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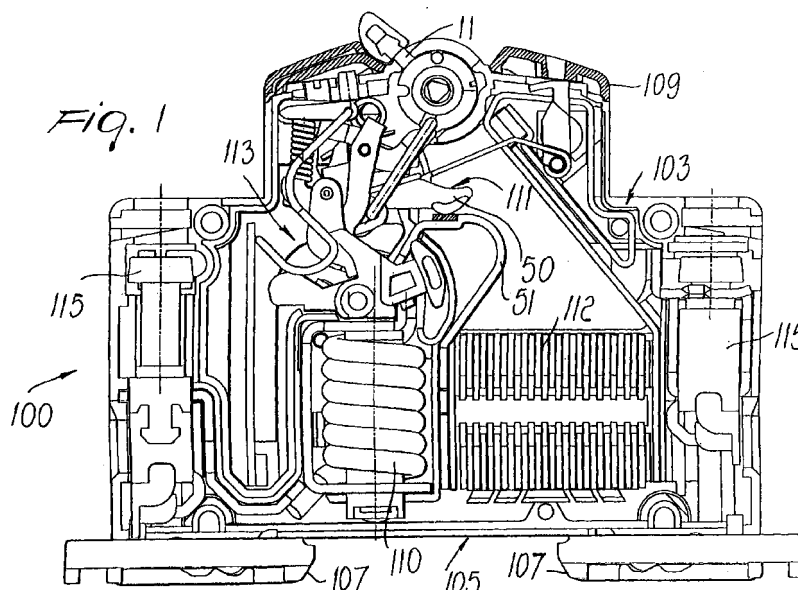
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(54) **Magnetothermal circuit breaker**

(57) A magnetothermal circuit breaker comprising a casing (103) which contains an electrical protection device (110) associated with a magnetic trip-off kinematic system (114), a kinematic system for actuating the moving contact (111), an arc chute (112), a thermal trip-off kinematic system (113), a connection means

(115) for the external electrical connections; the thermal trip-off kinematic system includes a bimetallic member which is operatively associated with a linkage whose initial position with respect to the bimetallic member can be adjusted mechanically.



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Description

[0001] Magnetothermal circuit breakers use kinematic systems which allow the moving contact to open and close both by actuating an external crossbar which can be accessed by the user and by virtue of the automatic intervention of the protection devices provided internally.

[0002] The two constant problems in the design of these circuit breakers are the complexity of the mechanisms and their dimensions.

[0003] The need is constantly felt to simplify the kinematic systems from the constructive point of view in order to allow low-cost production, and in this regard it is also very important to achieve simple and automatable assembly.

[0004] Another basic problem is to improve the performance of circuit breakers while maintaining compact dimensions which should in any case be within the standards.

[0005] The aim of the present invention is to provide a magnetothermal circuit breaker with improved electrical characteristics.

[0006] An object of the invention is to provide a circuit breaker which can be manufactured more cheaply than conventional ones and at the same time has an improved performance.

[0007] Another object is to provide a circuit breaker which is more reliable in use.

[0008] This aim, these objects and others which will become apparent hereinafter are achieved by a magnetothermal circuit breaker as claimed in the appended claims.

[0009] Further characteristics and advantages will become apparent from the description of a preferred but not exclusive embodiment of the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

FIG. 1 is a side elevation view of the circuit breaker with a wall of the casing removed;

FIG. 2 is a side elevation view of the kinematic system of the moving contact in the open position;

FIG. 3 is a side elevation view of the kinematic system of the moving contact during a first step of closure;

FIG. 4 is a side elevation view of the kinematic system of the moving contact in the closed position;

FIG. 5 is a side elevation view of the thermal kinematic system in the closed position;

FIG. 6 is a side elevation view of the thermal kinematic system shown in a position in which the bimetallic part is in contact with the thermal linkage;

FIG. 7 is a side elevation view of the magnetic trip-off kinematic system in the closed position;

FIG. 8 is a side elevation view of the magnetic trip-off kinematic system in the position after tripping;

FIG. 9 is a side elevation view, taken from the opposite side with respect to the preceding views, of the kinematic system of the indicator in the position for indicating that tripping has occurred;

FIG. 10 is a side elevation view, taken from the opposite side with respect to the preceding views, of the kinematic system of the indicator in the position for normal operation.

[0010] With reference to the above figures, the magnetothermal circuit breaker according to the invention, generally designated by the reference numeral 100, comprises a casing 103, which has a standard shape, and, at the rear face 105, forms a coupling means 107 for coupling to an omega-shaped rail (not shown) according to DIN standards.

[0011] At the front face, the casing 103 has a protrusion 109 in which the actuation member or actuation crossbar 11 is arranged.

[0012] The casing 103 contains an electrical protection device 110 which is associated with a magnetic trip-off kinematic system 114, a kinematic system for actuating the moving contact 111, an arc chute 112, a thermal trip-off kinematic system 113, and terminals 115 for the external electrical connections.

[0013] In FIG. 1, the circuit breaker 100 is shown in the closed-contact position, in which the moving contact 50 rests on the fixed contact 51.

[0014] The operation for closing the circuit breaker occurs as follows.

[0015] From the open position, shown in FIG. 2, the crossbar 11 is actuated and the link rod of the crossbar descends, sliding on the engagement lever 3, which is kept in a fixed position being rigidly coupled both to its fulcrum 41 and to the actuation lever 4. In this manner, the spring holder 2 is lowered and loads the driving spring 8 and the contact spring 6.

[0016] The moving contact 50 begins to rotate until its rear part strikes the trip-off lever 1, which stops the contact so that the pad remains at a distance of approximately 1 mm from the fixed contact, as shown more clearly in FIG. 3. As the rotation of the crossbar 11 continues, the coupling point 31 between the link rod 12 of the crossbar and the crossbar 11 makes contact with the right end of the trip-off lever 1, turning it and thus releasing the contact which, under the pressure of the contact spring 6, can close with a constant force which is independent of the force applied to the crossbar during the closure maneuver (independent closure). The motion of the trip-off lever 1 also loads the catch spring 7, which returns the trip-off lever 1 to the initial position

once it has disengaged from the crossbar.

[0017] The maneuver for opening the circuit breaker is performed in the following manner.

[0018] From the closed position, shown in FIG. 4, the crossbar 11. is actuated by the crossbar link rod 12 and the spring holder 2 is returned to the initial open position, as shown in FIG. 2. By rotating, the spring holder 2 abuts against the moving contact at the point 32, bringing it to the open position, as clearly shown in FIG. 2. During the motion of the spring holder 2, the contact spring 6 and the driving spring 8 are partially released.

[0019] The emergency thermal tripping occurs as follows.

[0020] From the closed position, shown in FIG. 5, reference should be made to the motion of the bimetallic member 15 toward the thermal trip-off linkage 13. When the bimetallic member 15 makes contact with the thermal trip-off linkage 13, which by moving pushes the actuation lever 4, acting on an inclined plane 33, and the actuation lever 4 turns clockwise, releasing the engagement lever 3. In this manner the engagement lever 3 moves into the position shown in FIG. 6. The spring holder 2 rotates under the action of the driving spring 8 and the actuation lever 4 turns clockwise. The engagement lever 3 is in fact coupled to the actuation lever 4 at its lower end on the plane 44.

[0021] The actuation lever 4 is provided with a slot which can be engaged by a pivot for the functional connection of a separate electric module, allowing the cascade tripping of the module or modules associated with the circuit breaker. A second wing of the catch spring 7 is also loaded, returning the engagement lever 3 to the initial configuration once the crossbar is in the tripped position, by virtue of a spring (not shown) located inside the crossbar. The actuation spring 9 is also loaded, returning the actuation lever to the initial position (reset).

[0022] The initial position of the thermal trip-off linkage 13 can be adjusted by means of the thermal trip-off adjustment screw 14, which by acting on the thermal trip-off linkage support 10, contrasted by the driving spring 8, can raise or lower the thermal trip-off linkage 13, which moves toward or away from the bimetallic member 15. It is thus possible to achieve an effective pre-positioning of the thermal trip-off linkage 13.

[0023] Emergency magnetic tripping occurs as follows.

[0024] From the closed position, shown in FIG. 7, in case of magnetic tripping the pusher 116 moves to the position shown in FIG. 8, pushing upward the magnetic trip-off hook 5 which, by rotating counterclockwise and being coupled to the actuation lever 4 at the point 35, causes the rotation of the lever, thus activating the release sequence as already described in the preceding paragraph. During the rotation, the magnetic trip-off hook 5 strikes, with its right end, against the lower part of the moving contact 50, making it open faster. The repositioning of the magnetic trip-off pusher 116 also is

achieved by means of the magnetic trip-off hook 5, which is contrasted by the magnetic trip-off spring 17, which is released during the intervention. The magnetic trip-off spring can be adjusted by virtue of the magnetic trip-off adjustment screw 18, allowing to vary the intervention threshold.

[0025] The circuit breaker according to the invention also includes a device for indicating the position of the moving contact, shown in FIGS. 9 and 10, which includes an indicator 60 which is connected to the moving contact 50 by means of a linkage 61, so that the indicator, provided with colored parts in a per se known manner, indicates the position of the moving contact 50 (open, as in FIG. 9, or closed, as in FIG. 10) regardless of the position of the actuation crossbar 11. Advantageously, the indicator 60 and the linkage are monolithically made of plastics.

[0026] The advantage of this solution is that it provides an exact indication of the state of the circuit breaker even when the crossbar is in the open position but the contact is instead closed, for example because the moving contact has stuck to the fixed contact.

[0027] An important advantage of the present invention is the possibility of mechanically adjusting the position of the thermal trip-off linkage 13 of the circuit breaker by means of the screw 14. This allows much faster and more reliable adjustment, reducing the production costs of the circuit breaker.

[0028] It is also noted that the arc chute 112 can be made of 14 elements and still maintain compact dimensions for the circuit breaker.

[0029] In practice it has been found that the invention achieves the intended aim and objects.

[0030] The circuit breaker according to the invention is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with technically equivalent elements.

[0031] The materials used, as well as the dimensions, may of course be any according to the requirements and the state of the art.

Claims

1. A magnetothermal circuit breaker, comprising a casing containing an electrical protection device associated with a magnetic trip-off kinematic system, a kinematic system for actuating the moving contact, an arc chute, a thermal trip-off kinematic system, a connection means for the external electrical connections, characterized in that said thermal trip-off kinematic system comprises a bimetallic member which is operatively associated with a linkage whose initial position with respect to said bimetallic member can be adjusted mechanically.
2. A circuit breaker according to claim 1, characterized in that it comprises a crossbar and a crossbar

link rod which are adapted to descend by sliding on an engagement lever which is kept in a fixed position, being rigidly coupled both to a fulcrum and to an actuation lever, so as to lower a spring holder which loads a driving spring and a contact spring, a moving contact which is adapted to rotate until its rear part strikes a trip-off lever which is suitable to stop said moving contact so that its pad remains at a distance of approximately 1 mm from a fixed contact; as the rotation of said crossbar continues, a coupling point between said crossbar link rod and said crossbar makes contact with the right end of said trip-off lever, turning it and thus releasing the contact which, under the pressure of the contact spring, can close with a constant force which is independent of the force applied to the crossbar during the closure maneuver.

3. A circuit breaker according to claim 1 or 2, characterized in that the motion of said trip-off lever loads the catch spring which returns said trip-off lever to the initial position once it has been disconnected from the crossbar.

4. A circuit breaker according to one or more of the preceding claims, characterized in that from the closed-contact position, by actuating said crossbar, the spring holder is returned to the initial open position by means of the crossbar link rod, said spring holder being adapted to abut against said moving contact by rotating, moving it into the open position, said contact spring and said driving spring being released during the movement of said spring holder.

5. A circuit breaker according to one or more of the preceding claims, characterized in that in the thermal emergency trip-off function, from the closed position, a bimetallic member moves toward a thermal trip-off linkage; when the bimetallic member makes contact with the thermal trip-off linkage, which by moving pushes the actuation lever by acting on an inclined plane, the actuation lever rotates clockwise, releasing the engagement lever, a spring holder rotates under the action of the driving spring, and the actuation lever turns clockwise, said engagement lever being coupled to said actuation lever at its lower end, a second wing of said catch spring, suitable to return said engagement lever to the initial configuration once the crossbar is in the tripped position, and said actuation spring, suitable to return said actuation lever to the initial position, being both loaded.

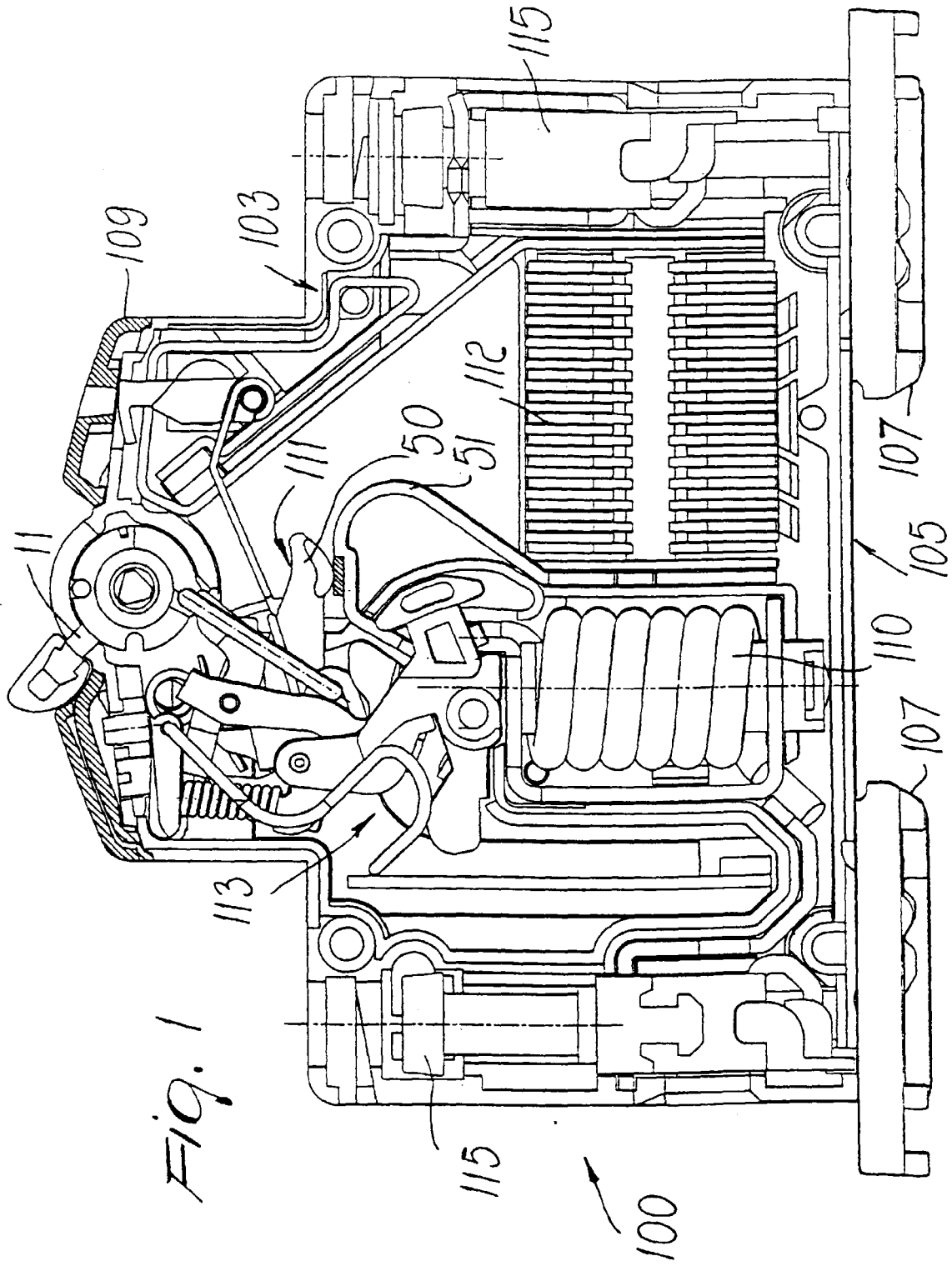
6. A circuit breaker according to one or more of the preceding claims, characterized in that the initial position of said thermal trip-off linkage can be adjusted by means of a thermal adjustment screw

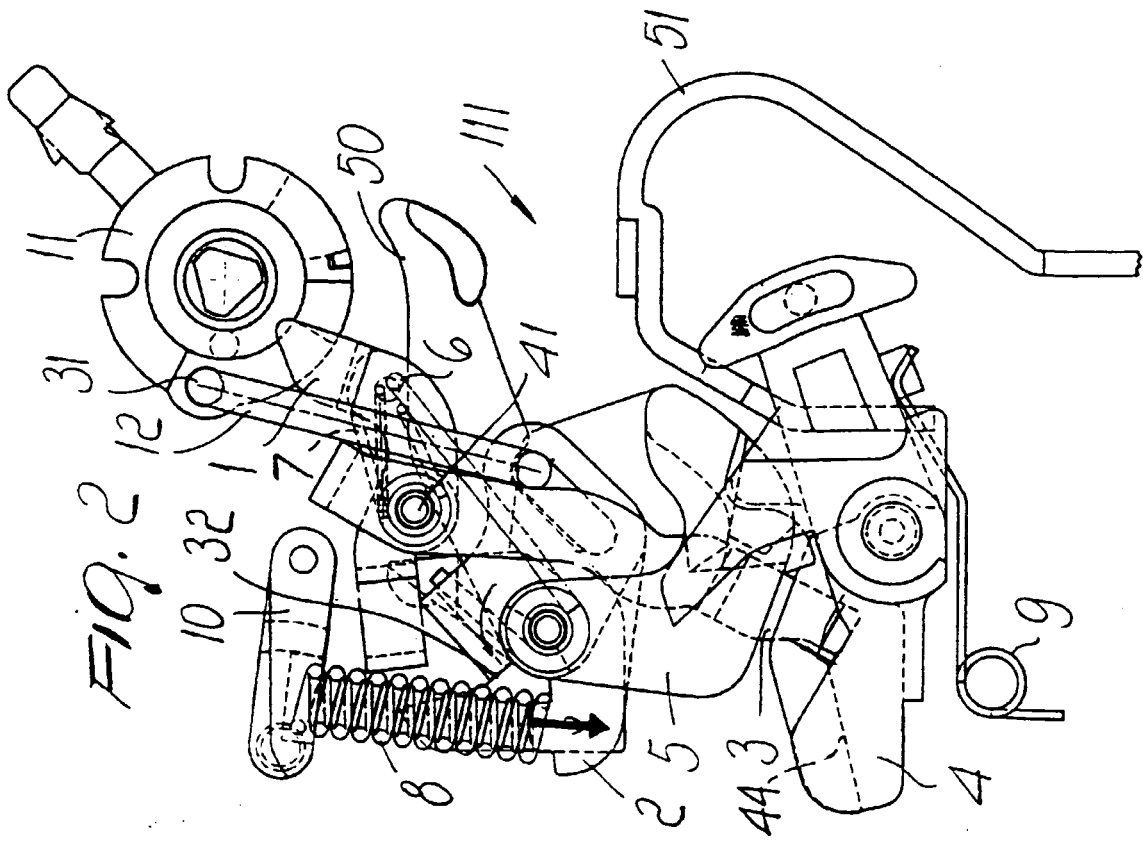
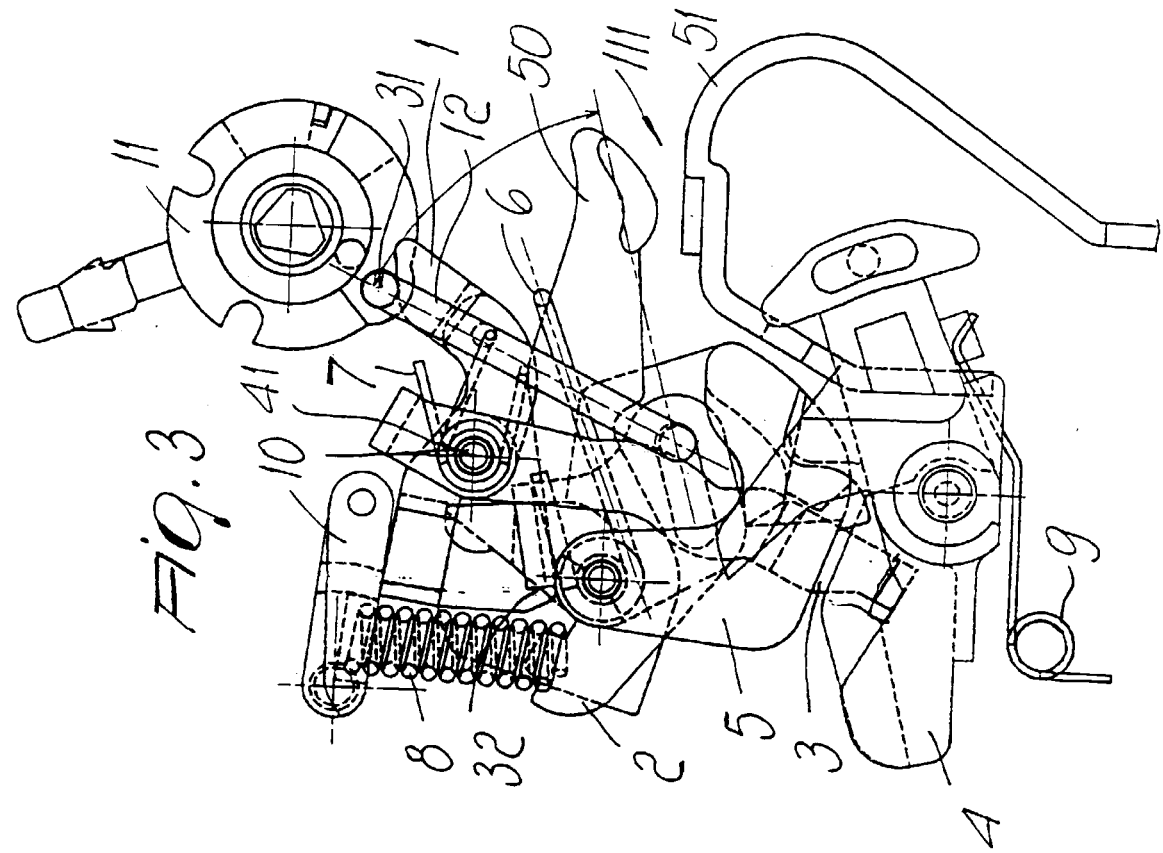
which, by acting on said thermal trip-off linkage support, contrasted by said driving spring, can lower or raise the thermal trip-off linkage, which moves toward or away from said bimetallic member, so as to achieve an effective pre-positioning of said thermal trip-off linkage.

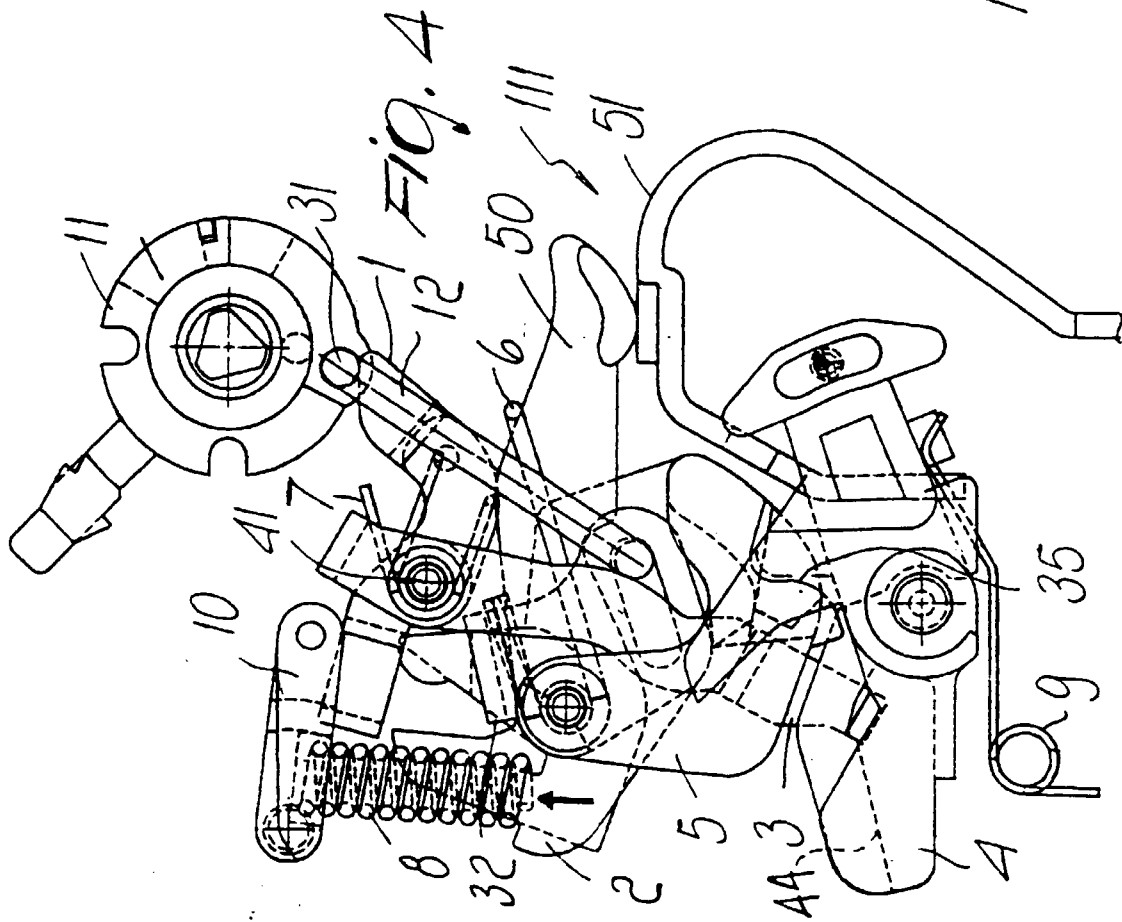
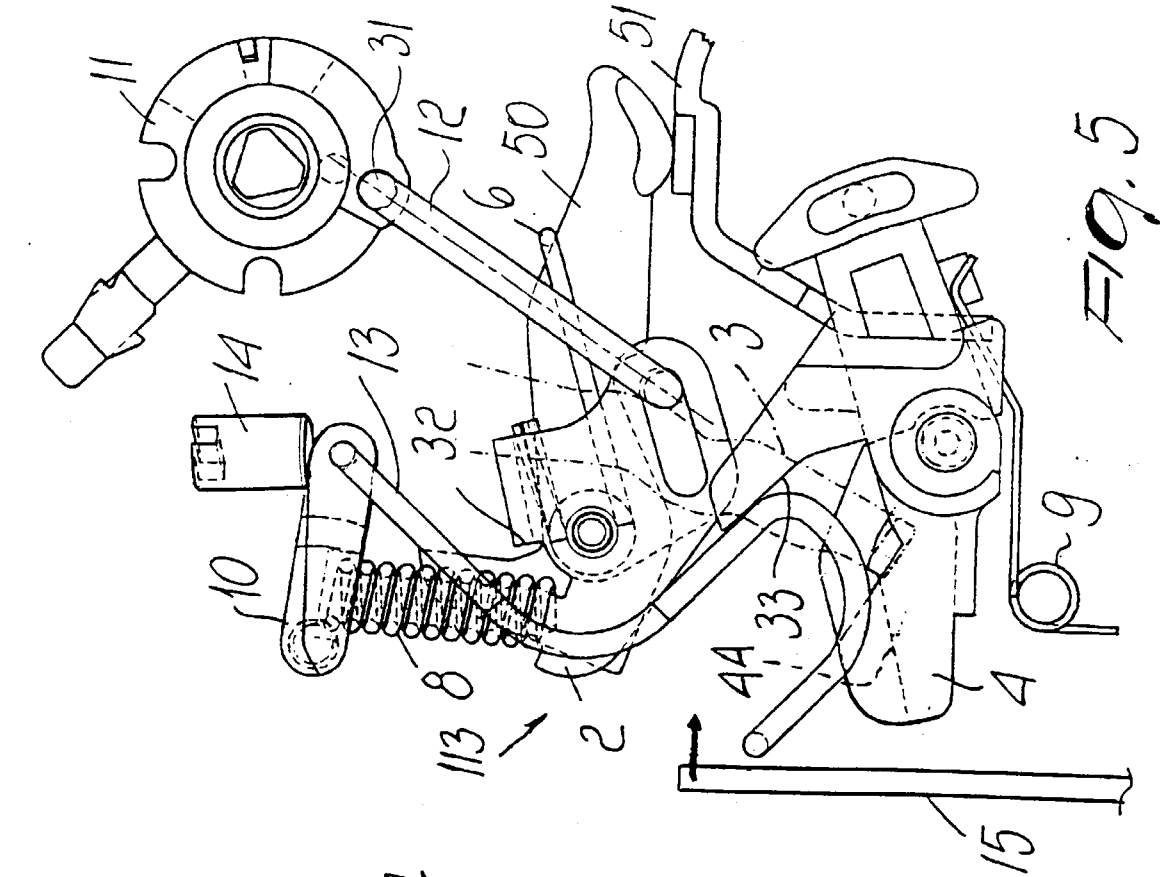
7. A circuit breaker according to one or more of the preceding claims, characterized in that during magnetic emergency tripping, from the position in which the contacts are closed, in case of magnetic intervention a pusher pushes upward a magnetic trip-off hook which, by rotating and being coupled to said actuation lever, causes the rotation of said actuation lever, thus activating the release sequence; during said rotation, the magnetic trip-off hook strikes, with one of its ends, the lower part of said moving contact, making it open faster; the repositioning of said magnetic trip-off pusher being achieved by means of said magnetic trip-off hook, which is contrasted by a magnetic trip-off spring which releases during intervention.

8. A circuit breaker according to one or more of the preceding claims, characterized in that said magnetic trip-off spring is adjustable by means of a magnetic trip-off adjustment screw, allowing to vary the intervention threshold.

9. A circuit breaker according to one or more of the preceding claims, characterized in that it comprises a device for indicating the position of the moving contact which comprises an indicator which is connected to said moving contact by means of a linkage, so that said indicator indicates the position of said moving contact regardless of the position of said actuation crossbar.







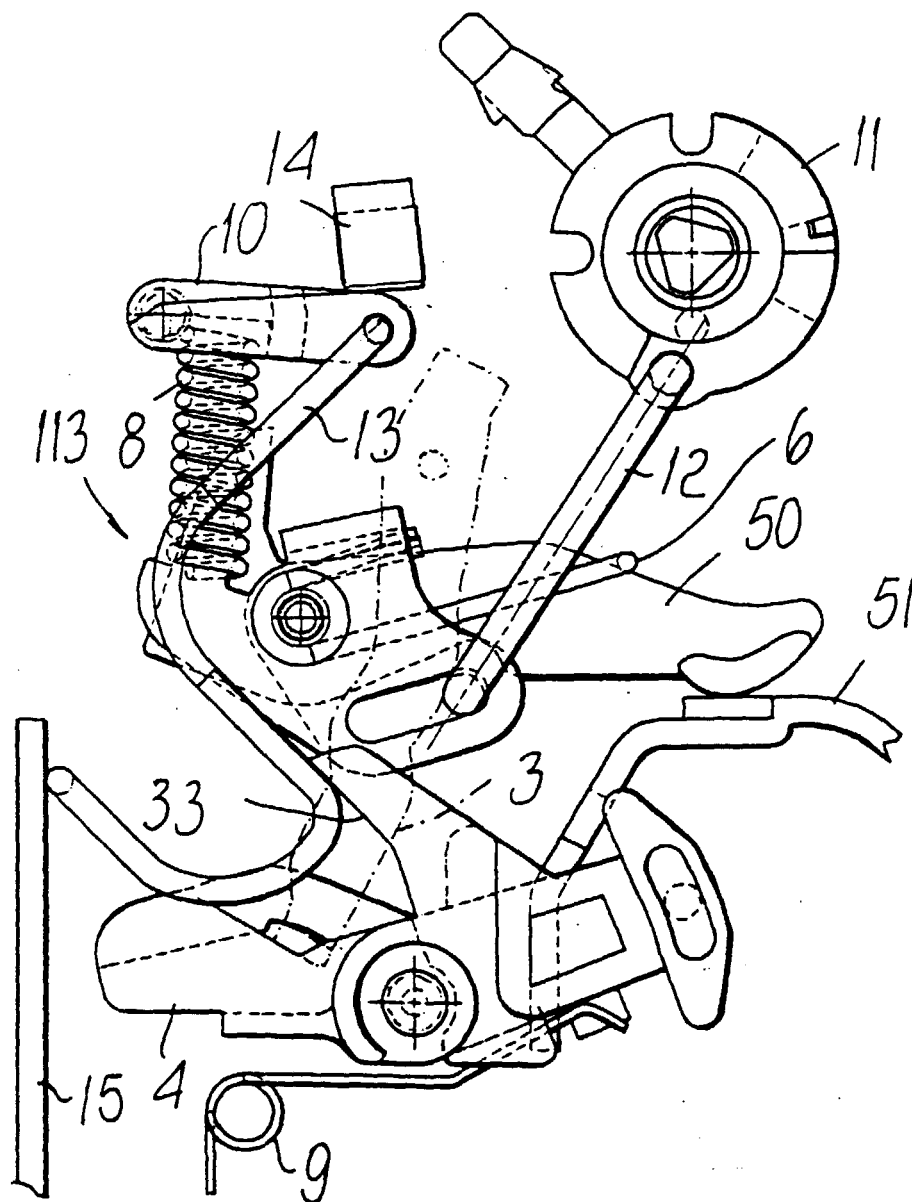


Fig. 6

