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(54) Enclosed magnetothermal electric circuit breaker

(57) An enclosed magnetothermal electric circuit breaker, comprising a containment body that contains a plurality of movable electrical contacts, which are in parallel and move synchronously, and of fixed contacts with corresponding arc quenching chambers, a mechanism for actuating the movable electrical contacts, a thermal tripping mechanism and an electrical protection device

associated with a magnetic tripping mechanism, and a connection means for the external electrical connections. The actuation mechanism allows the movable electrical contacts to reach a stable position that is extremely close to the fixed contacts and then trip, from that position, onto the fixed contacts, closing the circuit breaker, regardless of the force and speeds applied to the actuation handle.

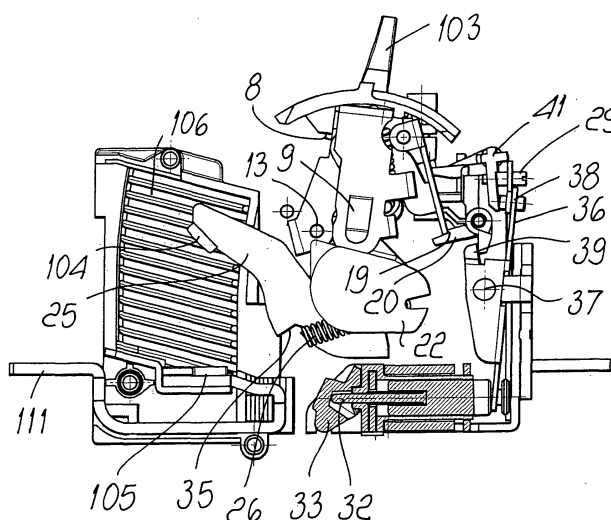


Fig. 13

Description

[0001] The present invention relates to an enclosed magnetothermal electric circuit breaker.

[0002] The present invention relates in particular to enclosed circuit breakers for currents between 125 and 1600 amps.

[0003] Enclosed magnetothermal electric circuit breakers use mechanisms that allow to open and close a plurality of moving contacts in parallel and synchronously by actuating an external handle that can be accessed by the user and also by virtue of the automatic tripping of the protection devices provided internally.

[0004] The two constant problems in the design of these circuit breakers are the complexity of the mechanisms and the dimensions.

[0005] The need is constantly felt to simplify the mechanisms from the constructive point of view so that low-cost manufacturing is achieved, and within the scope of this aim it is also very important to achieve an assembly that is simple and can be automated.

[0006] Another fundamental problem is to improve the performance of enclosed circuit breakers while maintaining reduced dimensions that in any case comply with the standards.

[0007] The aim of the present invention is to provide an enclosed circuit breaker having improved electrical and constructive characteristics.

[0008] An object of the invention is to provide an enclosed circuit breaker that has superior characteristics with respect to conventional models as regards the opening of the contacts by magnetic repulsion in short-circuit conditions.

[0009] Another object of the invention is to provide a box-like enclosure that can be manufactured more cheaply than conventional ones and at the same time has an improved performance.

[0010] Another object is to provide a circuit breaker that is more reliable in operation.

[0011] This aim, these objects and others that will become better apparent hereinafter are achieved by an enclosed magnetothermal electric circuit breaker, as claimed in the appended claims.

[0012] Further characteristics and advantages of the invention will become better apparent from the description of preferred but not exclusive embodiments thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the circuit breaker according to the invention;

Figure 2 is a perspective view of the circuit breaker according to the invention without the front panel, illustrating the mechanisms;

Figure 3 is a perspective view of the handle support;

Figure 4 is a side elevation view of a closure linkage;

Figure 5 is a side elevation view of the mechanisms in the position in which the circuit breaker is open;

Figure 6 is a side elevation view of the mechanisms in the position in which the circuit breaker is closed; Figure 7 is a side elevation view of the mechanisms during a step of the closure of the circuit breaker; Figure 8 is a side elevation view of the mechanisms, illustrating the pushing action of the magnetic release lever;

Figure 9 is a side elevation view of the mechanisms in the position in which the circuit breaker has tripped due to thermal tripping;

Figure 10 is a side elevation view of the mechanisms, illustrating the contacts opened by repulsion;

Figure 11 is a side elevation view of the mechanisms, in the position in which the circuit breaker is open, illustrating the electrical protection device set with maximum gap;

Figure 12 is a side elevation view of the mechanisms in the position in which the circuit breaker has tripped due to magnetic tripping;

Figure 13 is a side elevation view of the mechanisms in the position in which the circuit breaker is open, illustrating the electrical protection device set with minimum gap;

Figure 14 is a perspective view of a body for containing an arc quenching chamber;

Figure 15 is a side elevation view of the left side wall of a containment body of an arc quenching chamber;

Figure 16 is an exploded perspective view of a containment body of an arc quenching chamber.

[0013] With reference to the above figures, the enclosed circuit breaker according to the invention, generally designated by the reference numeral 100, comprises a containment body 101, which has the classic standardized configuration and forms, at the rear face, a means for coupling to an omega-shaped guide (not shown) according to DIN standards.

[0014] The containment body 101 has a front panel 102, which allows access to the internal components of the circuit breaker and from which one acts on an actuation handle 103. The enclosed circuit breaker 100 has movable electrical contacts 104, which are in parallel and move synchronously, and a corresponding number of fixed contacts 105 with corresponding arc quenching chambers 106.

[0015] The containment body 101 contains a mechanism for actuating the movable electrical contacts 107, a thermal tripping mechanism 108, and, for each movable contact 104, a magnetic protection device 109, which is associated with a magnetic tripping mechanism 110, and electrodes 111 for the external electrical connections.

[0016] Safety insulating partitions 112 are applied to the containment body 101 in order to separate the adjacent terminals, while a test button 113 for mechanically checking the operation of the tripping mechanisms and the corresponding adjustment means 114 and 115, can

be actuated from the front panel 102.

[0017] According to the invention, the circuit breaker is provided with a mechanism for actuating the circuit breaker 107, which allows the movable contacts 104, during the closure of the circuit, to move gradually toward the fixed contacts 105 up to a given distance, typically a few millimeters, and then to trip from this position onto the fixed contacts 105, closing the circuit breaker, regardless of the force and speeds applied to the actuation handle 103.

[0018] In order to provide this particular closure of the contacts, as will become better apparent hereinafter by describing the mechanism for actuating the movable electrical contacts 107, one uses a handle support 1 which, by means of actuation tabs 2, acts on a concave profile 3 formed on two closure linkages 4.

[0019] The handle support 1 is substantially saddle-shaped, with a head portion 5 and two identical lateral portions 6. Two slots and two holes (not shown) are formed in the head portion 5, and the hooks of two release springs 7 engage therein, coupling to a protruding cambered portion, provided between the slots and the holes, which acts as a locator for the springs. The release springs 7 are therefore located inside the two lateral portions 6. The head portion 5 also has an actuation lug 8, which protrudes downward.

[0020] Each of the two lateral portions 6 has a pivoting protrusion 9, which pivots the handle support 1 to the containment body 101. A profiled central tab 10 and the actuation tab 2 complete the structure of each lateral portion 6, so as to protrude toward the inside of the concave region of the handle support 1.

[0021] The actuation tabs 2 act symmetrically, during the closure of the circuit breaker, on the two closure linkages 4, causing the particular closure of the movable contacts 104. In particular, they slidably make contact with a concave profile 3 formed at one end of each linkage 4 by virtue of a wedge-shaped portion 11, which constitutes a sort of cam.

[0022] The concave profile 3 allows to actuate the mechanism 107 by means of the handle 103, moving it to the end of its stroke, without causing the movable contacts 104 to move closer to the fixed contacts with respect to the minimum-distance position that they have already reached, and simultaneously allows to load an elastic means suitable to close with a snap action the movable contacts 104.

[0023] The operation of closing the circuit breaker is as follows.

[0024] From the position in which the circuit breaker has undergone thermal or magnetic tripping, shown in Figures 9 and 12, the mechanism 107 is reset in order to be able to subsequently close the contacts. For this operation, the handle support 1 is turned clockwise about the pivoting protrusions 9, which are pivoted to the containment body 101, by virtue of the actuation handle 103 rigidly coupled thereto.

[0025] The handle support 1, in its motion, abuts by

means of the actuation lug 8 with a locator step formed on an opening lever 12, moving it.

[0026] The opening lever 12, which is located inside the concave region of the handle support 1, is substantially crescent-shaped, so as to slide within the slot formed by the two central tabs 10.

[0027] The opening lever 12 has a first end, which is pivoted to the containment body 101 by means of a pivot 13, and a second end, which can oscillate freely. The closure linkages 4 are moved by the rotation of the opening lever 12, since they are pivoted laterally thereto by means of a pivot 14 at a first end, while each second end is pivoted to an actuation lever 15 by means of a single traction pivot 16, which acts as a support for the coupling of the hooks of the release springs 7 and is located proximate to the lower arc-like profile of the opening lever 12. The combined rotary and translational motion of the closure linkages 4 tensions the release springs 7, since the traction pivot 16 moves away from the head portion 5 of the handle support 1. The pivot 16, therefore, due to the reaction of the release springs 7, contrasts the resetting movement and therefore the rotation of the opening lever 12, contrasting the movement of the closure linkages 4.

[0028] At the end of the stroke of the handle support 1, during resetting, as shown in Figure 5, the oscillating end of the opening lever 12 enters a slot formed in a contrast lever 17 and engages an upper edge of the slot in order to remain in position, so as to contrast the action of the release springs 7 which, by releasing, would induce a sudden counterclockwise rotation of the opening lever 12.

[0029] The contrast lever 17 is pivoted at a first end by means of the pivot 18 and abuts, with a second end, against a detent 19 of a release lever 20 which acts as a ratchet system for the contrast lever 17, preventing its counterclockwise rotation and the consequent release of the opening lever 12.

[0030] The release lever 20 is responsible for the snap opening of the circuit when circuit anomalies occur, as will become better apparent hereinafter.

[0031] In order to close the contacts, from the position in which the mechanism has been reset, Figure 5, the actuation handle is moved forward, thus turning the handle support 1 counterclockwise.

[0032] During the rotation, the opening lever 12 remains motionless, as it is locked by the contrast lever 17, and the first end of the closure linkages 4 also remains motionless, while their second end is turned clockwise due to the contact of the actuation tabs 2 of the handle support 1, in rotation, on the concave profile 3 at the second end of the closure linkages 4.

[0033] In this manner, the traction pivot 16 is moved toward the pivoted end of the opening lever 12, moving slightly below the lower arc-like profile of the opening lever 12, producing a combined rotary and translational motion of the actuation linkages 15, which in turn produce the counterclockwise rotation, by means of a con-

necting pivot 21, of a support of the movable contacts 22, which is pivoted to the containment body 102 by means of a kinematic actuation pivot.

[0034] At the same time, by way of the movement of the traction pivot 16 with respect to the head portion 5 of the handle support 1, the release springs 7 are further subjected to traction.

[0035] The connection pivot 21, as it moves, acts on the support of the movable contacts 22, so as to turn counterclockwise the lever 25 pivoted therein, gradually moving the movable contact 104 toward the fixed contact 105 up to a distance of a few millimeters (approximately 6 mm), as shown in Figure 7.

[0036] As the rotation of the handle support 1 continues to the end of its stroke, the actuation tabs 2 slide along the concave profile 3 of the closure linkages 4 up to the apex of the wedge 11, turning the second end of the closure linkages 4 up to the pivoted end of the opening lever 12.

[0037] The movement induced on the actuation linkages 15 causes the connecting pivot 21 to trace a semicircular path without causing a further rotation of the movable contact lever 25 with respect to the position that it has already reached.

[0038] The simultaneous counterclockwise rotation of the movable contact support 22, caused by the connecting pivot 21, subjects to traction an engagement spring 26 which is fixed to a pivot 27 provided on the movable contact support 22 and to a hook-shaped profile formed on the movable contact lever 25.

[0039] This traction arises from the fact that the connecting pivot 21, in the new position that it has reached, contrasts the circular portion 24, preventing the counterclockwise rotation of the movable contact lever 25, which owing to the coupling of the engagement spring 26 should follow the rotation of the engagement lever 22.

[0040] At the end of the stroke of the handle support 1, the return action of the engagement springs 26, which are now fully in traction, allows the circular portion 24 to slide on the connecting pivot 21, overcoming its resistance, and allows the movable contact lever 25 to trip toward the fixed contact 105, closing the circuit.

[0041] Emergency thermal tripping, shown in Figure 9, is ensured by bimetallic members 28 which are identical but independent and are per se known; by bending partially toward the inside of the containment body 101, the members strike, by means of a thermal actuator 29 with which they are provided, an upper extension of the release lever 20.

[0042] The consequent counterclockwise rotation induced on the release lever 20 releases the contrast lever 17 from the detent 19.

[0043] The contrast lever 17, by turning counterclockwise, frees the oscillating end of the opening lever 12, which therefore cannot contrast the action of the release springs 7, which are activated and pull the traction pivot 16 toward the head portion 5 of the handle support 1.

[0044] The traction pivot causes the counterclockwise rotation of the opening lever 12 and the clockwise rotation, by means of the actuation linkages 15, of the engagement lever 22 which, by means of a protruding profile 30, abuts against a contrast edge of the movable contact lever 25, making it turn clockwise with a snap action, thus opening the circuit.

[0045] The release lever 20 is returned to the initial position of mutual abutment with the contrast lever 17 by means of a contrast spring.

[0046] The release lever can also be actuated when the circuit is open, obviously when the mechanism is reset, in order to check the correct release of the opening lever 12 by means of the test button 113.

[0047] The position of the bimetallic members 28 can be modified by means of an adjustment screw which can be actuated from the front panel of the circuit breaker containment body, varying the position between the thermal actuator 29 and the upper extension of the release lever 20 and adjusting thermal release tripping.

[0048] In the case of magnetic tripping, shown in Figure 8, a horizontal magnetic pusher 32 actuated by the electrical protection device 109 in a per se known manner pushes a magnetic release lever 33 pivoted to the containment body, making it turn counterclockwise, so that a lug 34 thereof abuts against the front of a concave region 35 of the movable contact lever 25, which opens the circuit by being turned clockwise. The magnetic pusher 32 moves the movable contact 104 away from the fixed contact 105 by a few millimeters, typically 4-5 millimeters, before the electrical protection member 109 actuates the thermal tripping mechanism 108 described earlier so as to fully open the contacts as described hereinafter.

[0049] The magnetic release lever 33 is returned into position by a contact spring, while the repositioning of the pusher is achieved by means of a magnetic spring loaded during the closure of the magnetic section of the electrical protection device.

[0050] An external portion of the magnetic section is coupled to a movement lever 36, which is pivoted, by a pivot 37, to the containment body, which has a contact end 38 and a protruding step 39.

[0051] When the magnetic section closes, the movement lever 12 is turned clockwise, abutting by virtue of the protruding step 39 against a lower extension of the release lever 20, making it turn counterclockwise and thus activating the release sequence that leads to the full opening of the contacts, which has already been described with reference to thermal tripping, as shown in Figure 12.

[0052] The circuit breaker is provided with an adjustment mechanism which allows to position the magnetic section so as to vary the gap of the electrical protection device 109, as shown in Figures 11 and 13, and therefore adjust the tripping threshold thereof, in the manner described above.

[0053] In particular, on the front mask 102 of the con-

tainment body 101 there is a camtype screw 40, which can be actuated by means of a tool that acts on a first arm of an adjustment lever 41 pivoted to the containment body 101, making it turn counterclockwise in an adjustable manner up to a maximum angle. A second

arm of the adjustment lever 41 acts on the contact end 38 of the movement lever 36, actuating it.

[0054] The magnetic section, moved by the movement lever 36, thus varies the gap between a maximum value, substantially at the vertical position of the movement lever, and a minimum value, at the position of maximum inclination of the movement lever 36 allowed by the adjustment lever 41.

[0055] It is noted that, in the minimum gap position, the movement lever 36 places its protruding step 39 practically adjacent to the lower extension of the release lever 20 to allow more prompt actuation.

[0056] Each fixed contact 105, with the corresponding electrode 111 and arc quenching chamber, is contained in a containment body 50, which can be removed from the compartment in which it is accommodated inside the circuit breaker.

[0057] The containment body is constituted by a left side wall 51 and by a right side wall 52, which are made of thermosetting plastic material and are coupled along corresponding closure edges and are fastened by rivets 53, so as to constitute a sort of box-like body which has, at the rear, a vertical slot through which the movable contact 104 slides during the opening and closure of the circuit breaker.

[0058] The left side wall 51 has, in a lower region, a seat 54 which accommodates an electrode 111 for the external electrical connections, on the upper end portion of which the pad of the fixed contact 105 is fixed, closing the vertical slot in a lower region.

[0059] A sliding electrode 55 transfers the electric arc to a plurality of arc-like arc quenching blades or laminas 56, arranged in a parallel configuration along guides 57 formed in the inner lateral surfaces of the side walls 51 and 52. Both side walls have, at the rear, seats 58 in which magnetic reinforcement blades 59 are inserted; as a whole, the blades surround the fixed contact 105 in order to increase the magnetic field that repels the movable contact with respect to the fixed contact when the circuit breaker is short-circuited, so as to accelerate contact separation even before the electrical protection device trips.

[0060] This magnetic repulsion is even more effective when the contacts are closed in the presence of a short circuit. The snap closure of the circuit breaker, as described above, in fact occurs while the movable contacts are very close to the fixed contacts and therefore requires a small impact force in order to be performed.

[0061] This allows magnetic repulsion to accelerate more promptly the separation of the movable contact when the circuit breaker is closed in the presence of a short circuit, even before the magnetic section trips. Moreover, the arrangement of the engagement springs

does not hinder the opening of the circuit breaker due to magnetic repulsion, allowing the movable contact lever to turn clockwise although the movable contact support remains motionless, with no opposition on the part of the traction applied by the springs.

[0062] In practice it has been observed that the invention achieves the intended aim and objects, an enclosed circuit breaker having been provided which has improved electrical characteristics.

[0063] The circuit breaker has the advantage of achieving a more rapid opening of the contacts in the presence of a short circuit by means of the magnetic reinforcement laminas and of a particular arrangement of the engagement springs.

[0064] A further advantage of the circuit breaker is that it has a closure mechanism that allows to close the contacts with a reduced impact force, so as to make their magnetic repulsion particularly effective when the circuit breaker is closed while a short circuit is already occurring.

[0065] A further advantage of the circuit breaker is that it has a mechanism for adjusting the tripping threshold of the electrical protection device by varying the gap of the magnetic section.

[0066] A further advantage of the circuit breaker is that it has an arc quenching chamber that is monolithic and removable and includes the fixed contact with the corresponding electrode for external connections and magnetic reinforcement laminas.

[0067] Advantageously, the side walls that constitute the arc quenching chamber containment enclosure are made of thermosetting plastics, while the rest of the circuit breaker containment body is made of thermoplastic material.

[0068] The device according to the invention is susceptible of numerous modifications and variations, within the scope of the appended claims. All the details may be replaced with technically equivalent elements.

[0069] The materials used, as well as the dimensions, may of course be any according to requirements and to the state of the art.

Claims

1. An enclosed magnetothermal electric circuit breaker, comprising a containment body that contains movable electrical contacts, which are in parallel and move synchronously, and a corresponding number of fixed contacts with corresponding arc quenching chambers, a mechanism for actuating the movable electrical contacts, a thermal tripping mechanism, an electrical protection device associated with a magnetic tripping mechanism, and a connection means for the external electrical connections, **characterized in that** said actuation mechanism allows said movable electrical contacts to reach a stable position that is extremely close to

said fixed contacts and then trip, from said position, onto said fixed contacts, closing said circuit breaker, regardless of the force and speeds applied to the actuation handle.

2. The circuit breaker according to claim 1, **characterized in that** said actuation mechanism uses a handle support which acts, by means of actuation tabs, on a cam-like profile formed on two closure linkages.
3. The circuit breaker according to claim 2, **characterized in that** said handle support is substantially saddle-shaped, with a head portion and two identical lateral portions, two slots and two holes being formed on said head portion, the hooks of two release springs entering said holes, said springs being coupled to a protruding cambered portion provided between said slots and said holes, said portion acting as a locator for said springs, said head portion having an actuation lug, said two lateral portions of the handle support each having a pivoting protrusion by means of which said handle support is pivoted to the containment body, each lateral portion comprising a central tab and an actuation tab which protrudes toward the inside of the concave region of said handle support.
4. The circuit breaker according to one or more of the preceding claims, **characterized in that** said actuation tabs act symmetrically, during the closure of the circuit breaker, on said two closure linkages, slidably contacting a concave profile formed at one end of each linkage by means of a wedge-shaped protruding portion that constitutes a sort of cam, said concave profile allowing said movable contacts to move no closer to the fixed contacts with respect to said stable position and simultaneously allowing the loading of elastic means adapted to close said movable contacts with a snap action.
5. The circuit breaker according to one or more of the preceding claims, **characterized in that** from the position in which the circuit breaker has undergone thermal or magnetic tripping, said handle support is turned clockwise about the pivoting protrusions, which are pivoted to the containment body, by means of an actuation handle rigidly coupled thereto, said handle support abutting by virtue of the actuation lug against an abutment step formed on an opening lever and moving it, said opening lever sliding within the slot formed by said two actuation tabs.
6. The circuit breaker according to one or more of the preceding claims, **characterized in that** said opening lever has a first end, which is pivoted to said containment body, and a second end, which can oscillate freely, said opening lever, during rotation,

moving said closure linkages, said linkages being pivoted laterally to said opening lever by virtue of a pivot at a first end, while each one of said second ends is pivoted to an actuation lever by virtue of a single traction pivot, which acts as a support for coupling the hooks of said release springs.

7. The circuit breaker according to one or more of the preceding claims, **characterized in that** said closure linkages, during a combined rotary and translational motion, tension said release springs, moving said traction pivot away from said head portion of said handle support, said pivot contrasting the movement of said closure linkages by means of the reaction of said release springs and therefore contrasting the rotation of said opening lever.
8. The circuit breaker according to one or more of the preceding claims, **characterized in that** at the end of the stroke of said handle support said oscillating end of said opening lever enters a slot formed in a contrast lever and engages an upper edge of said slot in order to remain in position, so as to contrast the action of said release springs.
9. The circuit breaker according to one or more of the preceding claims, **characterized in that** said contrast lever is pivoted to the containment body with a first end and abuts, with a second end, against a detent of a release lever which acts as a ratchet system for said contrast lever, preventing its counterclockwise rotation and the consequent disengagement of said opening lever.
10. The circuit breaker according to one or more of the preceding claims, **characterized in that** for contact closure, from the position in which the mechanism has been reset, said actuation handle is moved forward by turning counterclockwise said handle support, during said rotation said opening lever remaining locked by said contrast lever, said second end of said closure linkages being turned clockwise by way of the contact of said actuation tabs of said handle support during rotation on said concave profile at said second end of said closure linkages.
11. The circuit breaker according to one or more of the preceding claims, **characterized in that** said traction pivot is moved toward the pivoted end of said opening lever, subjecting to a combined rotary and translational motion said traction linkages, which in turn subject to a counterclockwise rotation, by means of a connecting pivot, an engagement lever pivoted to the containment body by means of a kinematic actuation pivot.
12. The circuit breaker according to one or more of the preceding claims, **characterized in that** said con-

necting pivot, during its movement, acts on the support of the movable contacts so as to turn counterclockwise said movable contact lever, which is pivoted in said support of the movable contacts, so as to gradually move the movable contact toward the fixed contact up to said stable position; as the rotation of said handle support continues to the end of its stroke, said actuation tab sliding along said concave profile of said closure linkages up to the apex of the wedge, turning the second end of said closure linkages up to the pivoted end of the opening lever.

13. The circuit breaker according to one or more of the preceding claims, **characterized in that** said actuation linkages move said connecting pivot, said connecting pivot tracing a circular path without causing further rotation of said movable contact lever with respect to said stable position; the simultaneous counterclockwise rotation of said movable contact support, caused by said connecting pivot, subjecting to traction an engagement spring, which is fixed to a pivot provided on said engagement lever and to a hook-shaped profile formed on said movable contact lever, said connecting pivot contrasting the counterclockwise rotation of said movable contact lever; at the end of the stroke of the handle support, the return action of the engagement springs allowing said movable contact lever to trip toward said fixed contact, closing the circuit.
14. The circuit breaker according to one or more of the preceding claims, **characterized in that** thermal emergency tripping is ensured by identical but independent bimetallic members, which by bending partially toward the inside of said containment body strike, by means of a thermal actuator with which they are provided, an upper extension of said release lever, said release lever, by turning counterclockwise, releasing said contrast lever from said retention pawl, said contrast lever turning counterclockwise and releasing the oscillating end of said opening lever, said opening lever being unable to contrast the action of said release springs, said release springs moving said traction pivot toward the head portion of said handle support, said traction pivot causing the counterclockwise rotation of said opening lever and the clockwise rotation of said engagement lever by virtue of said traction linkages, said engagement lever, by means of a protruding profile, abutting against a contrast edge of said movable contact lever, making it turn counterclockwise with a snap action and thus opening the circuit.
15. The circuit breaker according to one or more of the preceding claims, **characterized in that** in case of magnetic tripping a horizontal magnetic pusher actuated by said electrical protection device pushes a magnetic release lever pivoted to said containment

body, making it turn counterclockwise so that a lug thereof abuts against the front of a concave region of said movable contact lever which, by being turned clockwise, opens the circuit.

16. The circuit breaker according to one or more of the preceding claims, **characterized in that** an external portion of the magnetic section of the electrical protection member is coupled to a movement lever pivoted to the containment body, said movement lever comprising a contact end and a protruding step; said movement lever being moved clockwise, when the magnetic section closes, abutting, by means of the protruding step, with a lower extension of said release lever, turning it counterclockwise and activating release by thermal tripping.
17. The circuit breaker according to one or more of the preceding claims, **characterized in that** the circuit breaker is provided with an adjustment mechanism which allows to position the magnetic section so as to vary the gap of the electrical protection device and therefore vary accordingly the tripping threshold thereof.
18. The circuit breaker according to one or more of the preceding claims, **characterized in that** said adjustment mechanism is constituted by a cam-like screw, which can be actuated by means of a tool that acts on a first arm of an adjustment lever pivoted to the containment body, making said lever turn counterclockwise and adjustably up to a maximum angle, said adjustment lever acting by means of a second arm on said contact end of said movement lever, actuating it, said movement lever moving said magnetic section in order to vary the gap between a maximum value, substantially at the vertical position of said movement lever, and a minimum value at the position of maximum inclination of said movement lever allowed by said adjustment lever, said movement lever placing, in said minimum gap position, its protruding step adjacent to said lower extension of the release lever.
19. The circuit breaker according to one or more of the preceding claims, **characterized in that** each fixed contact with the corresponding electrode and arc quenching chamber is contained within a containment body which can be removed from the compartment in which it is arranged inside the circuit breaker.
20. The circuit breaker according to one or more of the preceding claims, **characterized in that** said containment body is constituted by a right side wall and a left side wall, said side walls mating along corresponding closure edges by means of rivets, so as to constitute a sort of box-like body that has, at the

rear, a vertical slot through which said movable contact slides during the opening and closure of the circuit breaker.

21. The circuit breaker according to one or more of the preceding claims, **characterized in that** said left side wall comprises, in a lower region, a seat that accommodates a connection electrode for the external electrical connections, on the upper end portion of which the pad of the fixed contact is fixed, said pad closing in a lower region said vertical slot, said seat containing a sliding electrode for transferring the electric arc to a plurality of arc-like arc quenching blades arranged in a parallel configuration along guides formed on the internal lateral surfaces of the side walls. 5 10 15
22. The circuit breaker according to one or more of the preceding claims, **characterized in that** both of said side walls comprise, at the rear, seats adapted to contain magnetic reinforcement blades, said blades surrounding said fixed contact in order to increase the magnetic field that repels said movable contact from said fixed contact when the circuit breaker short-circuits, so as to accelerate the separation of said contacts even before said electrical protection device trips. 20 25

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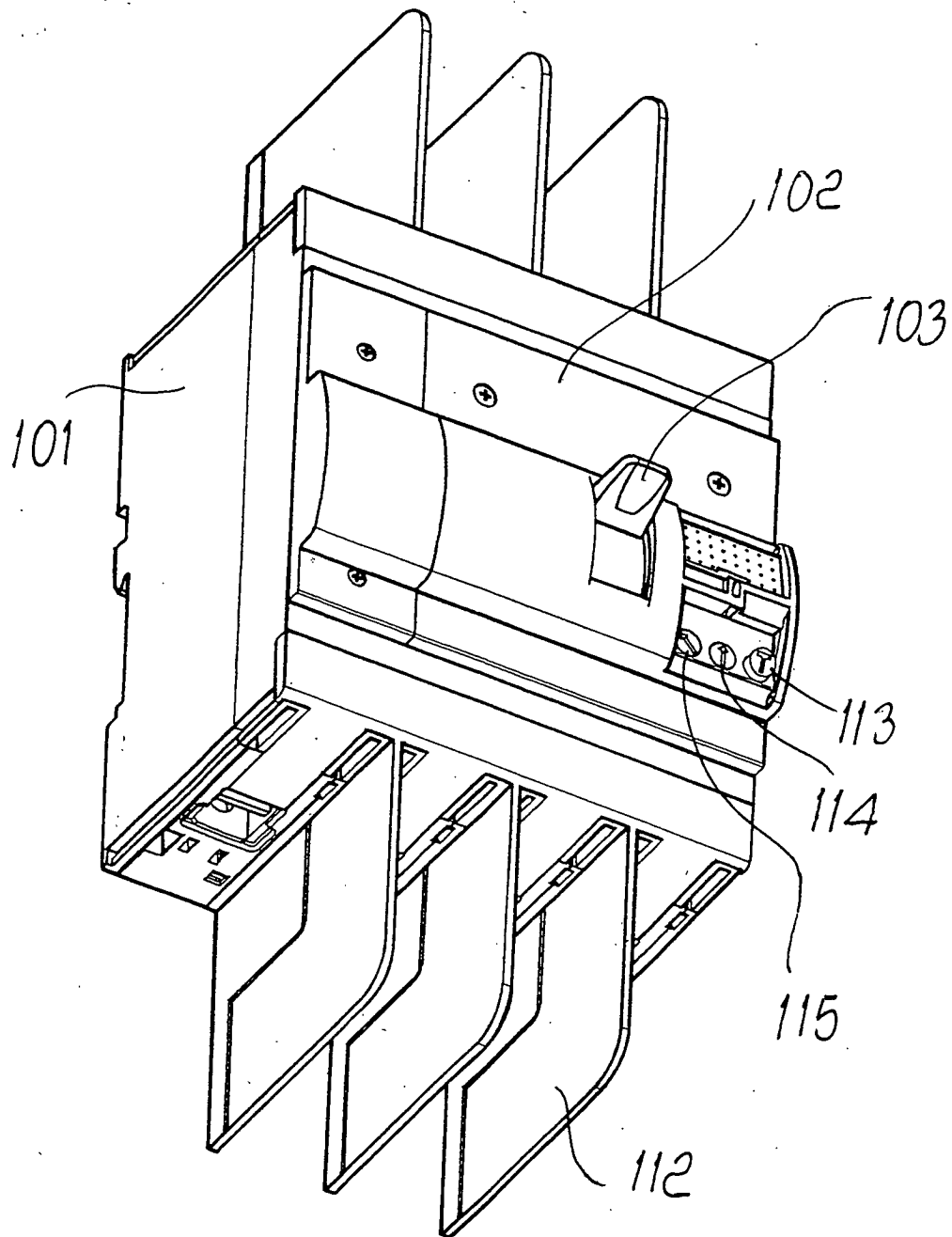


Fig. 1

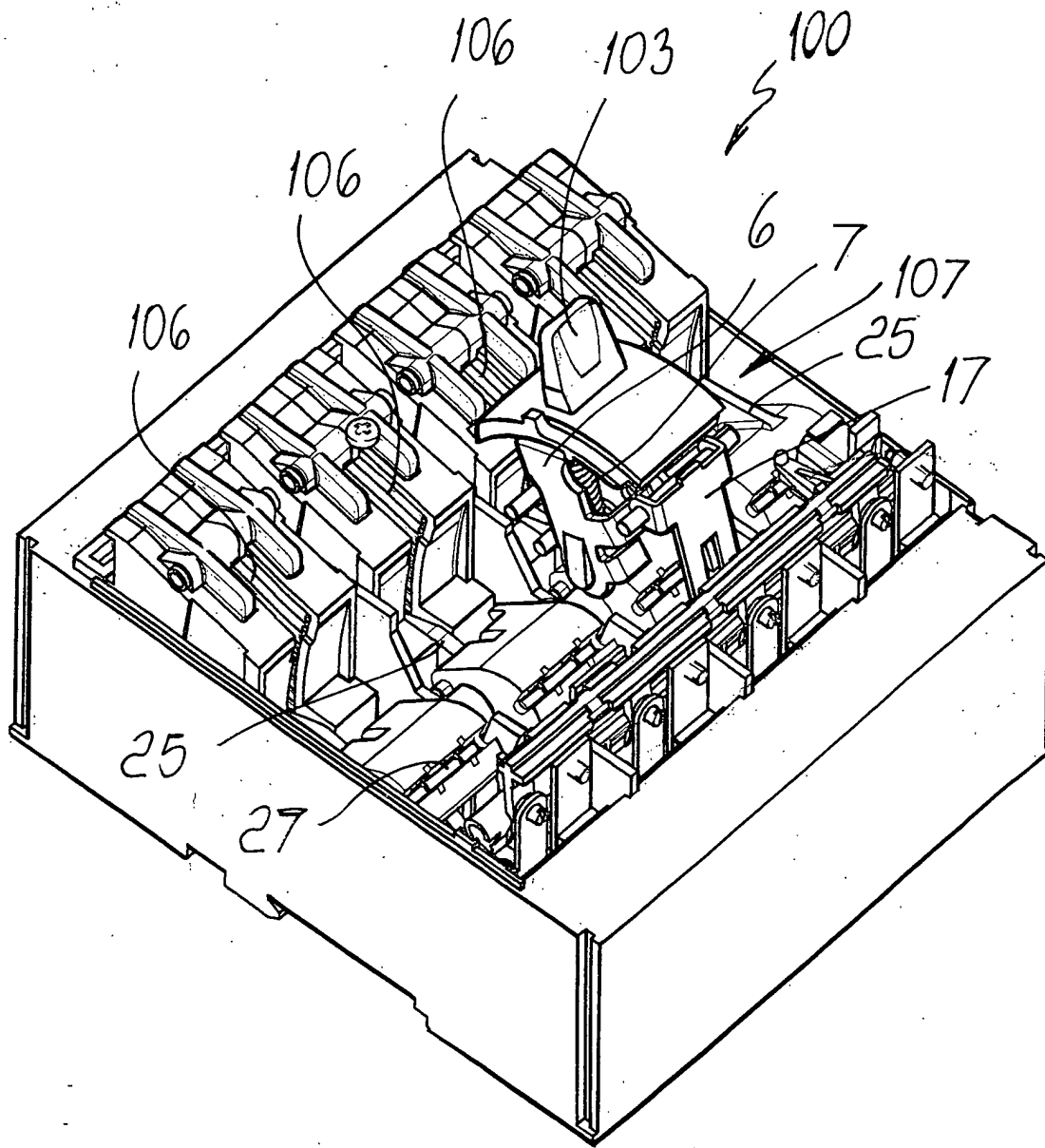
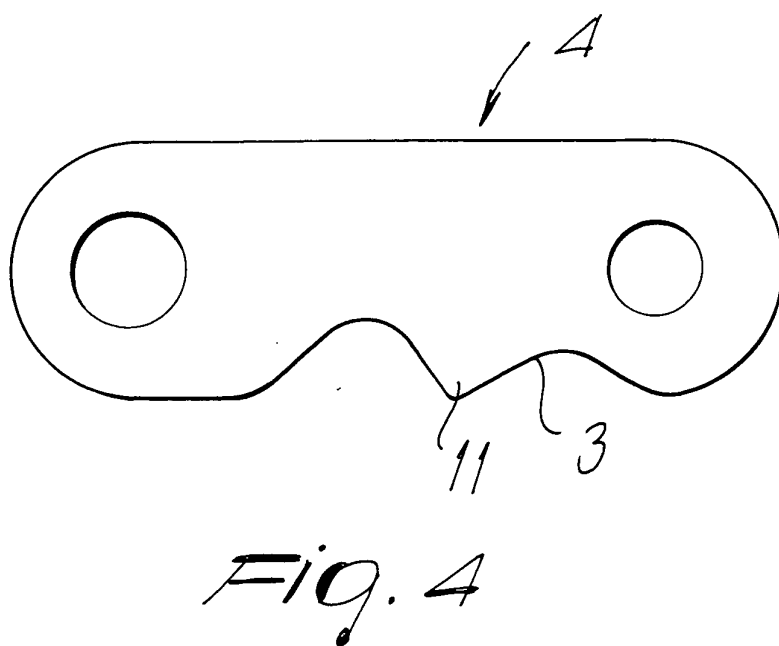
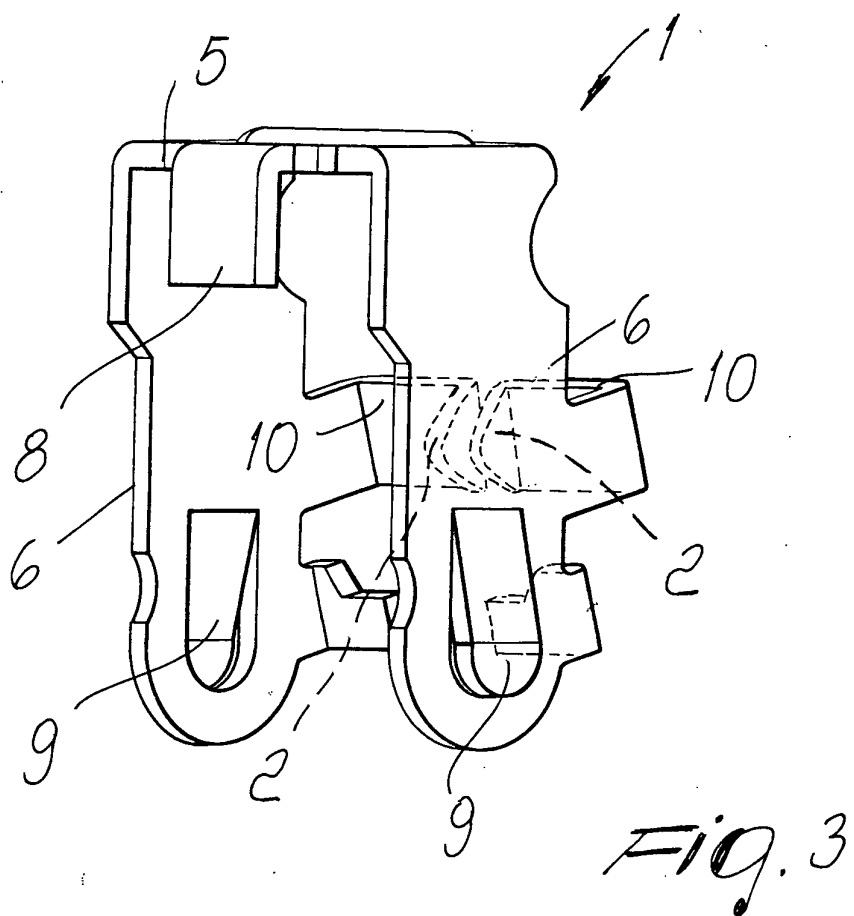


Fig. 2



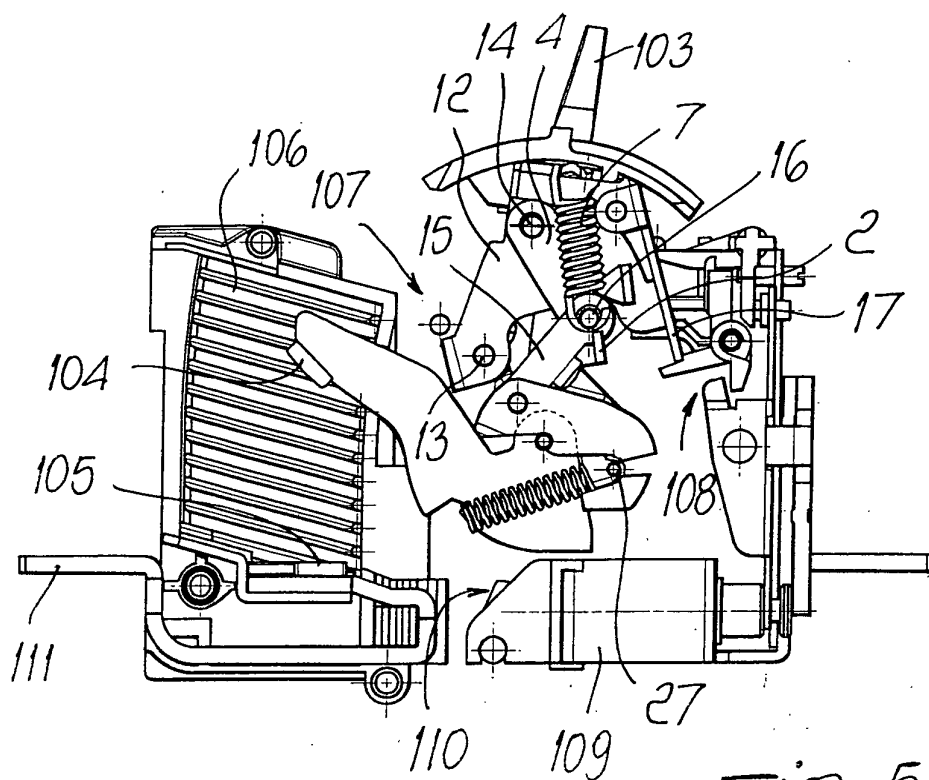


Fig. 5

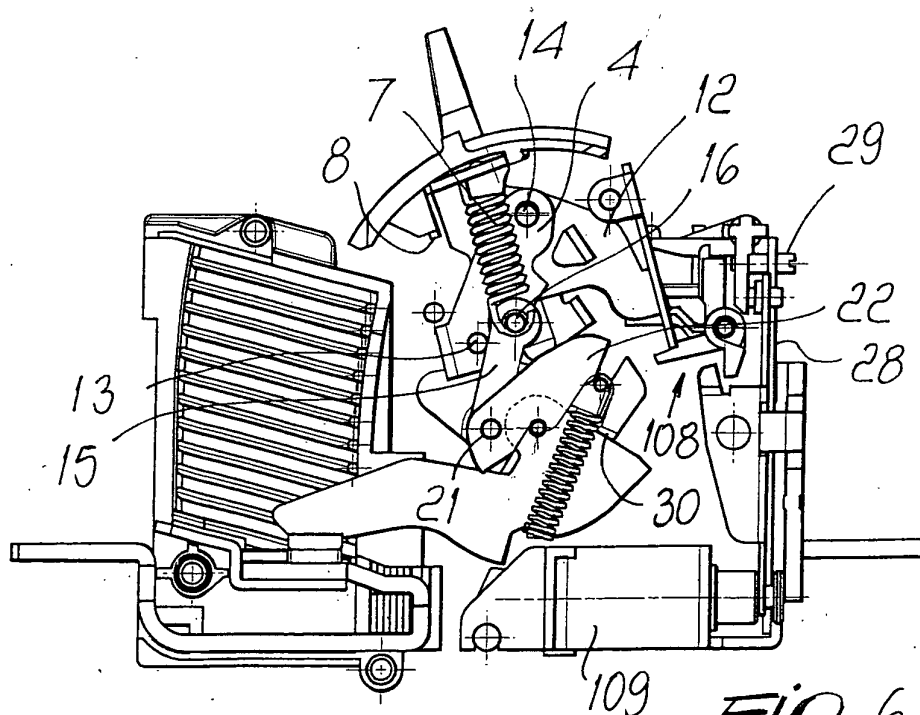
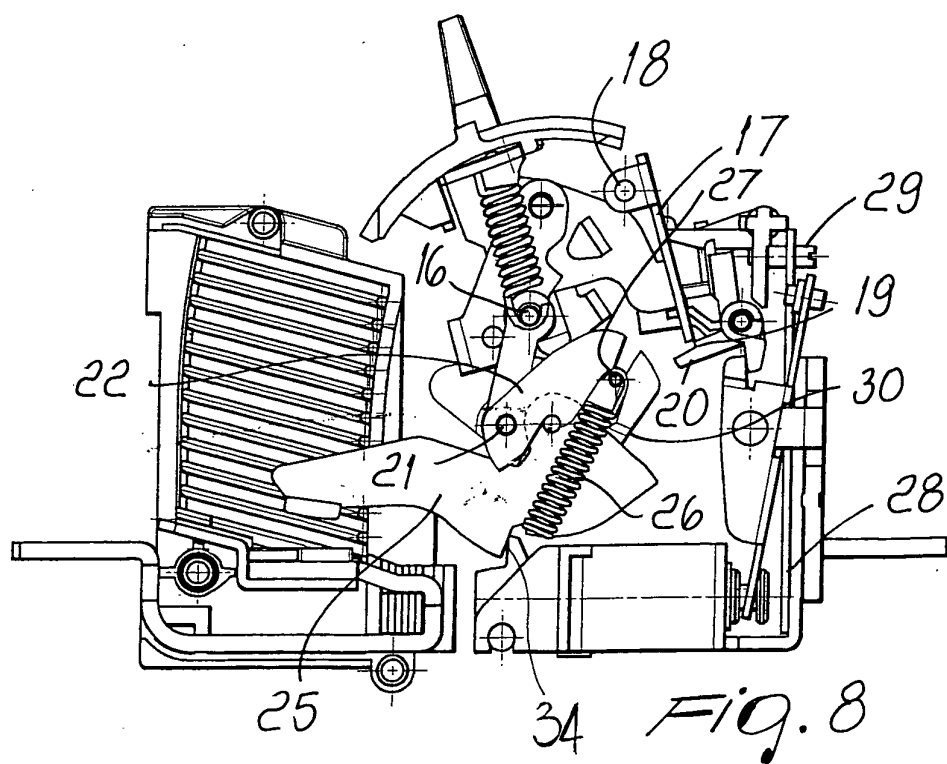
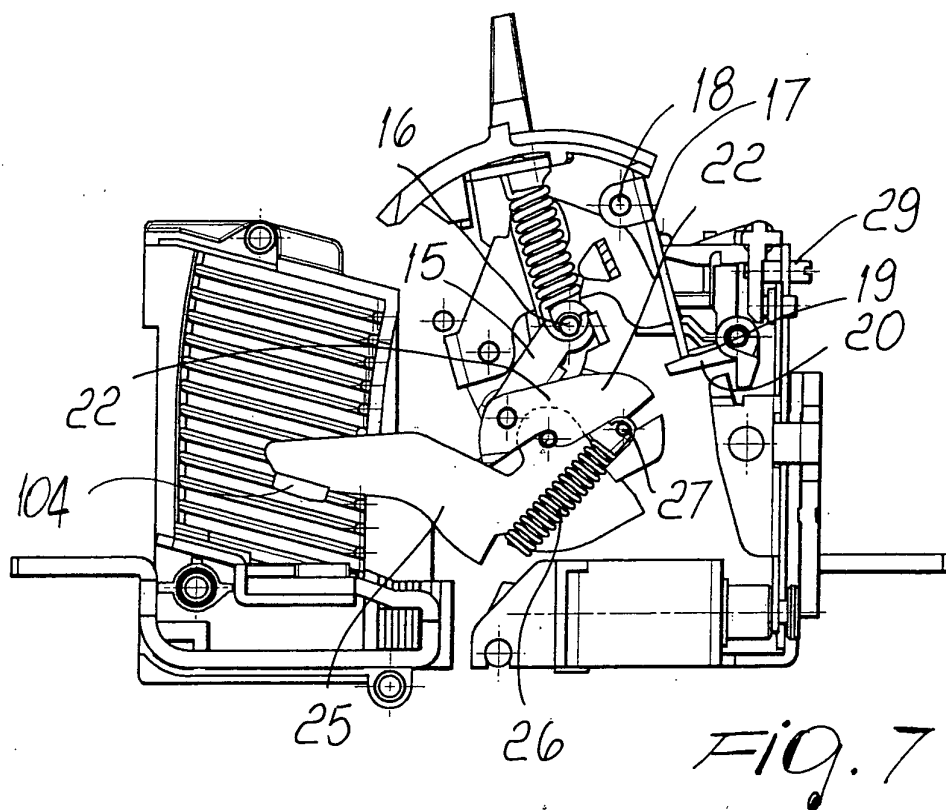
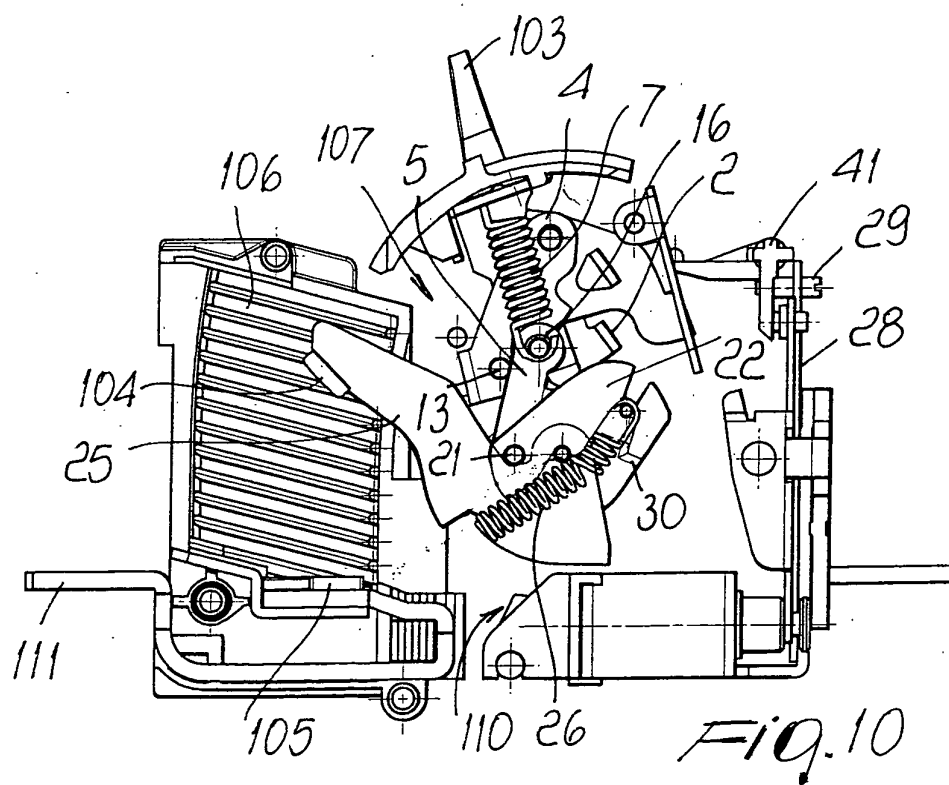
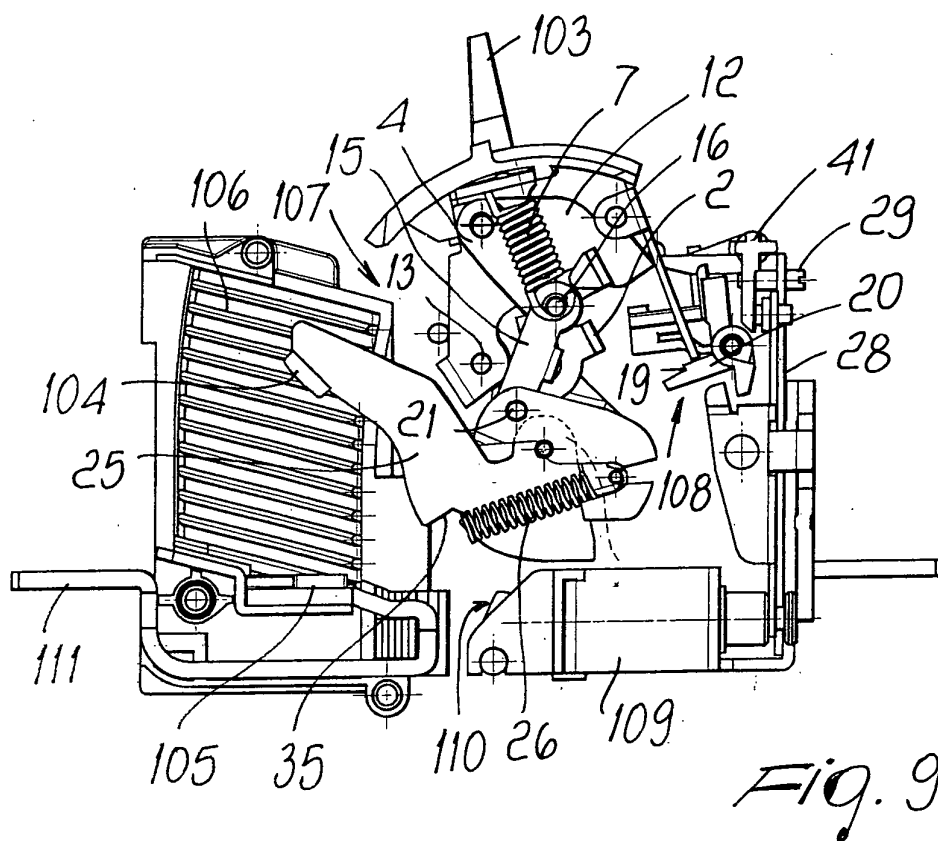
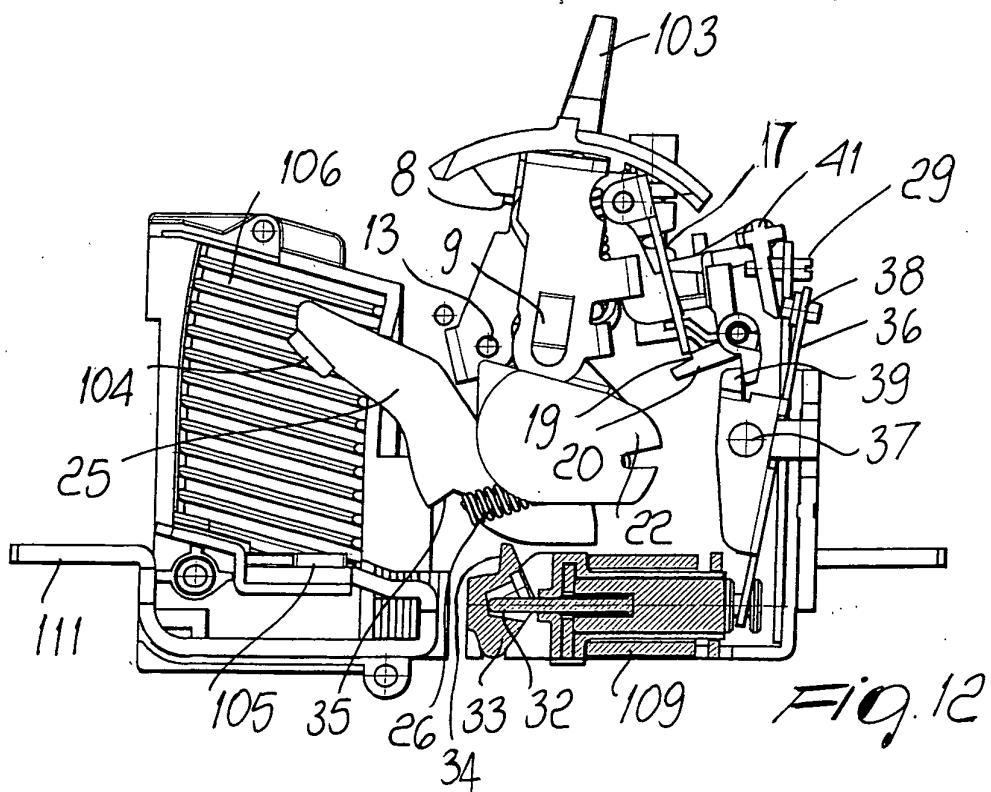
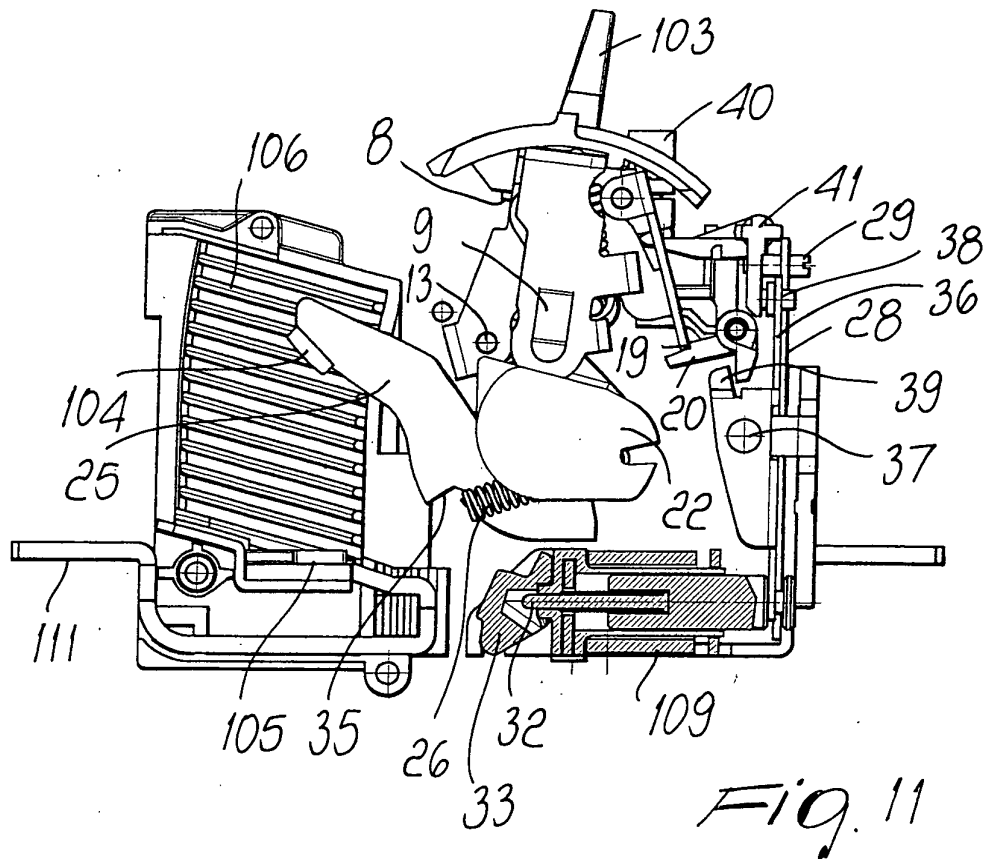


Fig. 6







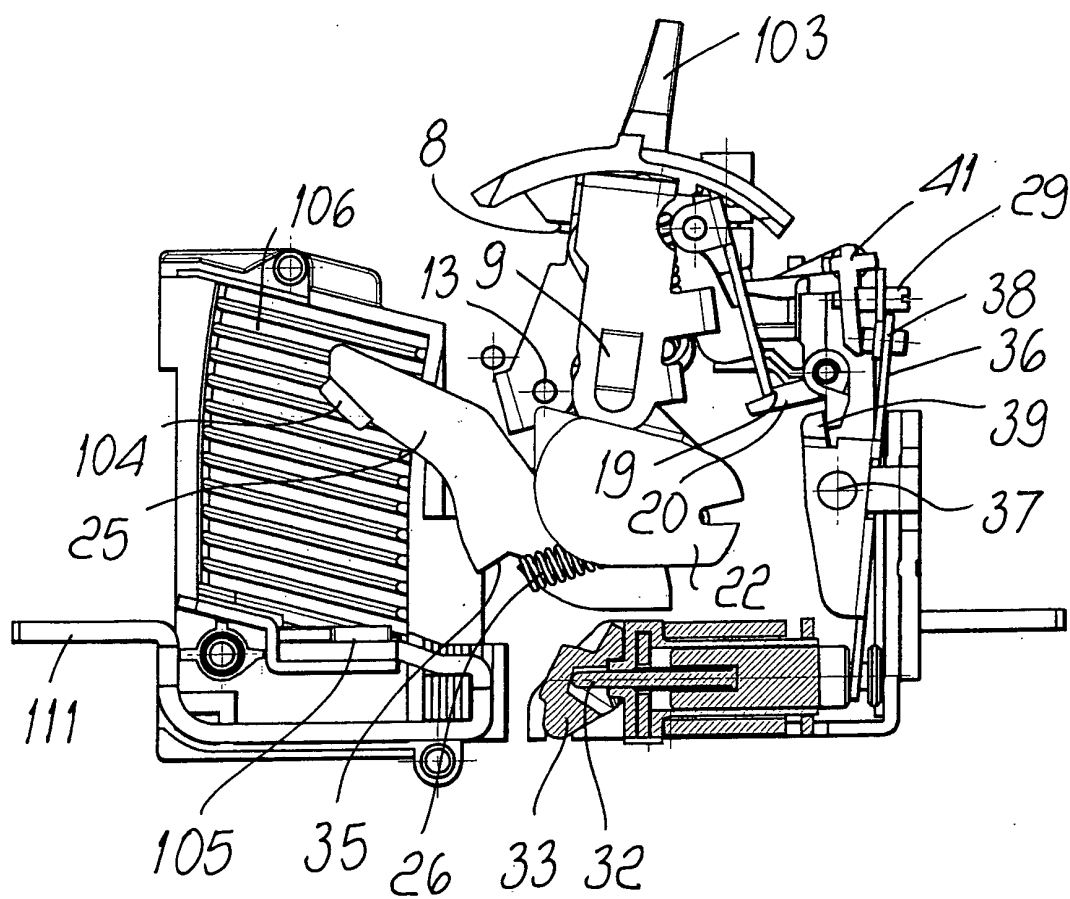
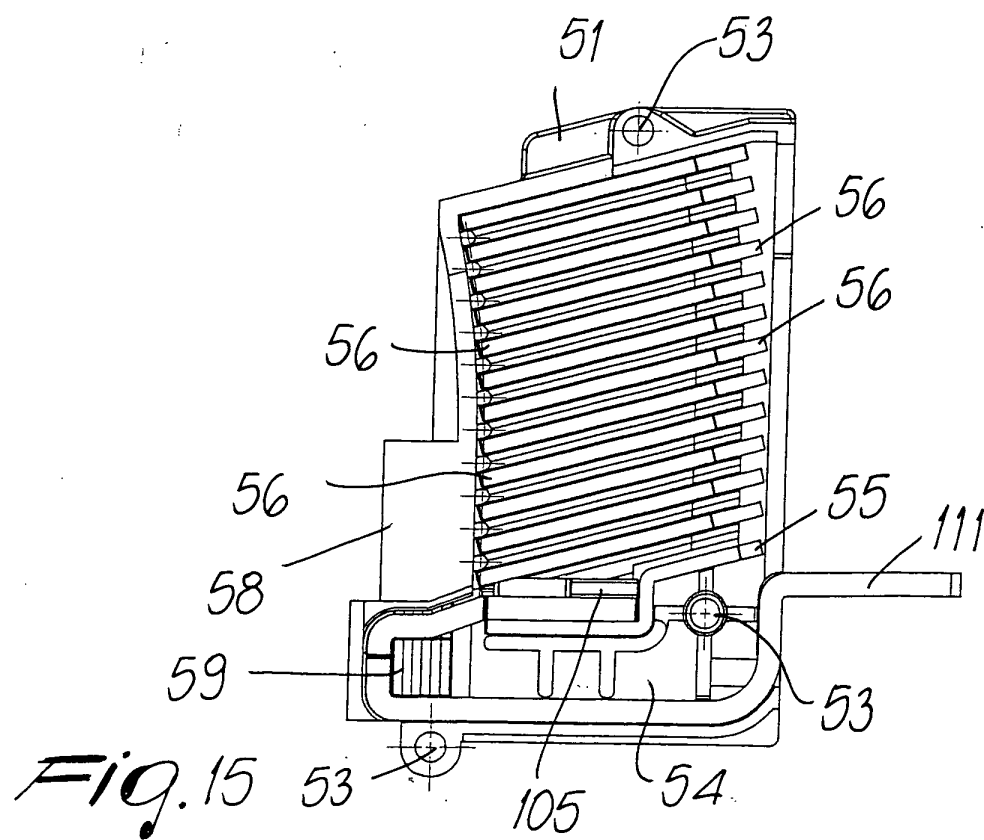
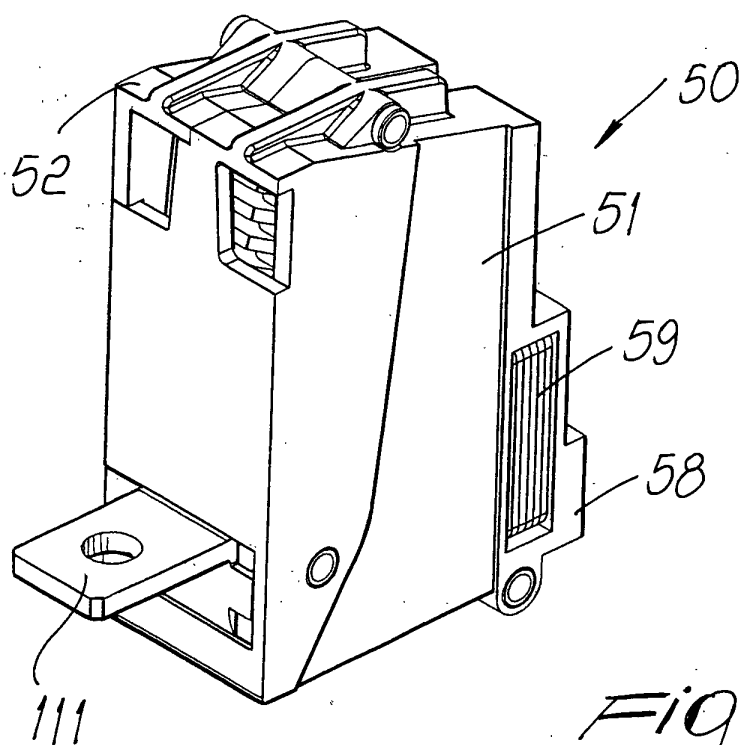
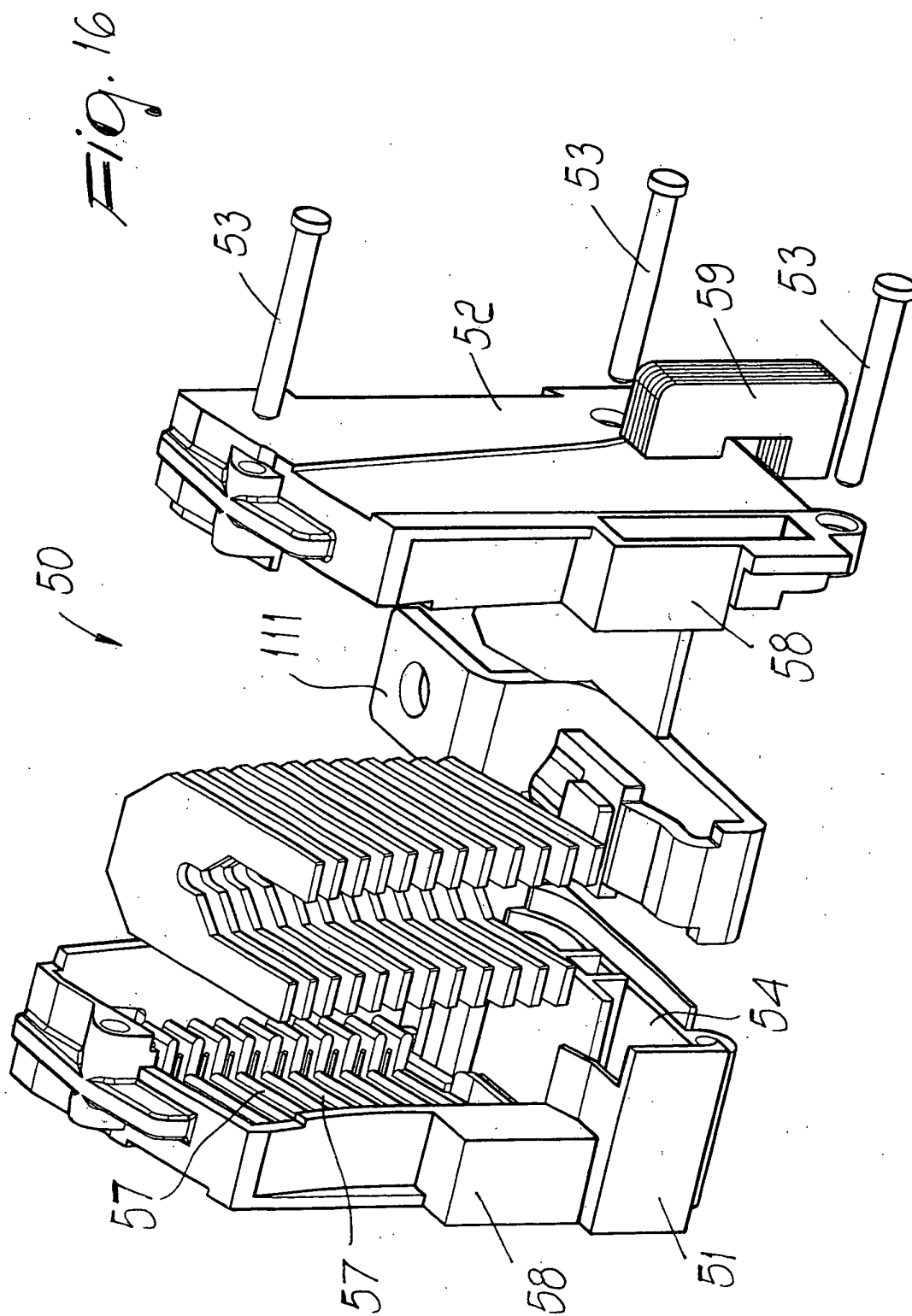


Fig. 13







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