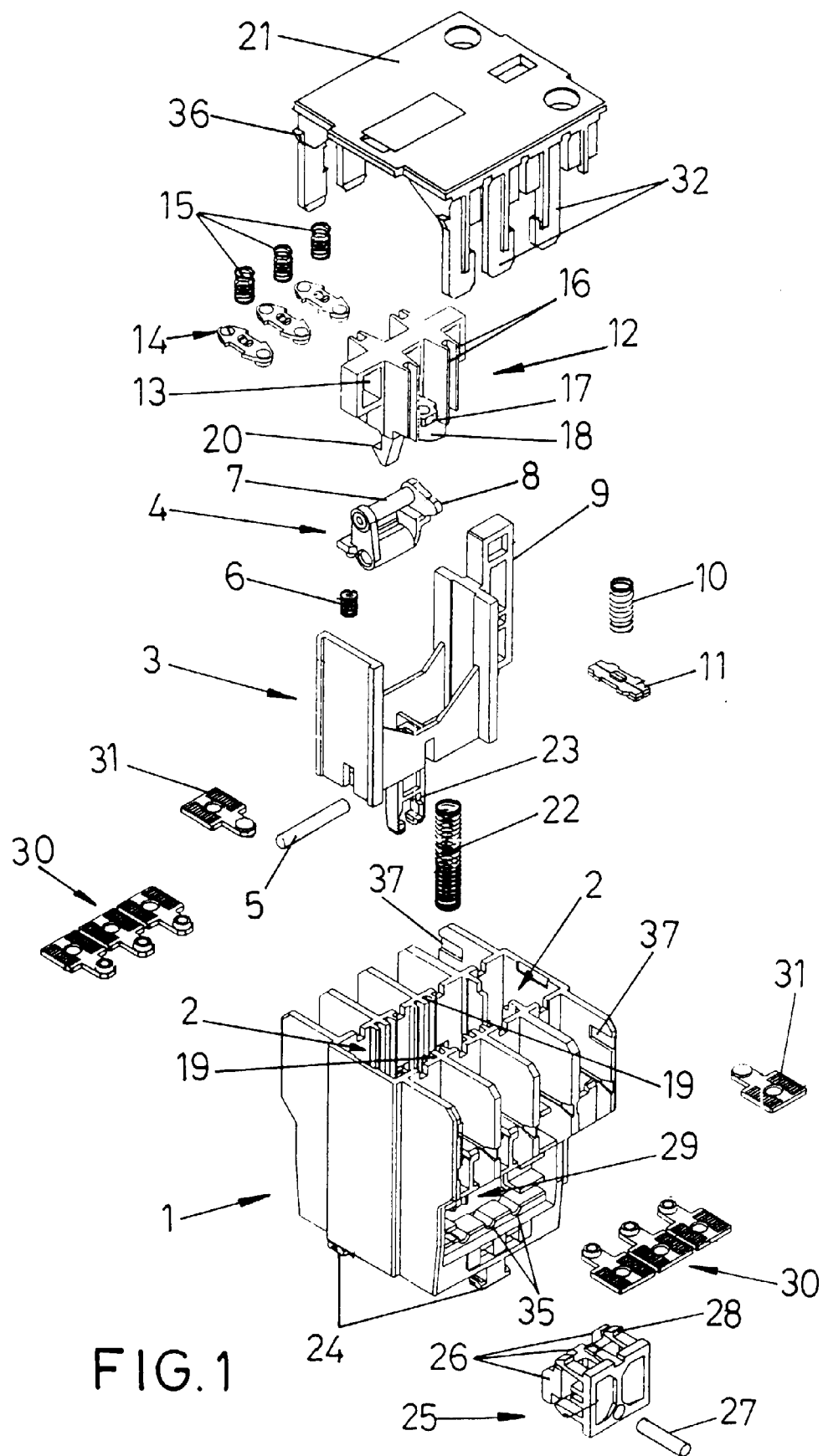
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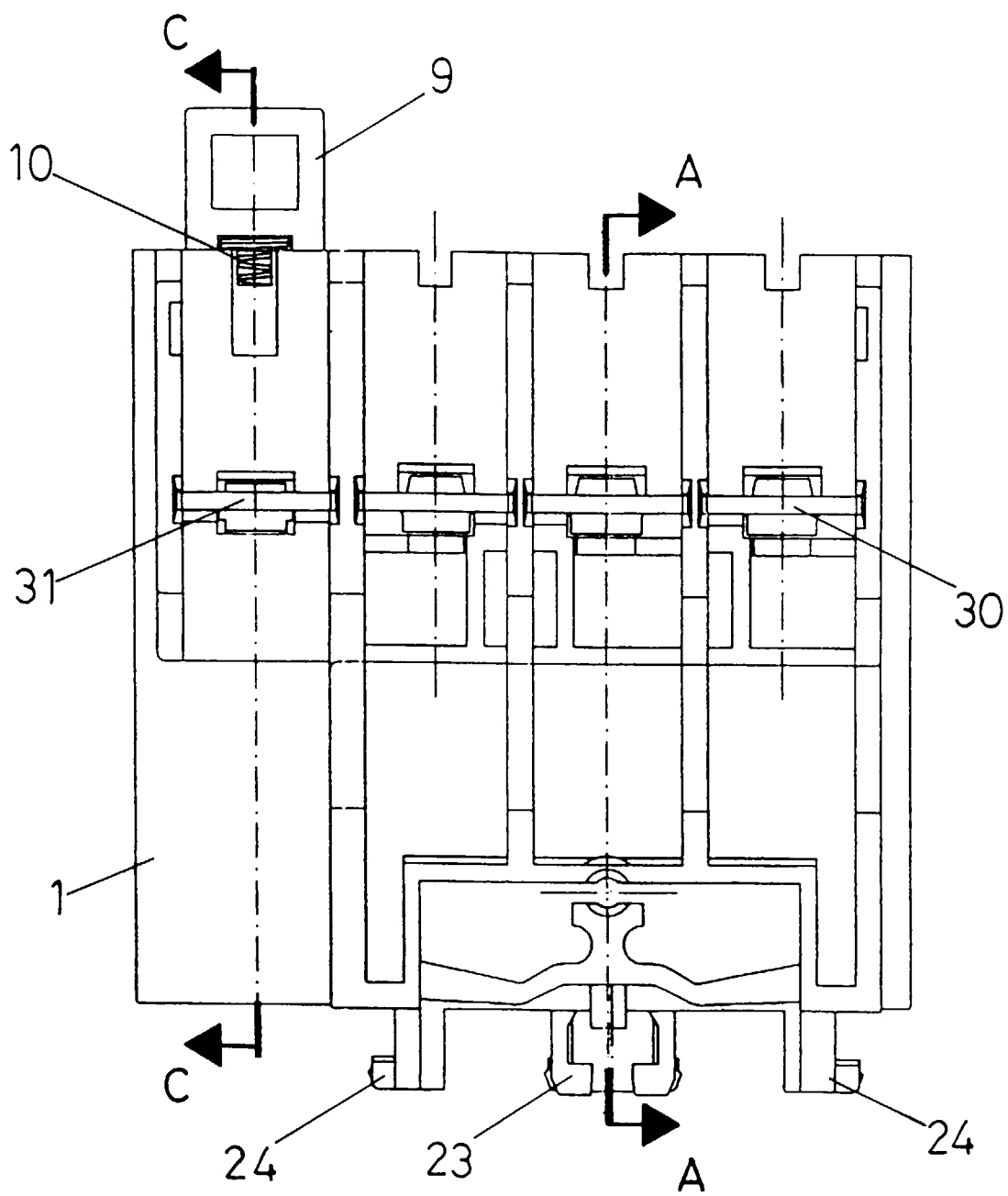


FIG. 2

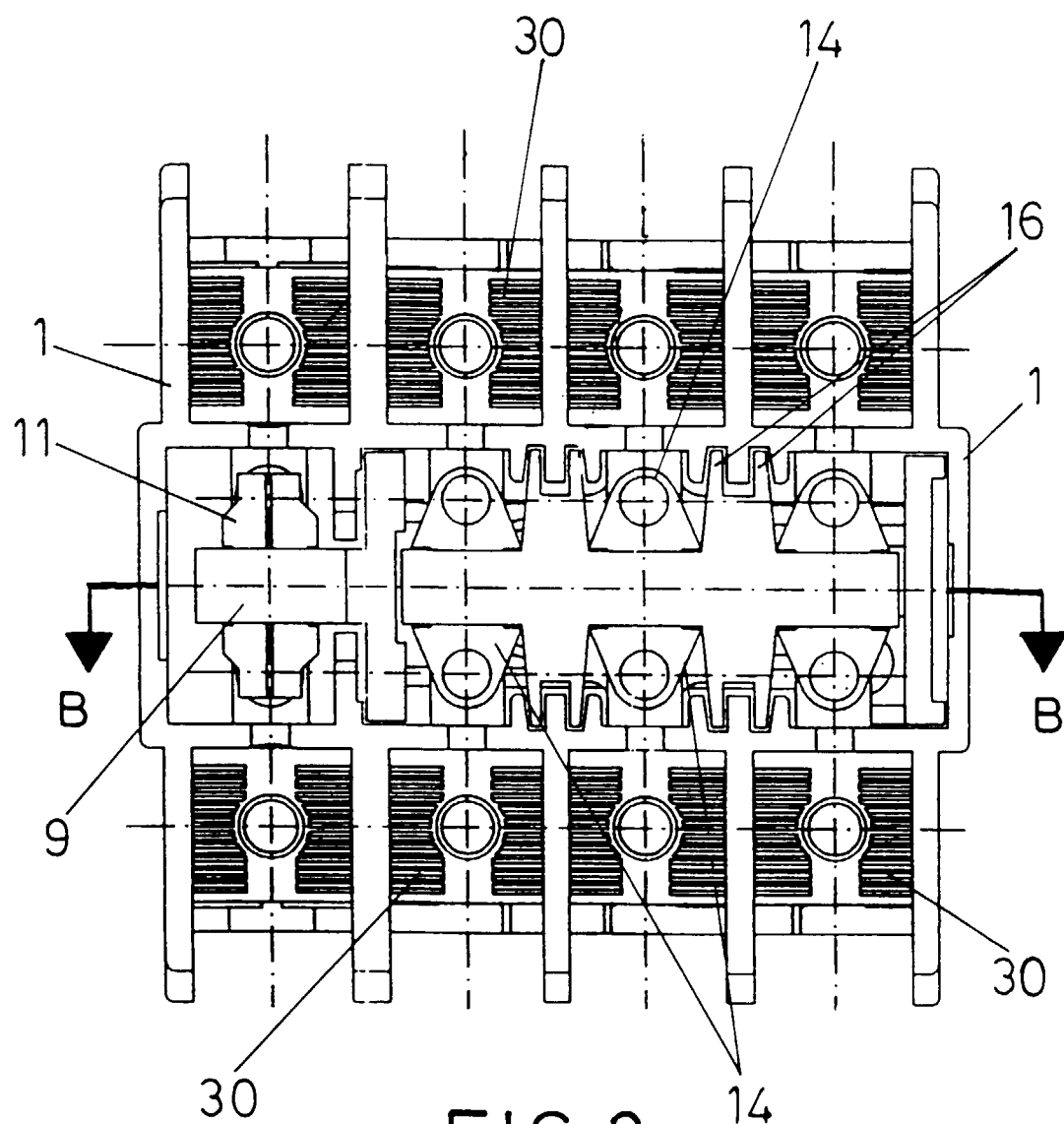


FIG. 3

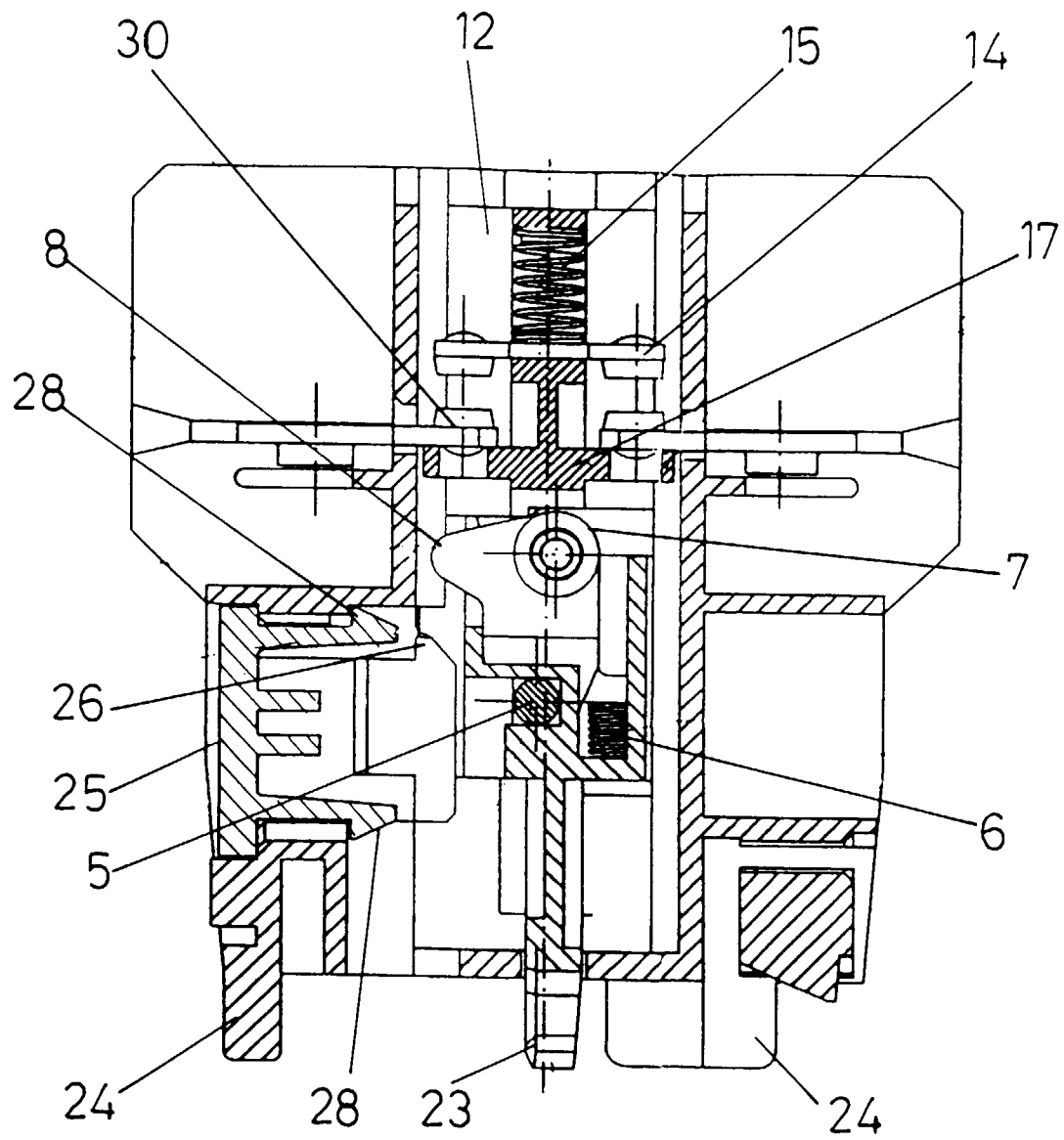


FIG. 4

A - A

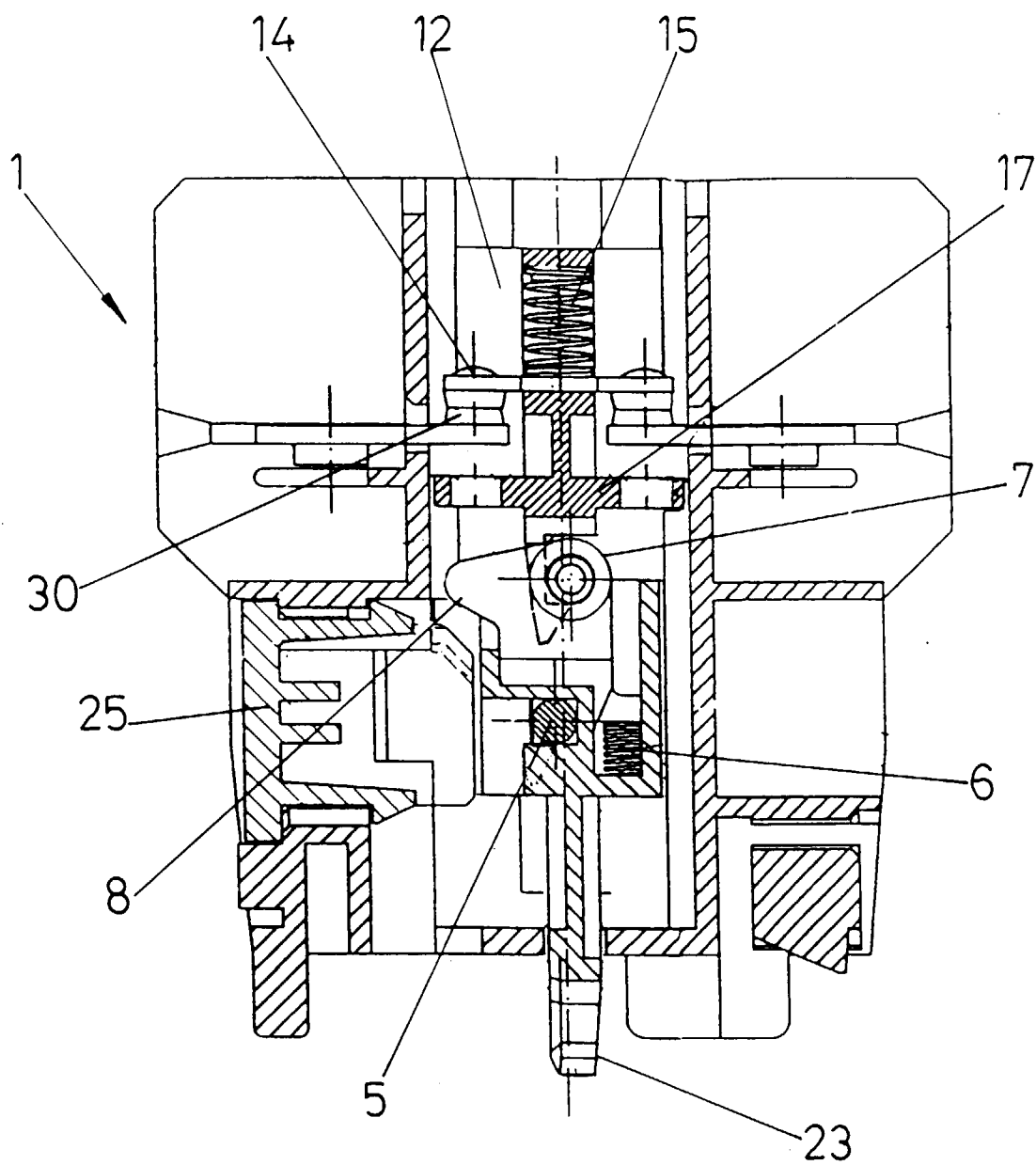


FIG. 5

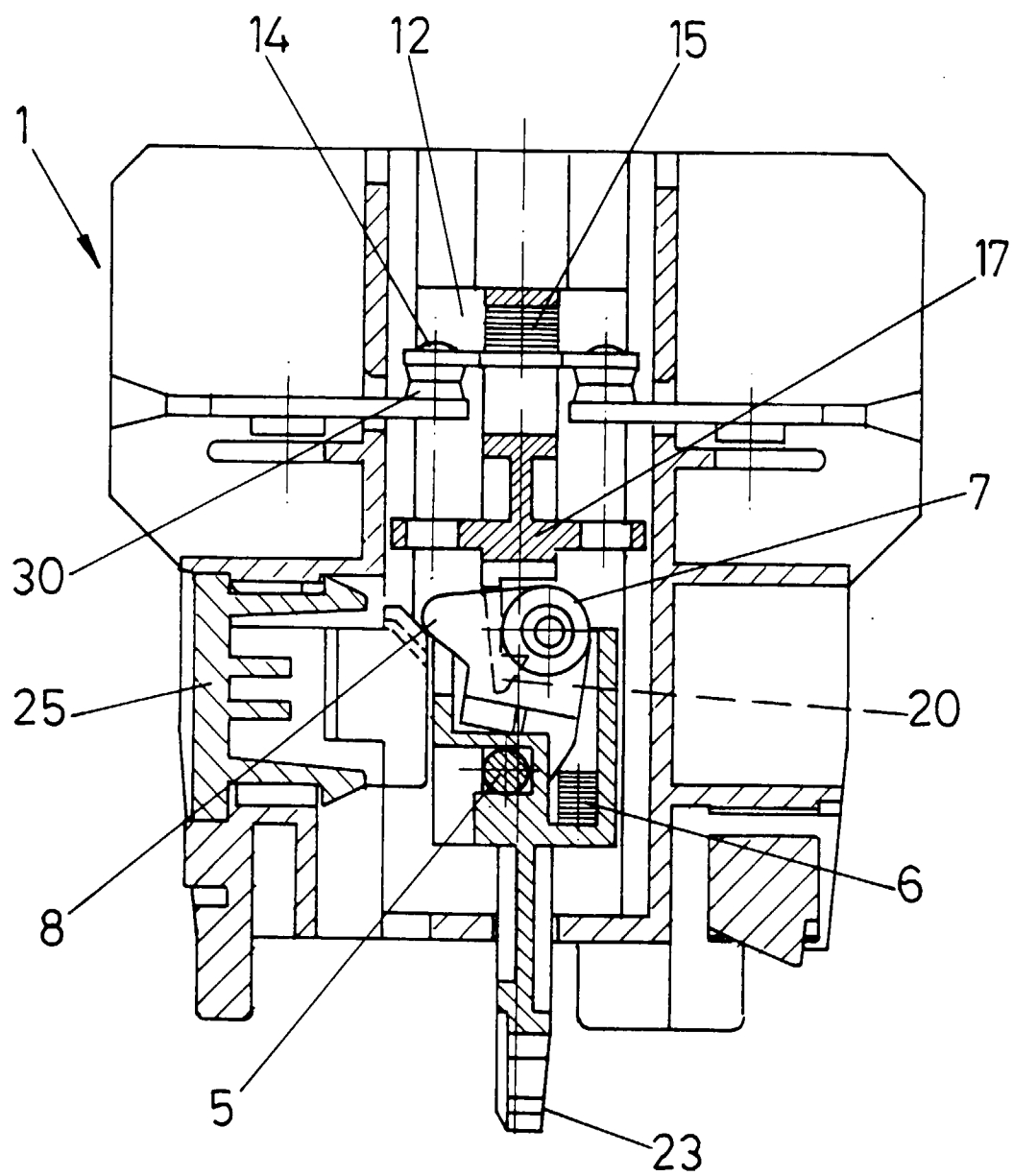
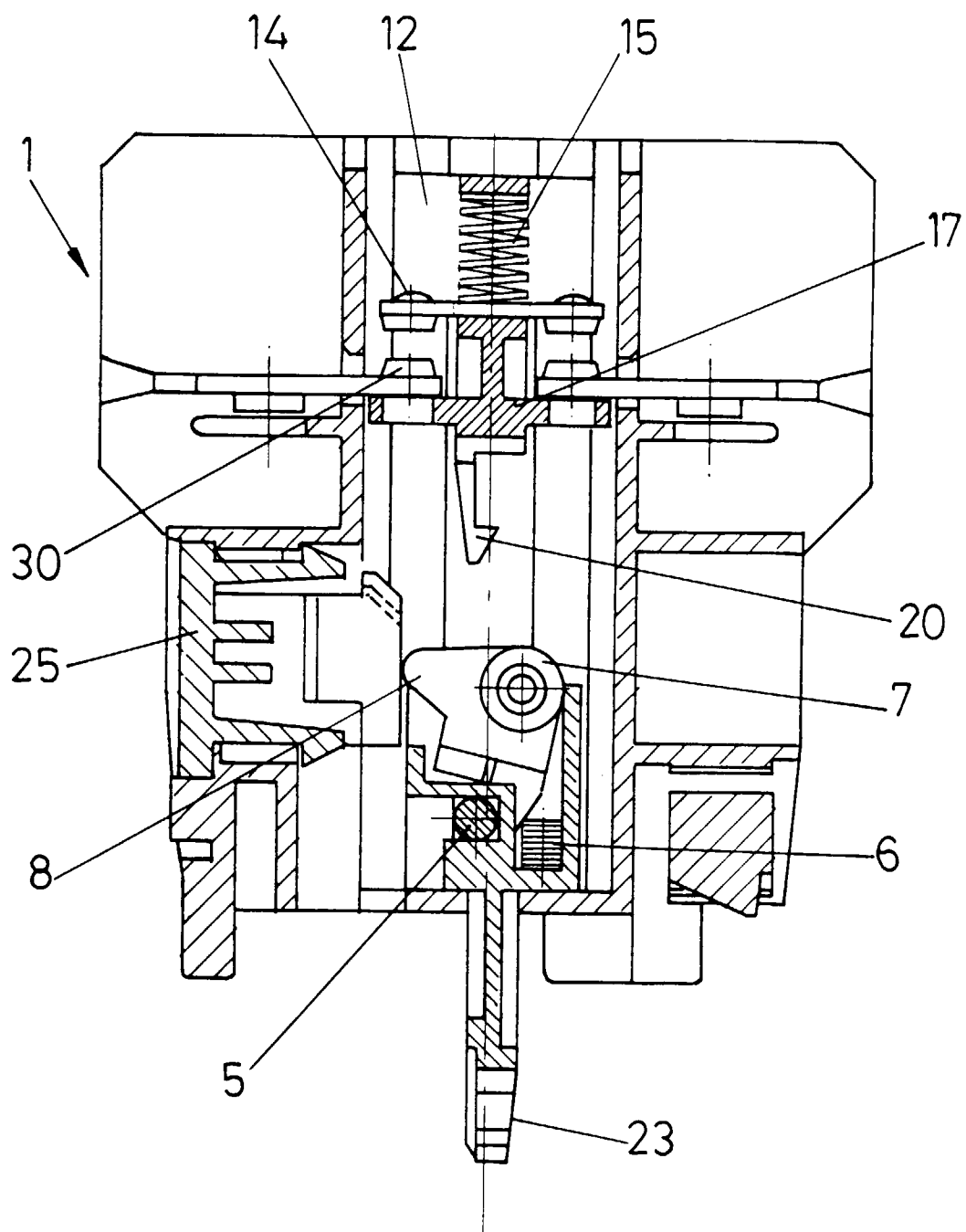


FIG. 6



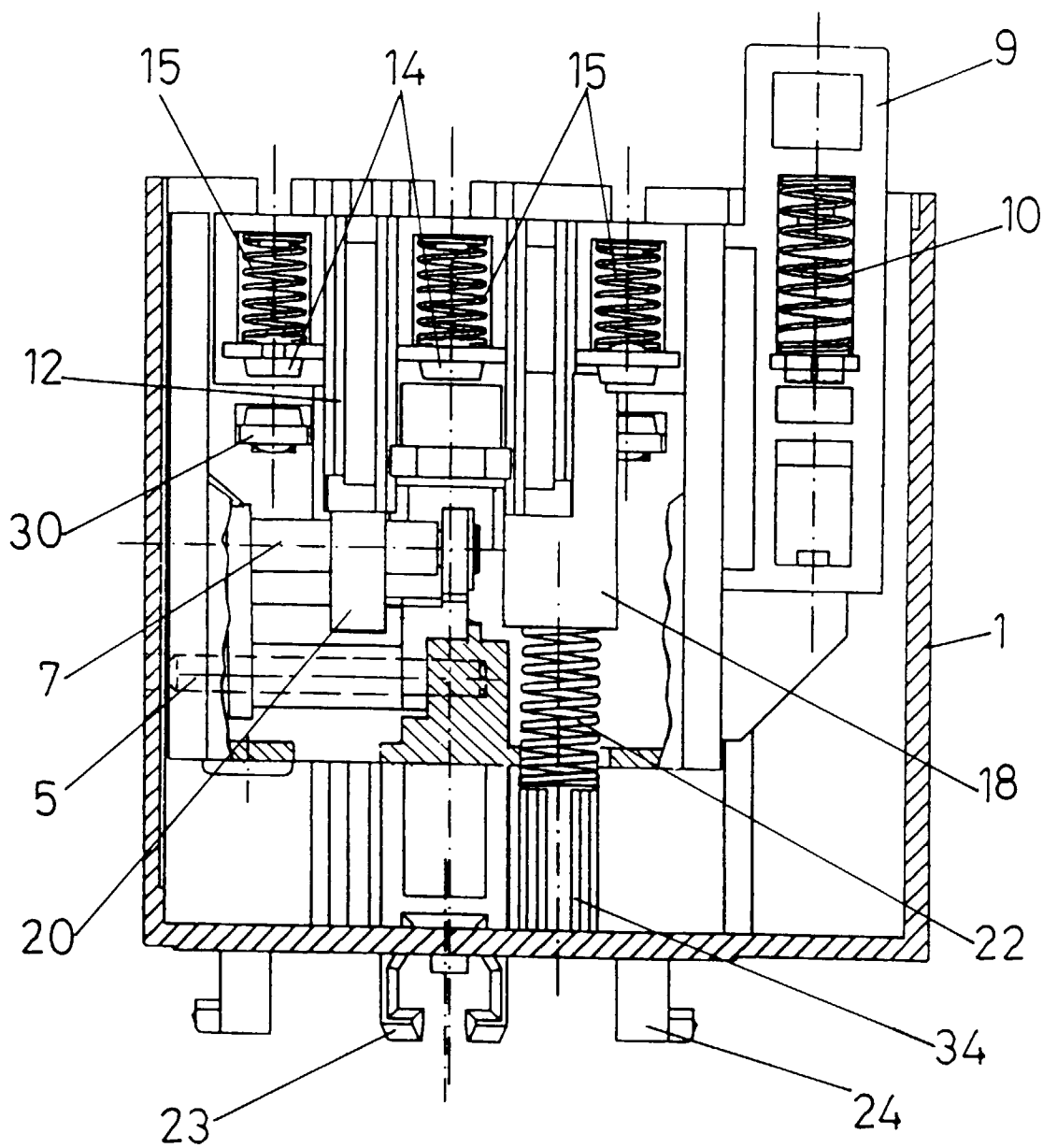


FIG. 8

B - B

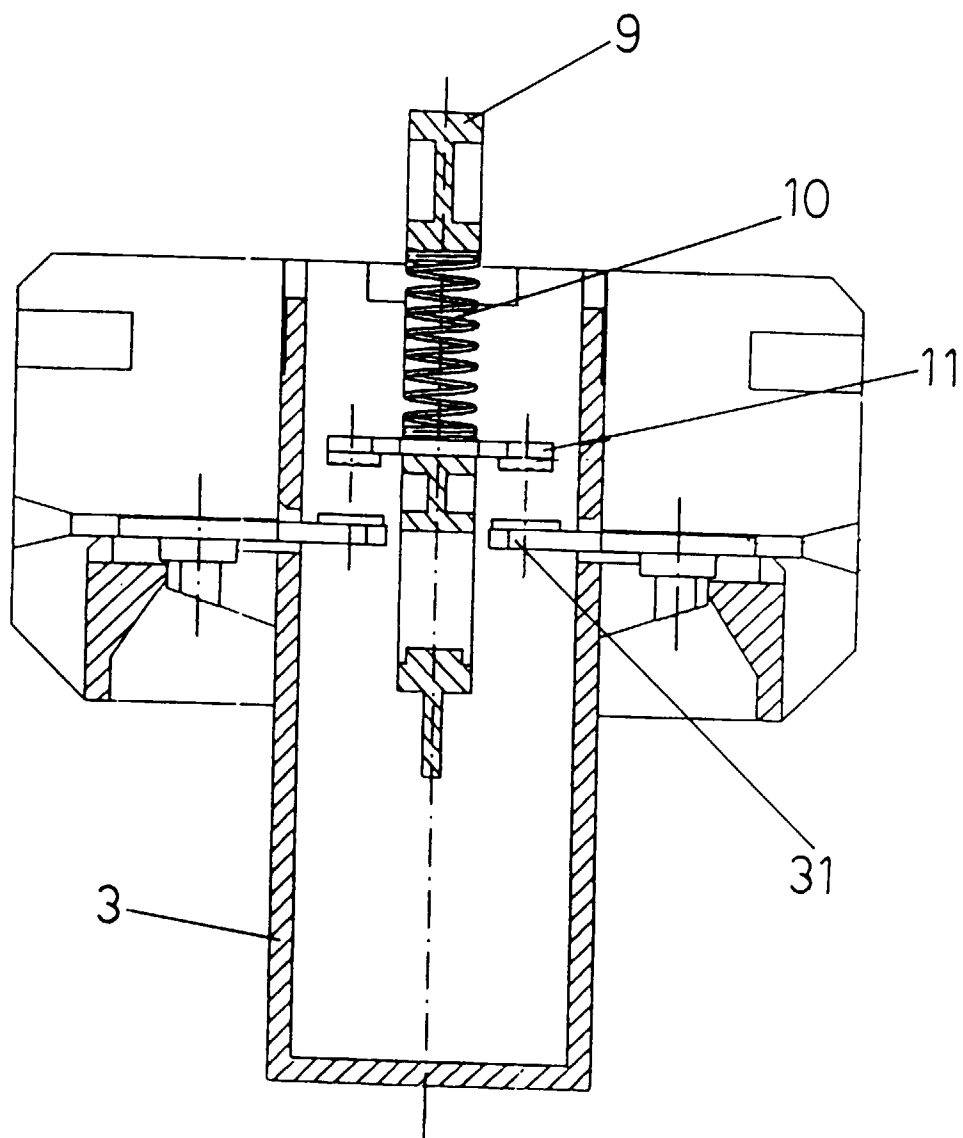


FIG. 9  
C - C



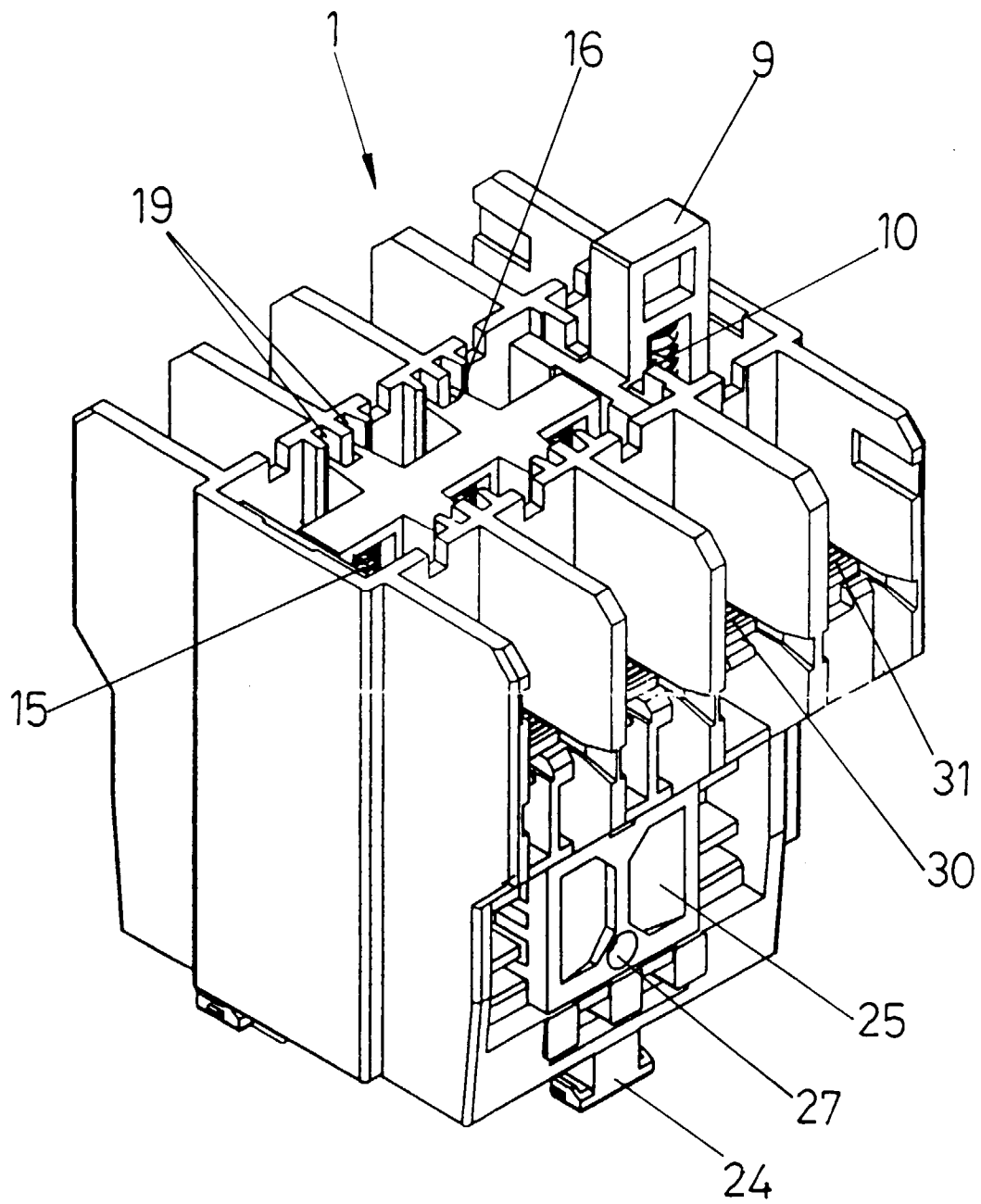


FIG. 10

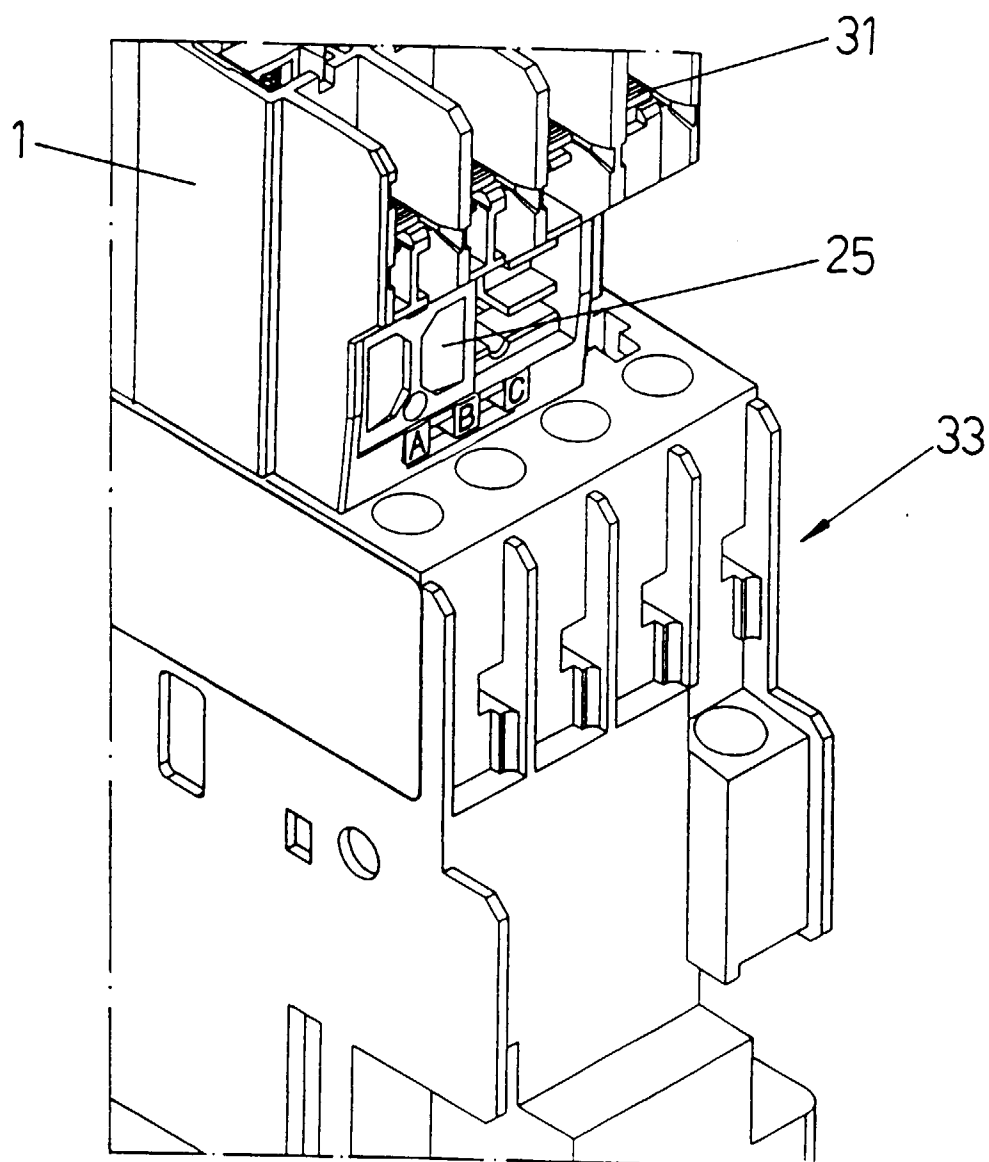


FIG. 11