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(54) **A double-pole circuit breaker for civil range electric equipment, incorporating an arc change-over device.**

(57) A double-pole circuit breaker (1) for enclosed boxes of civil range electric equipment has longer life and comprises, within a body (8), neutral (15) and protected (14) poles, moving (23,19) and fixed (22,18) contacts for each pole (15, 14), a diaphragm (3) in said body (8), two chambers (34,33) formed in said body (8) on opposed sides of the diaphragm (3) and being each adapted to accommodate a respective one of said moving contacts (23,19) for movement therein through a preset path (T) toward and away from a respective one of the fixed contacts (22,18), a throughgoing socket (35) in said diaphragm (3), and a metal crosspiece (37) having a middle portion inserted in said socket (35) and end portions (39,38) overhanging in said chambers (34,33) at a location facing said path (T).

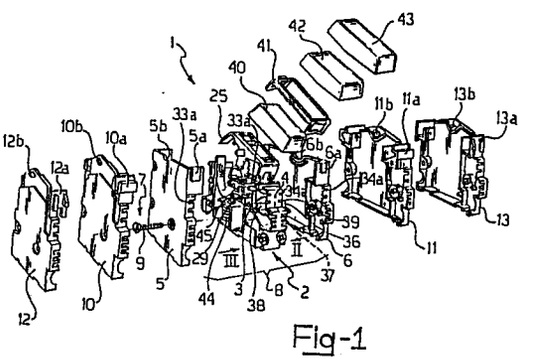

Fig-1

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Description

This invention relates to a double-pole circuit breaker for enclosed boxes of civil range electric equipment, being of a type which comprises, within a body, a neutral pole and a protected pole, as well as a moving contact and a fixed contact for each pole.

It is a known fact that on breaking an electric circuit an electric arc is struck between each moving contact and its respective fixed contact. This arc causes over time cratering especially of the moving contact.

It is an object of this invention to provide a circuit breaker as specified above, which affords longer life of its moving contacts.

This object is achieved by that a circuit breaker as indicated is characterized in that it comprises a diaphragm in said body, two chambers formed in said body on opposed sides of the diaphragm, each adapted to accommodate a respective one of said moving contacts for movement therein along a preset path toward and away from a respective one of said fixed contacts, a throughgoing socket in said diaphragm, and a metal crosspiece having a middle portion inserted in said socket and end portions overhanging into said chambers at a preset distance from said path.

Further features and the advantages of the circuit breaker according to this invention will become apparent from the following detailed description of a preferred embodiment thereof, given by way of illustration and not of limitation with reference to the accompanying drawings, where:

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

Figure 2 is a perspective detail view of the circuit breaker in Figure 1, as viewed in the direction of the arrow II;

Figure 3 is an elevation detail view of the circuit breaker in Figure 1, as viwed in the direction of the arrow III;

Figure 4 is an elevation view of the same detail as in Figure 3, but at a different stage of its operation; and

Figure 5 is an enlarged scale plan view of another detail of the circuit breaker shown in Figure 1.

With reference to the drawing figures, the numeral 1 designates generally a circuit breaker according to the invention, which is adapted for mounting on a small carrier frame, not shown in the drawing, for enclosed boxes of civil range electric equipment. Understandably, such circuit breakers as this may also be used for jutting installations and in exchanges.

The inventive circuit breaker 1 comprises a core member 2 of substantially parallelepipedal shape which is formed by a substantially rectangular central diaphragm 3 surrounded, along one side and the two sides adjoining said one side, by a framing member 4. The circuit breaker 1 further comprises a pair of cheek pieces, namely a first cheek piece 5 and second cheek piece 6, as well as fasteners 7 for securing the cheek pieces 5 and 6 on the core member 2, to form a box-type body 8 adapted for mounting on a carrier frame from the MAGIC civil range which constitutes a module measuring preferably 23-25 mm thereacross. To this aim, the cheek pieces 5 and 6 are provided with attachment means indicated at 5a and 6a, respectively, in the form of blocks of a preset size adapted to engage with mating means of attachment associated with the carrier frame from the MAGIC range.

The fasteners 7 for securing the cheek pieces 5 and 6 on the core member 2 comprise four screws 9 extending from the cheek piece 5 through the core member 2 and in thread engagement with the cheek piece 6.

The circuit breaker 1 also comprises a further pair of cheek pieces 10 and 11, respectively interchangeable with the cheek pieces 5 and 6 in the first-mentioned pair and attachable to the core member 2 by means of like fasteners 7. In this instance, the circuit breaker 1 would fit in a carrier frame from the LIVING civil range. To this aim, the cheek pieces 10 and 11 are provided with respective attachment means 10a and 11a in the form of blocks of a preset size adapted for engagement with mating means of attachment associated with the carrier frame from the LIVING range.

The circuit breaker 1 also comprises a further pair of cheek pieces 12 and 13, also respectively interchangeable with the cheek pieces 5 and 6 in the first-mentioned pair and attachable to the core member 2 by means of like fasteners 7. In this instance, the circuit breaker 1 is adapted to fit in a carrier frame from the TEKNE range. To this aim, the cheek pieces 12 and 13 are provided with hook-on dogs 12a and 13a adapted to engage in corresponding sockets associated with the carrier frame from the TEKNE range.

In the body 8 of the circuit breaker 1 there are housed a pole pair, namely a protected pole 14 and neutral pole 15. The protected pole 14 is accommodated between the core member 2 and the cheek piece 5, and extends between an input terminal 16 and an output terminal 17. Provided along the pole 14 are a fixed contact 18 located on the input terminal 16 side and a moving contact 19 located on the output terminal 17 side. The neutral pole 15 is accommodated between the core member 2 and the cheek piece 6, and extends between an input terminal 20 and an output terminal 21. Provided along the pole 15 are a fixed contact 22, located on the input terminal 20 side, and a moving contact 23, located on the output terminal 21 side.

The circuit breaker 1 further comprises circuit breaking linkages, comprehensively designated 24, which are supported on the core member 2. The linkages 24 include a key 25 and a moving contact holder assembly 26. Between the key 25 and the moving contact holder assembly 26 there is provided a toggle mechanism, known per se and indicated at 27.

The circuit breaking linkages 24 also comprise a spring-loaded lever 28 for hooking the moving contact holder assembly 26 in the make position of the circuit breaker. The lever 28 is pivoted to the diaphragm 3 astride it and has two lugs 29 and 30 located on opposed sides of the diaphragm 3, the lug 29 being located on the cheek piece 5 side and the lug 30 being located on the cheek piece 6 side.

The moving contact holder assembly 26 comprises a contact carrier body 31 being a unitary construction from a non-conductive material, such as a plastics material, and straddling the diaphragm 3 of the core member 2. Spring mounted to the contact carrier body 31 are the two moving contacts 19 and 23 through respective means of attchment 32, to be explained hereinafter.

The two moving contacts 19 and 23 extend on opposed sides of the diaphragm 3 into two respective arcing chambers 33 and 34 formed in the body 8 between the core member 2 and the cheek pieces 5 and 6, respectively. The arcing chambers 33 and 34 are formed with respective venting slits 33a and 34a which open outwards and are formed in part in the cheek pieces and in part in the framing member 4 of the core member 2, on opposed sides with respect to the central diaphragm 3. The moving contacts 19 and 23 are movable through equal paths T toward and away from their respective fixed contacts 19 and 22 facing said chambers 33 and 34, respectively.

Formed in the diaphragm 3 of the core member 2 is a throughgoing socket 35 having an L-shaped cross-section. Indicated at 36 is a metal crosspiece, made preferably of copper-plated iron, which has an L-shaped cross-section mating with the L-shaped cross-section of the throughgoing socket 35.

The crosspiece penetrates, with a middle portion 37 thereof, the throughgoing socket 35, in a substantially force fit relationship, and has opposed end portions 38 and 39 overhanging into said chambers 33 and 34.

The socket 35, and hence the crosspiece 36, is positioned relatively to the moving and fixed contacts such that the crosspiece locates itself at a preset distance from the path T, preferably at 2-3 mm, and such that the back of the "L" is facing the path T.

The key 25 of the circuit breaker 1 according to the invention is adapted to receive by snap action a key capping 40 as appropriate for the MAGIC civil range. It should be noted that the cheek pieces 5 and 6 are provided with respective seats 5b and 6b mating with the key 25. Indicated at 41 is a yoke which extends all around the key 25 and the capping 40 and is provided with means of mechanical connection interacting between the attachment means 5a and 6a and the carrier frame from the MAGIC civil range.

The key 25 is adapted to receive by snap action and in an interchangeable manner with the capping 40, a key capping 42 appropriate for the LIVING civil range and a key capping 43 appropriate for the TEKNE civil range, also in an interchangeable manner with the capping 40.

The cheek pieces 10 and 11, as well as the cheek pieces 12 and 13, are provided with respective seats 10b,11b, and 12b,13b mating with the key 25.

The circuit breaker 1 according to the invention further includes, within the body 8, an amperometer coil 44 of a large cross-section area wire which is accommodated on the core member 2, on the cheek piece 5 side, at the protected pole 14. The amperometer coil 44 has a respective pusher 45 adapted to engage with the lug 29 of the hooking lever 28 to release the moving contact holder assembly 26 on the occurrence of shorting currents, thereby causing the circuit breaker to break.

The circuit breaker 1 also comprises a bimetal strip thermal relay 62 housed in the proximities of the amperometer coil 44 between the core member 2 and the cheek piece 5. It is active on the lever 28 to release the moving contact holder assembly 26.

The circuit breaker 1 of this invention comprises, moreover, a thin wire voltmeter coil 46 which is housed in the body 8 on the core member 2, on the same side as the cheek piece 6, at the neutral pole 15. The voltmeter coil 46 has a respective pusher 47 adapted to engage with the lug 30 on the hooking lever to release the moving contact holder assembly 26 on the occurrence of a remote control command or by differential operation, thereby the circuit breaker is caused to break.

Thus, the circuit breaker 1 is either manually operated, as by acting on the key capping, or automatically operated by energization of the amperometer and voltmeter coils and the thermal relay.

The attachment means 32 for spring mounting the moving contact 19 to the contact carrier body 31 will be next described. These attachment means 32 include a pin 48 jutting out of the contact carrier body 31 toward the cheek piece 5. The pin 48 engages in a hole 49 formed in a central portion 50 of the moving contact 19. The attachment means 32 further include a forked spring 51 having a base 52 and two prongs 53 and 54, with free ends 55 and 56. The forked spring 51 has a base 52 straddling the moving contact 19 at a forward active portion 57 thereof, its prongs 53 and 54 extending from opposed sides of the central portion 50 and wound into a spiral, with turns in opposite directions around the pin 48, and the free ends ((and 56 of the prongs 53 and 54 in engagement with a lug 58 formed on the contact carrier body 31.

The spring 51, with its base 52, constantly urges the moving contact 19 to rotate around the pin 48 toward the fixed contact 18. A rearward tail portion 59 of the moving contact 19 engages with the lug 58 to stop rotation.

Retainer means 60 are provided to retain the moving contact 19 axially on the pin 48. These retainer means 60 are comprised of an elevation 61 formed on the lug 58 of the contact carrier body 31, against which the free end 56 of the prong 54 of the spring 51 engages laterally.

The attachment means 32 for spring mounting the moving contact 23 on the contact carrier body 31 are symmetrical of those described above for mounting the contact 19 relatively to the diaphragm 3, and accordingly, not described herein in detail.

Operation of the circuit breaker 1 will be described herein below with reference to a starting

condition, shown in Figure 3, wherein the circuit breaker is in its make setting.

On the appearance of a shorting current, there occurs energization of the amperometer coil 44, whose pusher 45 will move toward the lug 29 engaging it and causing the lever 28 to be pivoted in a counterclockwise direction. Thus, the moving contact assembly 26 is released and the moving contacts 19 and 23 are moved into their positions shown in Figure 4. Initially there will be struck between the moving contacts 19 and 23 and their respective fixed contacts 18 and 22 two like electric arcs indicated at a1. The crosspiece 36, by interacting with the magnetic field generated by the arcs, will at once attract the arcs a1 which move progressively toward their respective portions 38 and 39 of the crosspiece 36 as far as an intermediate position indicated at a3. At this stage, the arc roots standing on the moving contacts will separate from the moving contacts and stand on their respective portions 38 and 39 of the crosspiece which overhang into the chambers 33 and 34 at the back of the "L". Thus, the arcs come to a final position, indicated at a2, which extends from the fixed contacts to the crosspiece. On the arcs moving into their final positions a2, the moving contacts become released by the action of the electric arc, and accordingly unaffected by further cratering actions. These will in fact appear, at least before the arc is extinguished on the current half-wave going through zero on the crosspiece, on which they bear no harmful influence.

In other words, the circuit breaker 1 according to the invention has been provided with an electric arc change-over device effective to switch the arc from the moving contacts to an inert inoperative member, the crosspiece, with consequent increased life of the moving contacts.

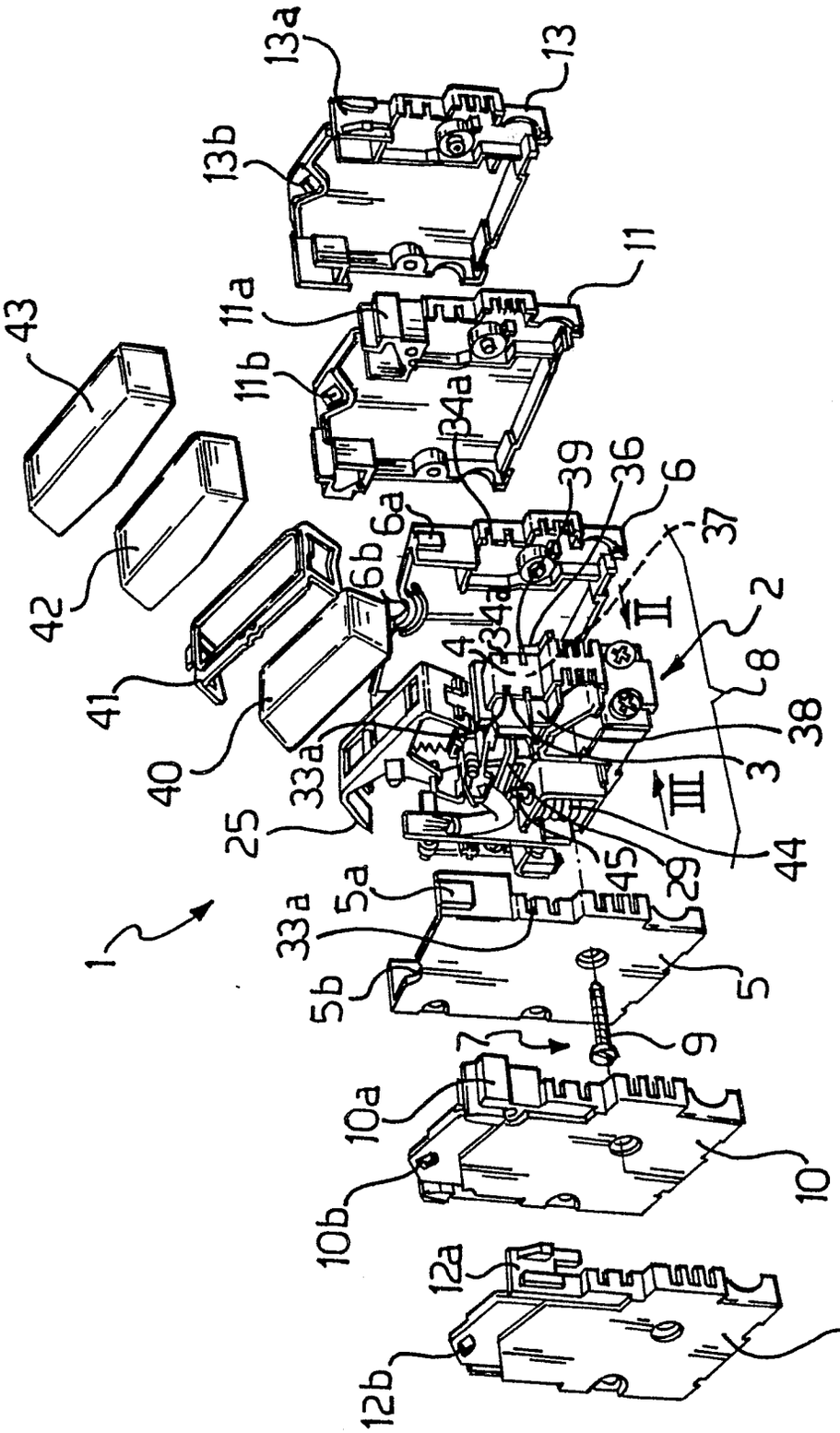
It should be also noted that on the arcs moving from their initial position a1 or intermediate position a3 to their final position a2, the user is fully shunted off the mains, thereby the shorting current through the user will become zero. Thus, also prevented will be any overloading of the amperometer coil and thermal relay circuits.

It may be appreciated that the circuit breaker disclosed hereinabove may be in many ways altered and modified by a skilled person in order to meet specific contingent requirements within the protection scope of the invention as set forth in the appended claims.

Claims

1. A double-pole circuit breaker (1) for enclosed boxes of civil range electric equipment, of a type comprising, within a body (8), a neutral pole (15) and a protected pole (14), as well as a moving contact (13,19) and a fixed contact (22,18) for each pole (15,14), and characterized in that it comprises a diaphragm (3) in said body (8), two chambers (34,33) formed in said body (8) on opposed sides of the diaphragm (3), each adapted to accommodate a respective one of said moving contacts (23,19) for movement therein along a preset path (T) toward and away from a respective one of said fixed contacts (22,18), a throughgoing socket (35) in said diaphragm (3), and a metal crosspiece (36) having a middle portion (37) inserted in said socket (35) and end portions (39,38) overhanging into said chambers (34,33) at a location facing said path (T).

2. A circuit breaker (1) according to Claim 1, characterized in that said socket (35) and said crosspiece (36) have L-shaped cross-sections with the back of the "L" laid to face said path (T).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6b
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8
41
38
40
33a
3
III
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Fig-1

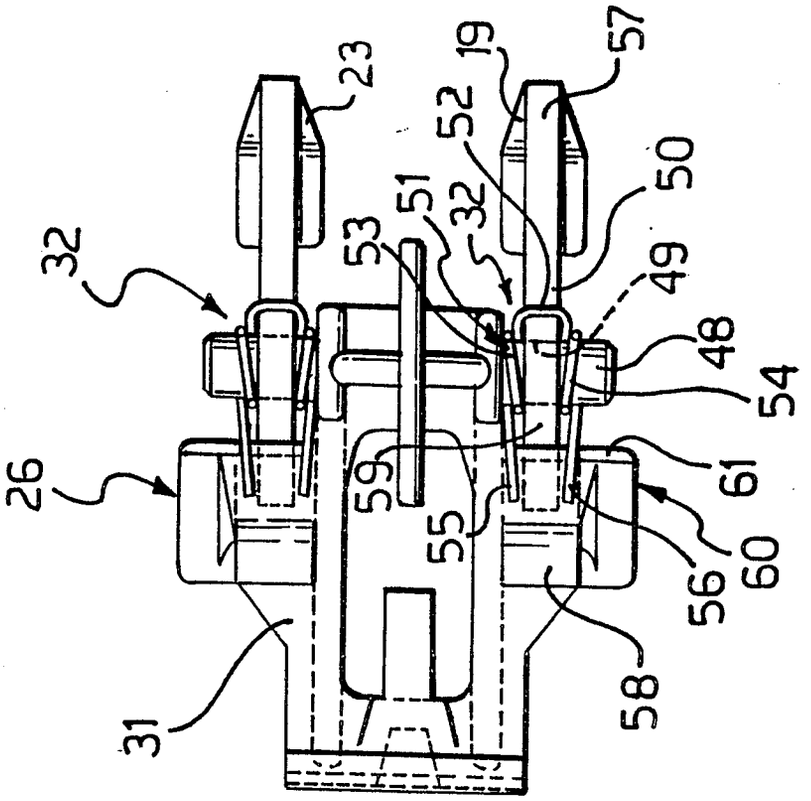
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Fig-5

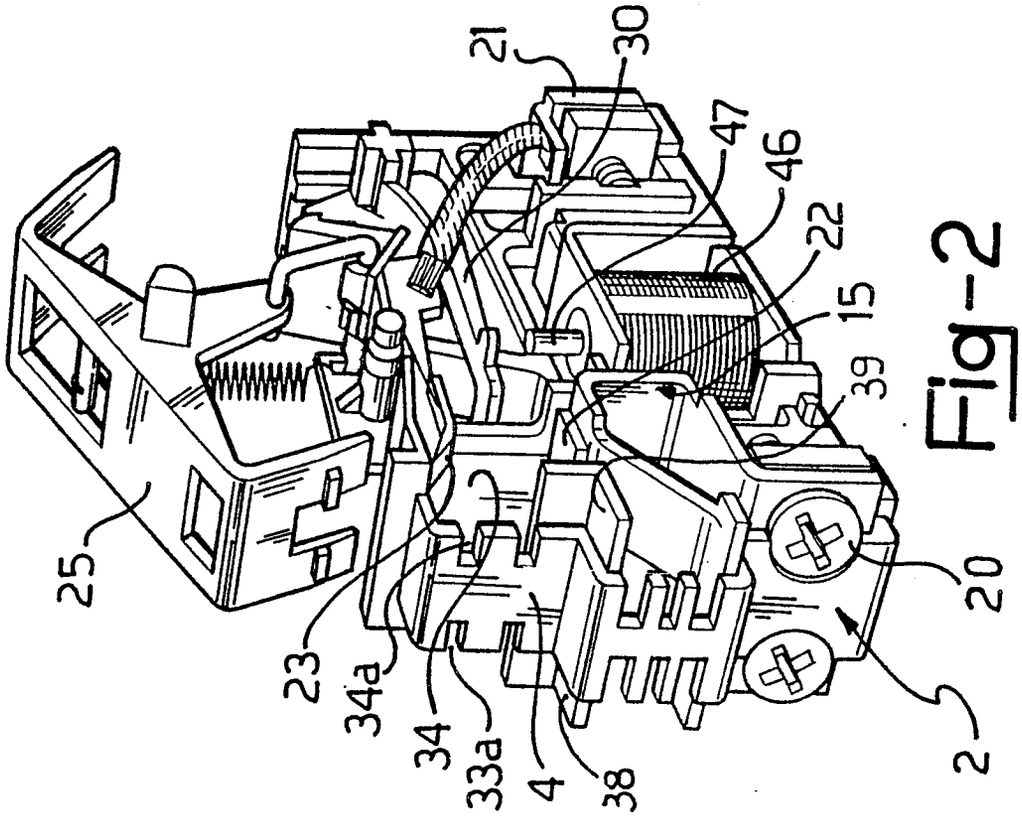
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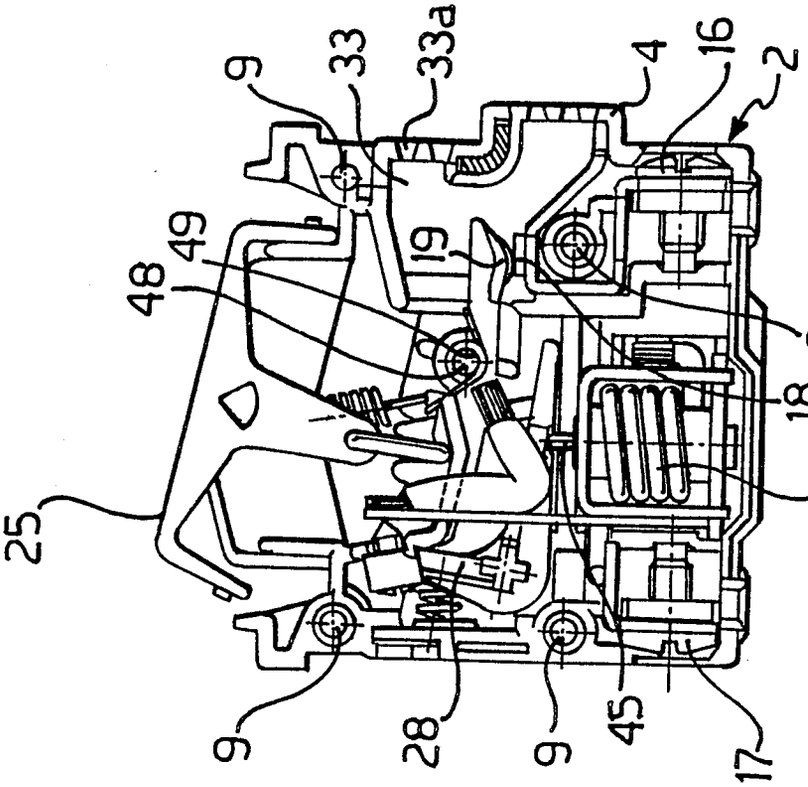
Fig-2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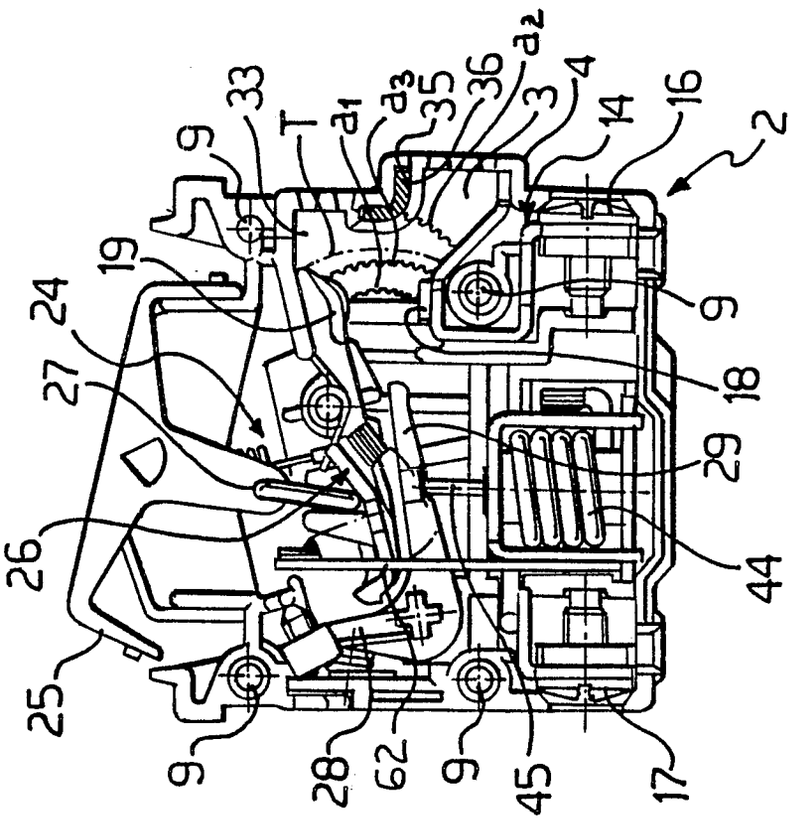
17

Fig-3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a3
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a2
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Fig-4