(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 220 258 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.07.2002 Bulletin 2002/27

(51) Int Cl.[7]: **H01H 71/12**, H01H 73/08

(21) Application number: **01204645.4**

(22) Date of filing: **29.11.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **28.12.2000 IT MI202852**

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(54) Accessory device for a low-voltage circuit breaker

(57) An accessory device for locking the resetting mechanism of a circuit breaker of the draw-out or removable type, characterized in that it comprises:

- an insulating enclosure;
- an actuating lever which protrudes, at least partially, outside said insulating enclosure;
- a kinematic chain which is accommodated inside said insulating enclosure and is operatively coupled to said actuating lever; and
- a lever for coupling to said resetting mechanism, said coupling lever being operatively coupled to said kinematic chain and protruding at least partially outside said insulating enclosure.

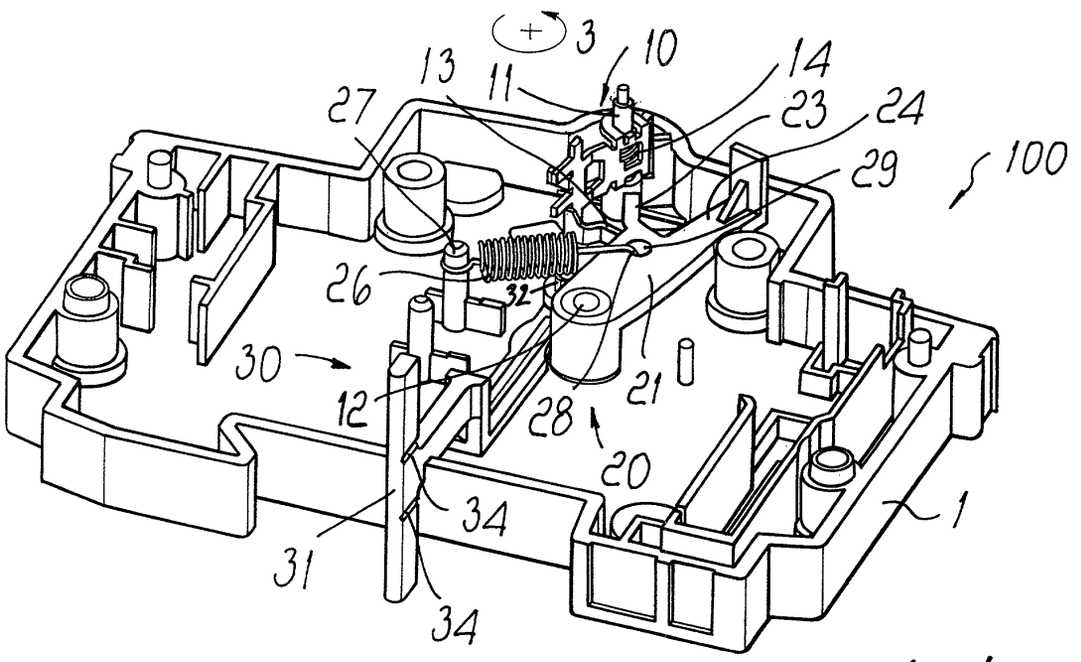

Fig.1

EP 1 220 258 A2

Description

[0001] The present invention relates to an accessory device for a low-voltage circuit breaker of the draw-out or removable type; more specifically, the expression "low-voltage circuit breaker" is to be understood as referencing a circuit breaker for applications with operating voltages of up to approximately 1000 volts.

[0002] It is known in the art that electric power supply circuits, both for home applications and for industrial applications, normally use circuit breakers that are conceived so as to provide performance features that are required in order to ensure the correct operation of the electric circuit in which they are inserted and protect the various users connected thereto against failures or malfunctions that can occur during the normal operating cycle.

[0003] These circuit breakers, together with other units possibly associated therewith, such as for example accessory devices used to provide the circuit breaker with additional functions that are auxiliary with respect to the basic ones that are generally performed, are normally used by mounting them on supporting elements, for example DIN guides, and optionally arranging them in appropriate electrical panels or control units.

[0004] Currently, circuit breakers are provided according to various constructive types: among these, one type used in the art is the so-called "draw-out or removable" type. In this embodiment, the circuit breaker is provided in two parts: a fixed base part, which is arranged on the supporting element and is provided with terminals for input and output connection to the electric circuit in which the circuit breaker is inserted, and a movable part, which comprises the main contacts of the circuit breaker, contact actuation means, and an actuation lever for resetting the circuit breaker. Furthermore, the two parts are provided with appropriate contact means that allow to electrically and detachably connect the movable part to the fixed part.

[0005] The solution of a draw-out or removable circuit breaker offers the great advantage of facilitating operations for replacing the movable parts of the circuit breaker or for inspecting them, for example for maintenance; in such cases, by way of the presence of the contact means, it is in fact sufficient to manually extract the movable part from the fixed part, without acting on the electrical cables connected to the terminals, and therefore with simple and quick interventions. For safety reasons, the separation or coupling of the two parts necessarily requires prior intervention on the circuit breaker, so as to disengage the main contacts and interrupt the flow of current; in some applications, this requirement can entail deactivating the set of units arranged on the same supporting element as the circuit breaker. Currently, if an operator intervenes carelessly on the circuit breaker without having first disengaged the main contacts, there is no system capable of ensuring in any case the interruption of the flow of current in the circuit breaker, both during coupling and during separation of the two parts; accordingly, these interventions can occur in non-optimal safety conditions, since it is possible to make electrical contact with exposed live parts, mainly with the contact means.

[0006] The aim of the present invention is to provide an accessory device for a low-voltage circuit breaker, of the removable or draw-out type, that allows to ensure that the interventions for separating or coupling the movable part with respect to the fixed part occur in optimum safety conditions even if an operator intervenes without first disarming the circuit breaker.

[0007] This aim is achieved by an accessory device for locking the resetting mechanism of a circuit breaker of the draw-out or removable type, characterized in that it comprises:

- an insulating enclosure;
- an actuating lever which protrudes, at least partially, outside said insulating enclosure;
- a kinematic chain which is accommodated inside said insulating enclosure and is operatively coupled to said actuating lever; and
- a lever for coupling to said resetting mechanism, said coupling lever being operatively coupled to said kinematic chain and protruding at least partially outside said insulating enclosure.

[0008] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the accessory device according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the accessory device according to the invention in a position in which the associated circuit breaker can be reset;
Figure 2 is a perspective view of the accessory device according to the invention in a position in which the associated circuit breaker cannot be reset;
Figure 3 is a plan view showing a preferred embodiment of the accessory device according to the invention in a position in which the associated circuit breaker can be reset;
Figure 4 illustrates the accessory device of Figure 3 in a position in which the associated circuit breaker cannot be reset; and
Figure 5 is a perspective view of the accessory device according to the invention, coupled to the movable part of a circuit breaker of the draw-out or removable type and during coupling to the fixing base.

[0009] With reference to the figures, the accessory device according to the invention, generally designated by the reference numeral 100, comprises an enclosure 1 that is meant to be connected to the enclosure of a low-voltage circuit breaker of the draw-out or removable

type associable therewith, in the manner and for the purposes that will become apparent in detail hereinafter.

[0010] In particular, as shown in Figure 5, said circuit breakers of the draw-out or removable type comprise a first part or base 50 and a second movable part 60, which can be mutually electrically coupled/separated. The base 50 has a shaped insulated body 51, which is suitable to be arranged in a fixed position on a supporting element, not shown, for example a DIN-type guide, and is provided with first contact means 52 and with terminals 53 for connection to a power supply circuit; said contact means 52 are advantageously accommodated within the insulating body 51, and except for the opening required to facilitate electrical coupling to the movable part 60, they are surrounded by insulating material.

[0011] In turn, the second part 60 comprises an enclosure 61 that contains, according to solutions that are widely known in the art and therefore are not illustrated in detail, at least one fixed contact and one movable contact that can be mutually coupled/uncoupled, and a mechanism for resetting the circuit breaker itself; in particular, the resetting mechanism comprises actuation means for actuating the movable contact and a resetting lever 62 which protrudes outside the enclosure 61 and is operatively coupled to the actuation means so as to allow manual resetting of the circuit breaker. Furthermore, the base 60 comprises second contact means 63 which protrude outside the enclosure 61 and are suitable to be electrically coupled, in a separable manner, to the first contact means 52.

[0012] In the embodiments of the accessory device according to the invention, the insulating enclosure 1, which is suitable for connection to the enclosure 61 of the movable part 60 as shown in Figure 5, is realized by means of two mutually coupled half-shells and has a base wall, a top wall, a rear wall, two side walls, and a front wall.

[0013] As illustrated in Figures 1-4, the device according to the invention, advantageously comprises: an actuating lever 30 which protrudes at least partially outside the insulating enclosure 1, preferably from the rear wall; a kinematic chain, generally designated by the reference numeral 20, which is accommodated inside said insulating enclosure 1 and is operatively coupled to the actuating lever 30; and a lever 10 for coupling to the resetting mechanism of the circuit breaker, which is operatively coupled to the kinematic chain 20 and protrudes at least partially outside the insulating enclosure 1 from one of the two side walls.

[0014] In particular, as shown in Figures 1-4, the coupling lever 10 has a contoured body which is pivoted, at one end, to a pivot 11 of the enclosure 1, and has a first end portion 13 that is suitable to interact operatively with the kinematic chain 20 and at least a portion, for example a pivot (not visible in the Figures), that protrudes transversely outside the enclosure 1, which is suitable for operatively coupling to the resetting mechanism positioned inside the movable part 60 and applying a locking action on it. A spring 14 is operatively associated with the coupling lever 10 and is also positioned on the pivot 11.

[0015] In turn, the actuating lever 30 comprises a shaped body having a first end which is operatively connected to the kinematic chain 20 and a second end 31 that lies opposite the first end and protrudes outside the enclosure 1; said end 31 is suitable to interact with a part of the circuit breaker so as to actuate the chain 20 and cause the coupling lever 10 to release said locking action in the position in which the accessory and the circuit breaker are operatively installed, in the manner which will be described in details hereinafter.

[0016] Advantageously, in the embodiments illustrated, the actuating lever 30 has a cantilevered shaped rod-like body in which the second end 31 is substantially T-shaped; notches 34 are furthermore formed in the wings of the T-shaped end 31 and are suitable to facilitate the breakage of said wings.

[0017] The kinematic chain 20 comprises an interacting lever 21 that is pivoted to a pivot 12 of the enclosure 1, and has a first arm 23 for interacting with the coupling lever 10 and a second arm 24 that is angularly spaced from the first arm 23 and is provided with a shaped end 25; said shaped end 25, which can be optionally colored, when the movable part 60 is coupled to the base 50, is suitable to arrange itself at an opening of the enclosure 1, designated by the reference numeral 2 in Figure 5, and to indicate that the circuit breaker can be reset. Furthermore, in the preferred embodiment of Figures 3 e 4, the interacting lever 21 has a third arm 22 which is angularly spaced from the first arm 23 and the second arm 24, and is connected to the first end of the actuating lever 30; alternatively, the actuating lever 30 can be coupled directly to the second arm 24, without providing the third arm 22, as shown for example in Figures 1-2.

[0018] In both cases, as shown partially in Figures 1-4, the first end of the lever 31 has a pivot 32 that enters an eye 33 formed in the body of the lever 21.

[0019] A second spring 26 is associated with the interacting lever 21; in particular, the spring 26 is preferably a spiral spring that acts by traction and has a first end that is connected to a pivot 27 formed on the enclosure 1 and a second end 28 that is anchored to a pivot 29 formed in the body of the interacting lever 21 as shown in Figures 3-4, or in a seat 29 as illustrated instead in Figures 1 and 2.

[0020] The practical use and operation of the accessory device according to the invention is now described.

[0021] First of all, the accessory device 100 is coupled to the movable part 60 of the circuit breaker, coupling the enclosure 1 to the enclosure 61, as shown in Figure 5; in this manner, the pivot of the coupling lever 10 that protrudes from on of the two side walls of the enclosure 1 passes through an appropriate slot formed in the enclosure 61 and couples to the resetting mechanism contained therein, being able to apply a locking action to it. In particular, in the embodiment shown in Figure 5, the

device 100 is mounted, with reference to a front view of the circuit breaker, to the left of the movable part 60; advantageously, depending on application requirements, the device 100 can also be mounted to the right of the movable part 60; depending on this position, one of the two ends of the T-shaped wing 34 is broken off appropriately so that additional components or devices can be freely mounted next to the device 100.

[0022] The assembly thus obtained is then coupled to the base 50 of the circuit breaker, which is arranged in a fixed position on a fixing element, for example the DIN guide, with the terminals 53 connected electrically to the electric circuit in which the circuit breaker is inserted.

[0023] In particular, the length of the actuating lever 30 is such that during the initial step of the coupling between the base 50 and the assembly device 100-fixed part 60, the T-shaped end 34 does not interact with the wall 54 of the base 50 until the contact means 63 are almost fully inserted in the body 51 and are therefore covered by insulating parts; once this condition has been reached, in the final part of the coupling step, in which the contact means 52 are electrically coupled to the contact means 63, the end 31 abuts against the wall 54 and the lever 30 applies a release action and, by virtue of the pivot 32, pushes against the interacting lever 21; by virtue of this thrust, the lever 21 rotates about the pivot 12 and pulls the spring 26. In this situation, the spring 14 acts on the lever 10, turning it in the direction indicated in Figures 1 and 3 by the arrow 3, so that the end 13 interacts with the arm 23. Only in this condition the coupling of the lever 10 with the resetting mechanism of the circuit breaker is such as to enable the actuation of the lever 62 and allow to reset the circuit breaker.

[0024] Instead, when an operator acts on the circuit breaker in order to extract the movable part 60 from the fixed part 50, the extraction movement causes the end 31 to no longer be in abutment on the wall 54 already in an initial step of the extraction operation in which the contact means 63 are not yet exposed with respect to the insulating body 51; in this situation, the spring 26 that is subjected to traction pulls the lever 21, which by virtue of the arm 23 pushes against the coupling lever 10 and overcomes the force applied by the spring 14. In this manner, the lever 10 turns in the direction indicated by the arrow 4 in Figures 2 and 4, moving into a position in which the coupling of its pivot to the resetting mechanism of the circuit breaker and the action of the spring 14 cause the release of the contacts contained in the movable part 60 and prevent actuation of the lever 62, in practice preventing the resetting of the circuit breaker.

[0025] In practice it has been found that the accessory device according to the invention fully achieves the intended aim, since it allows to provide interventions in full safety on the circuit breaker; as described above, both during extraction of the movable part from the fixed part and during coupling, the device 100 effectively prevents current from flowing in the circuit breaker if there are exposed live parts and prevents, in such conditions, inappropriate interventions on the lever 62 from causing the resetting of the circuit breaker, thus eliminating or at least reducing considerably the possibility of direct or indirect contact, with consequences that would be extremely dangerous for operators. One should not ignore the fact that all the innovative functions and the inventive aspects of the invention can be obtained by using commonly commercially available elements and materials with extremely modest costs.

[0026] The accessory device thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; for example the shape of the various levers and components may be modified provided that they are compatible with the application. All the details may further be replaced with other technically equivalent elements.

[0027] In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

Claims

1. An accessory device for locking the resetting mechanism of a circuit breaker of the draw-out or removable type, **characterized in that** it comprises:

   - an insulating enclosure;
   - an actuating lever which protrudes, at least partially, outside said insulating enclosure;
   - a kinematic chain which is accommodated inside said insulating enclosure and is operatively coupled to said actuating lever; and
   - a lever for coupling to said resetting mechanism, said coupling lever being operatively coupled to said kinematic chain and protruding at least partially outside said insulating enclosure.

2. The accessory device according to claim 1, **characterized in that** said insulating enclosure comprises a base wall, a top wall, a rear wall, two side walls, and a front wall, said actuating lever and said coupling lever protruding outside the enclosure from said rear wall and from one of the two side walls, respectively.

3. The accessory device according to claim 1 or 2, **characterized in that** said coupling lever has a contoured body having at least a portion suitable for coupling to said resetting mechanism and applying a locking action on it, and **in that** said actuating lever comprises a shaped body having a first end which is connected to the kinematic chain and a second end that lies opposite the first end which protrudes outside the enclosure and is suitable to interact with a part of said circuit breaker so as to actuate said kinematic chain and cause the cou-

pling lever to release said locking action in the position in which the accessory and the circuit breaker are operatively installed.

4. The accessory device according to one or more of the preceding claims, **characterized in that** said coupling lever is pivoted to said enclosure and has a first portion that is suitable to interact operatively with said kinematic chain and a second portion that protrudes transversely outside the enclosure and is suitable for coupling to the resetting mechanism of the circuit breaker, a first spring being operatively associated with said coupling lever.

5. The accessory device according to one or more of the preceding claims, **characterized in that** said kinematic chain comprises an interacting lever that is pivoted to said enclosure and has at least one first arm for interaction with said coupling lever, a second spring being operatively associated with said interconnecting lever.

6. The accessory device according to claim 5, **characterized in that** said interacting lever comprises a second arm that is angularly spaced from said first arm and has a shaped end which is suitable to arrange itself at an opening of the enclosure so as to indicate that the circuit breaker can be reset.

7. The accessory device according to 5 or 6, **characterized in that** said interacting lever comprises a third arm that is angularly spaced from said first arm and said second arm and is suitable for coupling with said actuating lever.

8. The accessory device according to claim 5, **characterized in that** said second spring is a traction spring in which a first end is connected to a pivot formed on the enclosure and a second end is anchored to said interacting lever.

9. The accessory device according to one or more of the preceding claims, **characterized in that** said actuating lever has a cantilevered rod-like shaped body in which said second end is T-shaped.

10. The accessory device according to claim 9, **characterized in that** on the wings of said T-shaped end there are notches suitable to facilitate the breakage of said wings.

11. A protecting device for a low voltage electric circuit **characterized in that** it comprises:

- a low-voltage circuit breaker of the draw-out or removable type, comprising:
- a base, which is suitable to be positioned on a supporting element and is provided with terminals for connection to said circuit and with first contact means that are electrically connected to said terminals; and
- a movable part, which can be coupled to/separated from said base and comprises a casing that contains separable contacts, a mechanism for resetting the circuit breaker which comprises a resetting lever protruding outside the casing, and second contact means which protrude outside the casing and are suitable to be detachably electrically coupled to said first contact means;
- an accessory device according to one or more of the preceding claims.

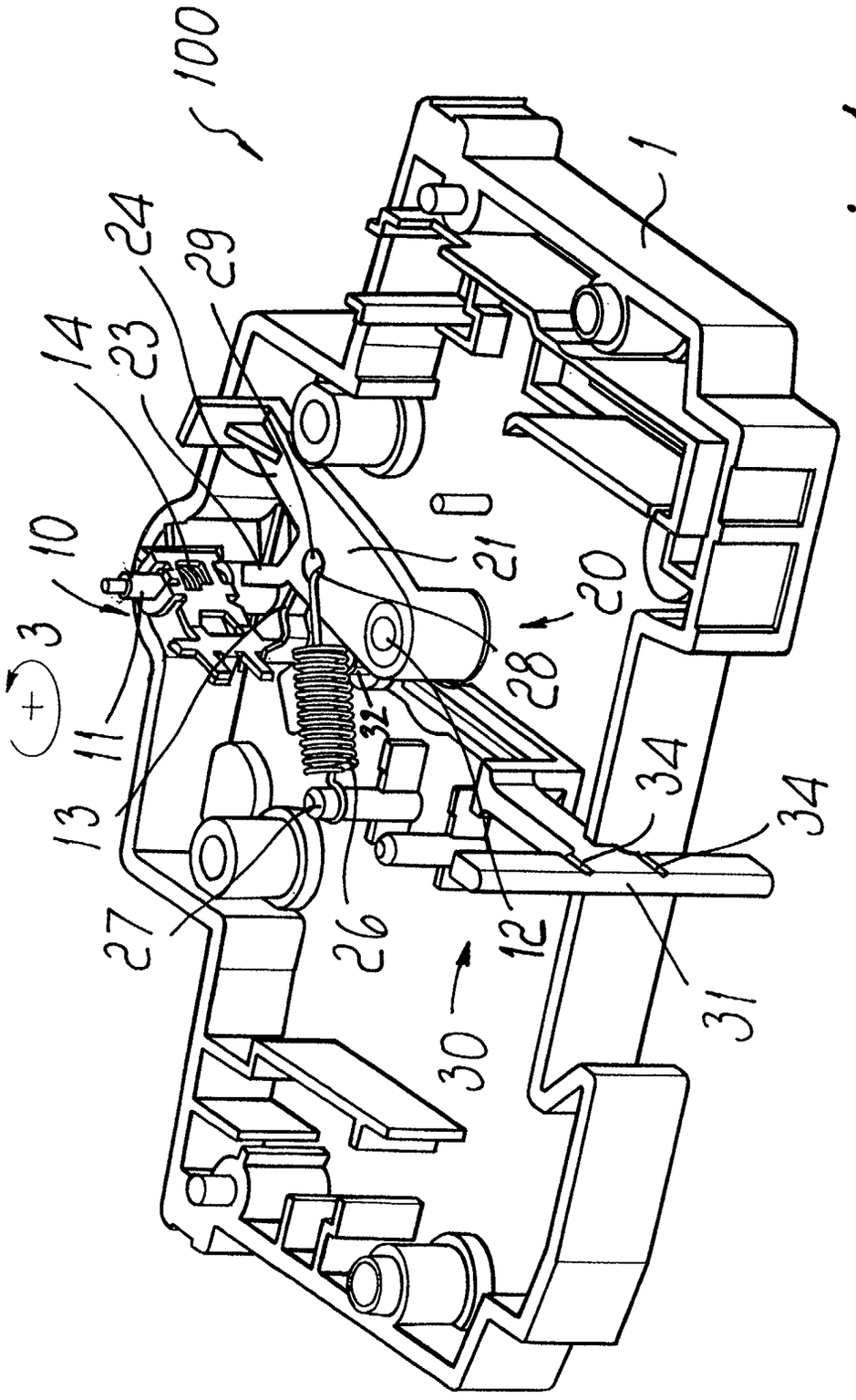

Fig.1

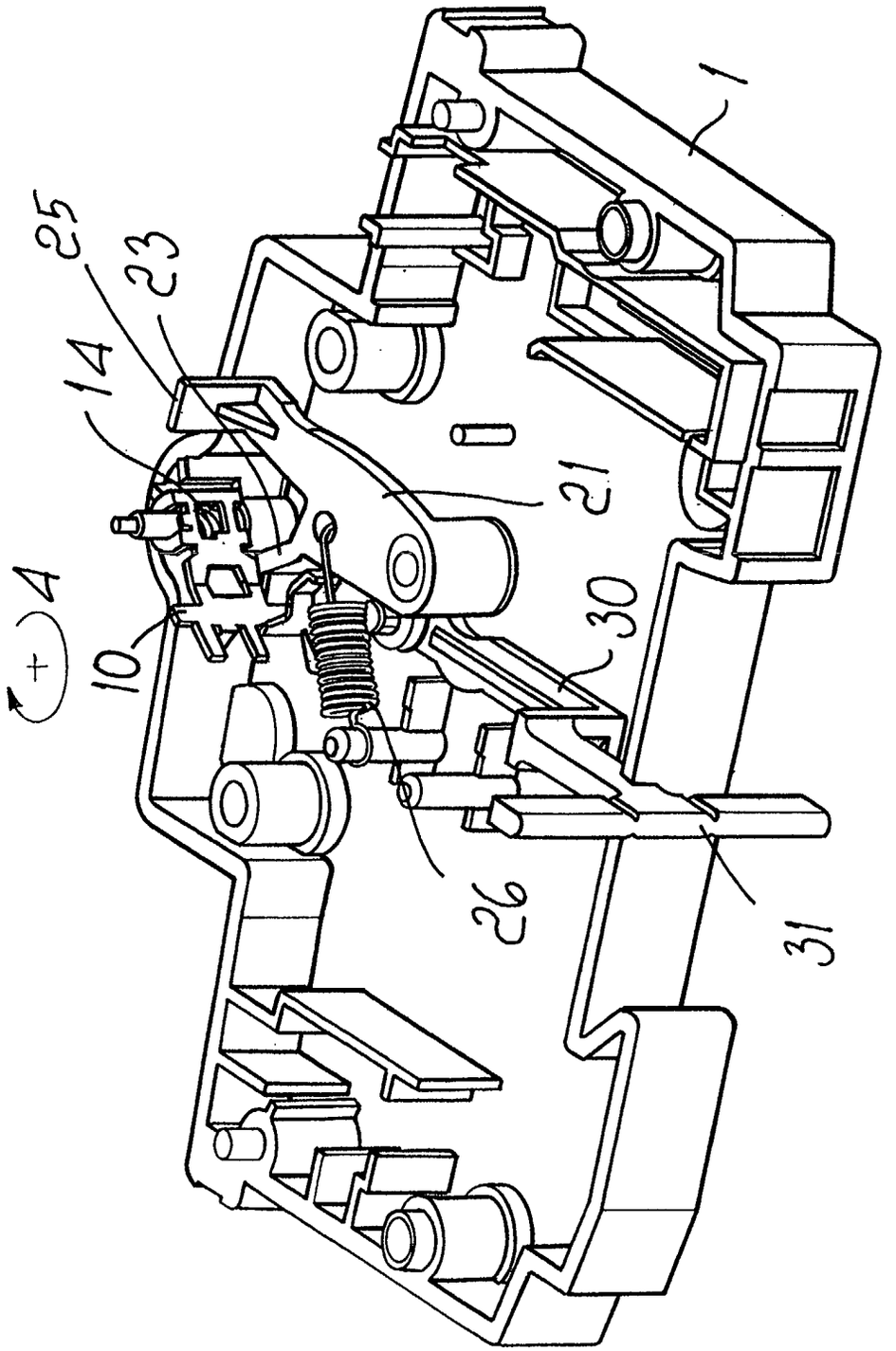

Fig. 2

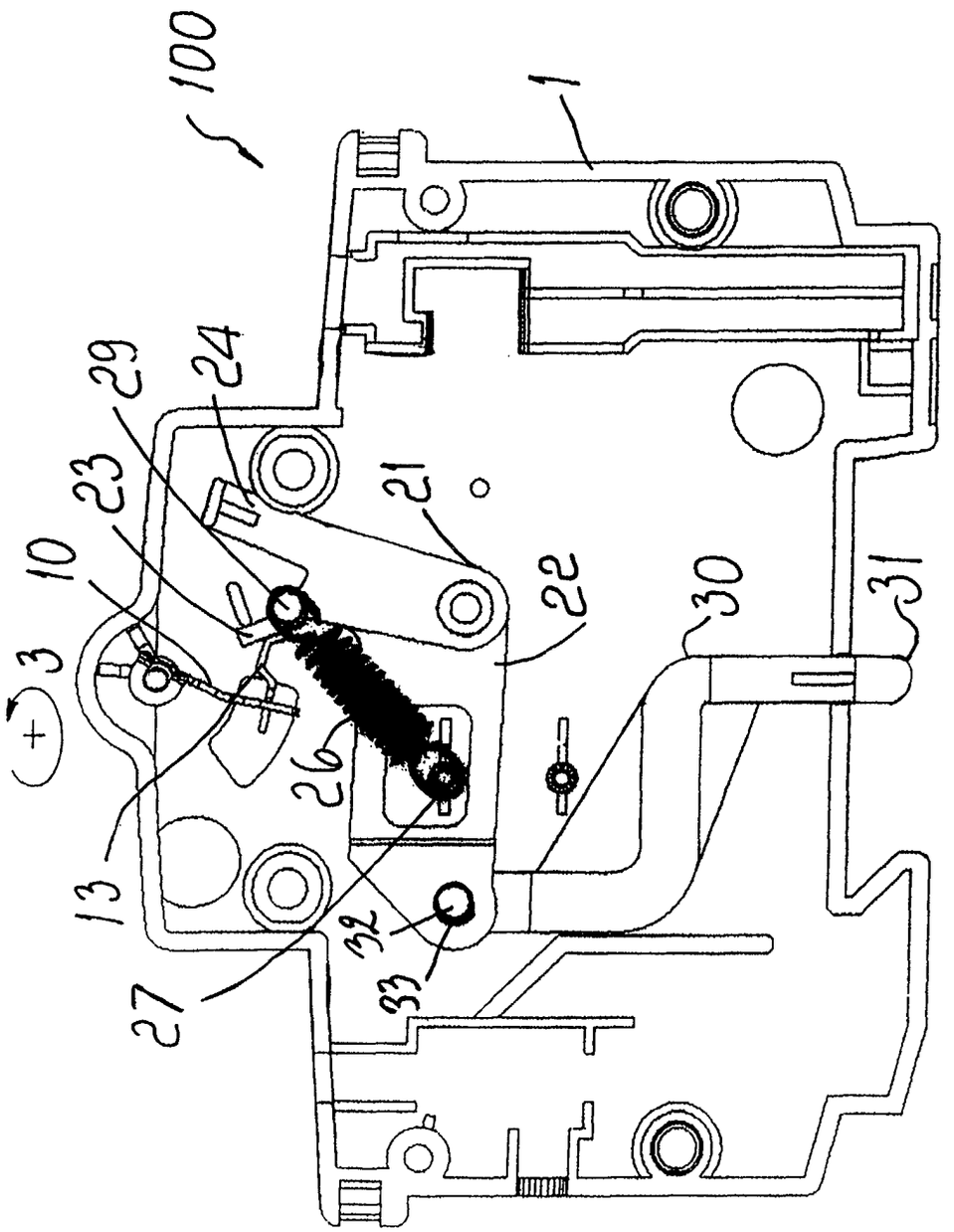

Fig. 3

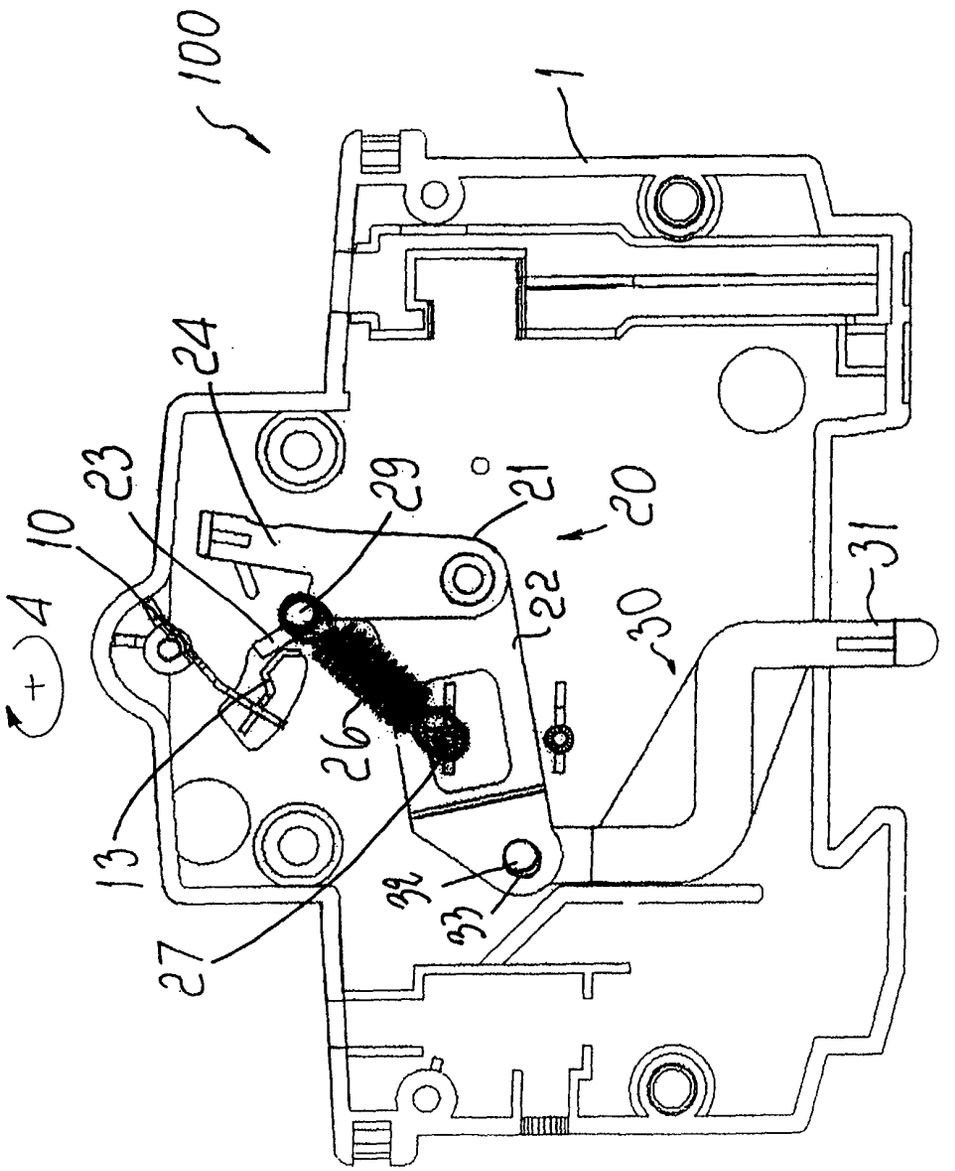

Fig. 4

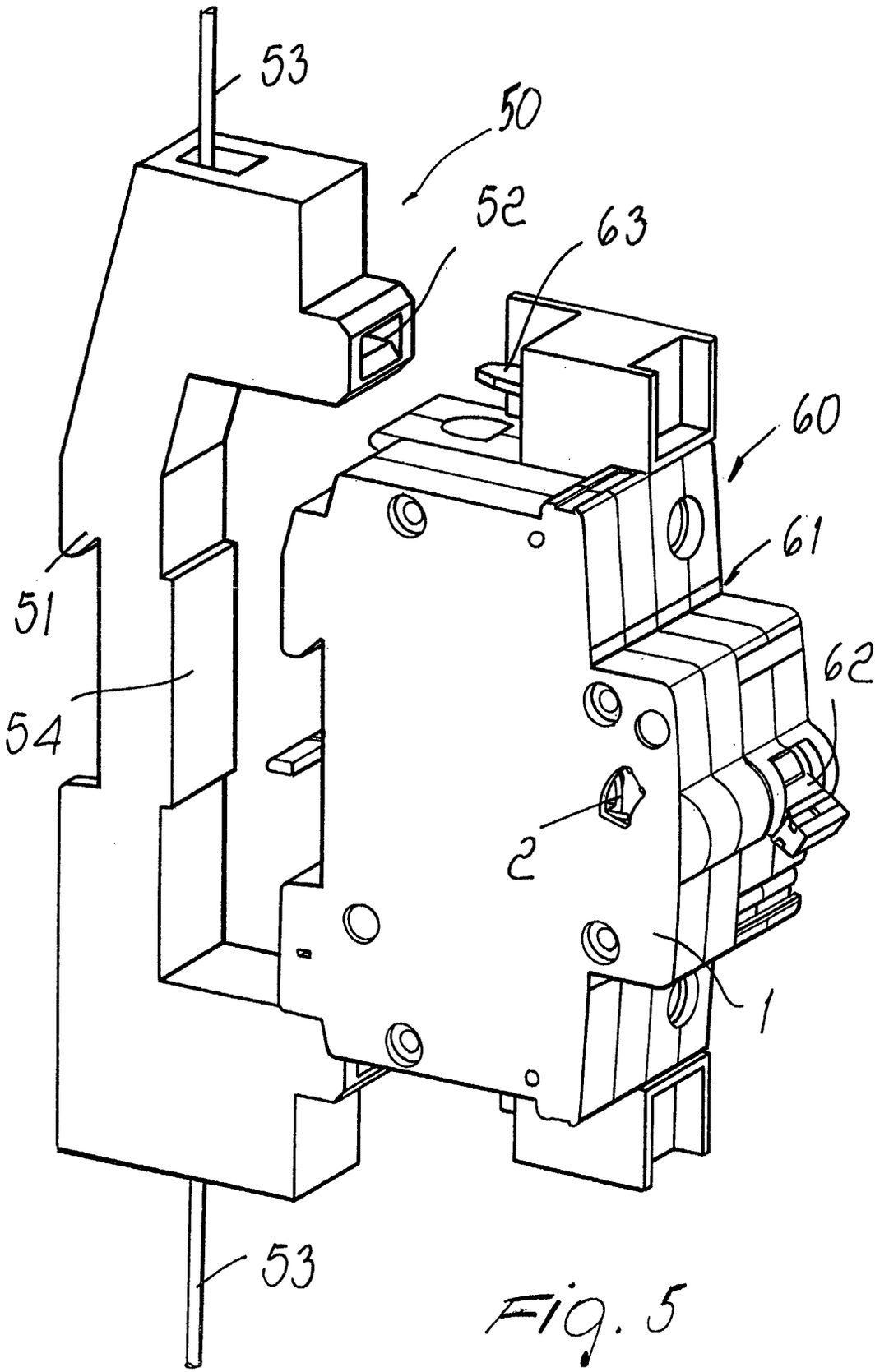

Fig. 5