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CIRCUIT BREAKERS

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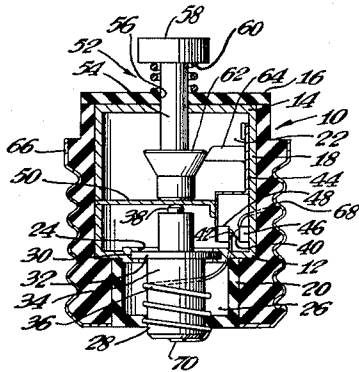


Fig. 1.

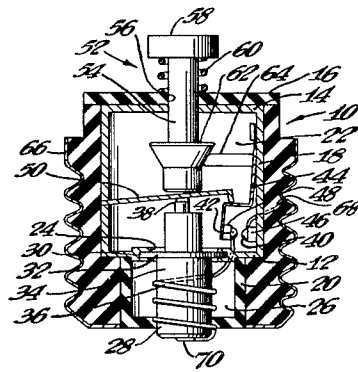


Fig. 2.

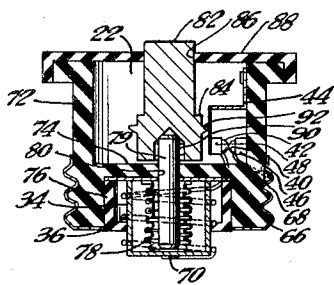


Fig. 3.

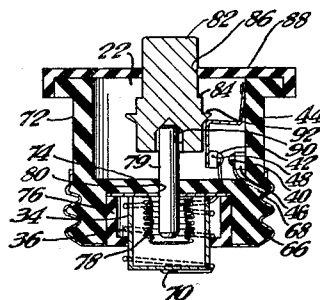


Fig. 4.

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CIRCUIT BREAKERS

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8 Claims. (Cl. 200—122)

This invention relates to circuit breakers and more particularly to the type of circuit breaker for use in screw type fuse sockets.

For a circuit breaker to be truly interchangeable with a screw type fuse, it is necessary that it be of such dimension that it can be inserted in the standard boxes and panel boards encountered in commercial practice. Since most of these boxes and panel boards are shallow, this problem has not been successfully solved.

It is, therefore, an object of this invention to reduce the overall height of a circuit breaker by greatly reducing the length of movement of its operating means while retaining its effectiveness.

Another object of this invention is to open and close a pair of contacts in such a manner that a minimum length of movement is required by the operating elements effectuating this action.

A further object of this invention is to increase the force while shortening the length of movement of a circuit breaker operating means.

It is a further object of this invention to utilize a heat motor to operate a circuit breaker.

In particular, the invention relates to a circuit breaker of the type having a pair of contacts operable to an open and closed position and normally held in a closed position by a latch. A heat motor responsive to the heat set up by the conveyed current automatically unlatches the contacts to an open position upon occurrence of a predetermined current, while a reset device is manually operable to relatch the contacts to a closed position.

The foregoing and all other features, objects, and advantages will become apparent from the following description taken in connection with the accompanying drawing, wherein:

Fig. 1 is a vertical cross-section of the circuit breaker of this invention showing the contacts in their closed position;

Fig. 2 is a view similar to Fig. 1 showing the contacts in their open position;

Fig. 3 is a vertical cross-section of a modification of a circuit breaker showing the contacts in their closed position; and

Fig. 4 is a view similar to Fig. 3 showing the contacts in their open position.

Referring more particularly to Fig. 1, there is shown a generally cylindrical housing of insulating material, indicated generally at 10. Centrally disposed bores of different diameters are provided at opposite ends of the housing, defining a shoulder portion 12 at their points of juncture. A cylindrical body 14, corresponding in length and diameters to the internal dimensions of the body 10, is adapted to be slidably inserted into body 10 through the larger diameter end thereof. The shoulder portion 12 engages a mating shoulder of the body 14 to prevent axial movement thereof in one direction. A cover member 16 of insulating material is sealed to body 10, by any suitable means, at the larger

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diameter end thereof to prevent axial movement of the body 14 in the other direction.

The body 14 consists of an upper cup-shaped metal shell 18 and a lower cup-shaped shell 20 of insulating material which may be fastened together by any suitable means (not shown) to form a unitary structure containing the operating components of this device. The interior of the large diameter shell 18 forms a switch chamber 22 with a centrally disposed aperture 24 in one end thereof. The smaller diameter shell 20 is centrally located relative to the switch chamber 22 and the interior thereof forms heat motor chamber 26. A hole 28 is bored in the small diameter shell 20 in axial alignment with aperture 24. Positioned in a groove 30, defined in aperture 24, is a flat circular washer-shaped retaining member 32 in axial alignment with hole 28.

A cylindrical heat motor body 34 with a reduced diameter at one end, is disposed axially in chamber 26 with both ends extending therefrom; the reduced diameter end extends into chamber 22 through retaining member 32 and the other end extends outwardly of the shell 20 through hole 28. The heat motor body 34 is fastened in hole 28 by any suitable means (not shown) to prevent any movement thereof. A heat motor for purposes of this description comprises the heat motor body 34, a heating coil 36, and a thermally responsive ram 38. It may be of any standard type wherein the body 34 contains a confined ram 38 movable between an active and an inactive position in accordance with temperature variations of the heat motor body 34 as determined by the magnitude of current flowing in coil 36.

Switch means are located in the switch chamber 22 and comprise a pair of contacts 40, 42 and resilient member 44. Contact 40 is shown fastened to a lateral wall of the chamber 22 and insulated therefrom by dielectric material 46. Contact 42 is fastened to a resilient member 44 and insulated therefrom by dielectric material 48. The member 44 is fastened, as by a rivet, to the lateral wall of the chamber 22 and biases the contact 42 away from engagement with contact 40. A portion of the length of member 44 is shown (Figs. 1 and 2) as lying along the lateral wall of the chamber 22 and a portion lying parallel to and spaced from the lateral wall of chamber 22. A resilient latch member 50 is fastened to the lateral wall of chamber 22 diametrically opposite the contacts 40, 42 and extends outwardly from the lateral wall toward the resilient member 44 for engagement therewith. During normal operation, the latch 50 engages resilient member 44 and, against the bias thereof, holds the contacts 40, 42 in a closed position. As illustrated in Fig. 1, the latch 50 rests upon ram 38 in its inactive position with the contacts 40, 42 and the latch 50 in their normal operating position.

A reset member, indicated generally at 52, is operative to return the latch 50 and the contacts 40, 42 to their normal operating positions. An elongated stem 54 slidably fits in an aperture 56 bored in the larger diameter shell 18 and the cover member 16. An enlarged diameter head 58 is centrally located exterior to housing 10 at one end of stem 54 to provide means for manual engagement of member 52. A spring 60 surrounds a portion of stem 54 and is mounted in compression between cover 16 and the undersurface of the head 58 to normally bias member 52 in a direction away from engagement with the latch 50. An enlarged diameter cam member 62, which can be made integral with stem 54, is located near the other end of stem 54 within chamber 22. The surface of the cam 62 tapers increasingly and radially outward from its smaller circumference nearest the end of stem 54 to its larger circumference furthest away from the end of stem 54. Cooperable with

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cam 62 is a cam follower 64 which is fixed to resilient means 44 on the portion thereof which lies on the lateral surface of chamber 22.

A shell-like fuse base member 66 is fastened to one end and a portion of the lateral surface of the exterior of housing 10. Base 66 adapts this circuit breaker to be threaded into a fuse socket and make electrical contact with one terminal thereof. A connecting wire 68 is provided between the shell 66 and the contact 40. A terminal 70, adapted to make electrical contact with a corresponding contact of a fuse socket, is provided on the extending portion of the heat motor body 34. One end of the coil 36 is connected to terminal 70 and the other end is connected to contact 42. In normal operation, this device is threaded into and makes electrical contact with a fuse socket to which is connected an external circuit to be protected.

In the use of the circuit breaker as thus far described, the current will pass from terminal 70 through coil 36, contact 42, contact 40, and wire 68 to screw base 66. A transient overload, that is, one of the type not injurious to the externally connected circuit, will not heat the heat motor sufficiently to change the relation shown in Fig. 1. Upon a sufficiently sustained overload however, ram 38 will be moved axially from its inactive position to its active position. With latch 50 normally resting against ram 38, the axial movement of the ram will move the latch to the limit of the rams travel. This length of travel is such that the latch 50 will be moved to its inoperative position disengaging resilient member 44, as illustrated in Fig. 2, and allowing the contacts 40 and 42 to open with a snap action under the bias of resilient member 44. By reason of this snap action, the contacts will be parted so rapidly that no arc will be maintained and the circuit will be sharply interrupted.

With contacts 40 and 42 in their open positions, the current will cease to flow in the external circuit and in the coil 36. With no current flow in the coil 36, the ram 38 will move axially to its inactive position away from engagement with the latch 50 and the latch and contacts will remain in their inoperative positions illustrated in Fig. 2 until returned to their normal operative positions by reset member 52. Manual engagement of head 58 causes cam member 62 to slidably engage cam member 64 causing movement of the resilient means 44 and contact 42 toward contact 40 to close contacts 40, 42. Simultaneously with the engagement of the two cam members 62 and 64, the end of stem 54 located in the interior of chamber 22 engages latch 50 to move it to its normal operative position engaging resilient member 44 to hold contacts 40 and 42 in their closed position. Travel of the latch 50 to its normal position and the travel of the member 52 in that direction is limited by the ram 38 in its inactive position. Travel of the member 52 in the other direction is limited by the enlarged diameter of the cam member 62.

The ram will remain in its active position after movement thereto until the heat motor cools sufficiently to allow it to return to its inactive position. Accordingly, it would be impossible to reset the circuit breaker prematurely. Thus, adequate time is afforded for the wires of the previously overloaded circuit to cool down before the circuit can be reclosed.

In the modification illustrated in Fig. 3, the housing 72 has centrally disposed bores of different diameters at its opposite ends. The bores do not communicate, as in the Fig. 1 embodiment, but instead a divider 74 made integral with housing 72 is provided to separate the interior of the housing 72 into two chambers. The interior of the larger diameter chamber constitutes the switch chamber 22.

Slidably inserted into the smaller diameter chamber is an integral unit comprising the heat motor body 34, insulating shell 76, and heating coil 36. The insulating shell 76 is rigidly fastened to the wall of the smaller

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diameter chamber by any suitable means (not shown). The heat motor shown in this embodiment functions in substantially the same manner as the one shown in the Fig. 1 embodiment. The thermally responsive means are, however, composed of a bellows 78 and a ram member 79 movable therewith in response to the temperature variations of the heat motor body 34 as determined by the magnitude of current flowing in coil 36. The ram 79 is disposed axially in an aperture 80 provided in divider 74 and freely slidable therein when moved between its active and inactive positions in response to actuation of the bellows 78.

A cylindrical reset member 82 comprises different diameters at its opposite ends, separated by a shoulder portion 84 at their point of juncture. The smaller diameter portion of the reset member 82 extends outwardly of the chamber 22 through an aperture 86, bored in a cover 88, in axial alignment with aperture 80. The extending portion of the reset member 82 is manually engageable exterior to the circuit breaker and is freely slidable in aperture 86. One end of ram 79 is received within an enlarged diameter bore 90 provided in the larger diameter end of member 82. Integral with the lateral surface of the larger diameter portion of reset member 82 is an axially disposed cam member 92.

Upon manual engagement of reset member 82 the surface of the cam member 92 engages that portion of resilient member 44 lying parallel to but spaced from the lateral surface of chamber 22 and urges member 44 and contact 42 toward contact 40. Engagement of the resilient means 44 by the extreme circumferential edge of cam 92 will latch the contacts 40 and 42 in their closed positions and further movement thereafter of the member 82 will move the cam 92 along the resilient member 44 until limited by the bellows 78 coming to rest against the bottom of heat motor body 34, as illustrated in Fig. 3. A predetermined over-current in the circuit connected externally to the fuse socket will cause the heat motor to move ram 79 to an active position so that member 82 and the latching cam 92 are moved to an inoperative position. Contacts 40 and 42 will open, as illustrated in Fig. 4, when cam 92 disengages member 44 and motion of the member 82 in this direction will be limited by the shoulder portion 84.

While the invention has been shown incorporated in a fuse plug, it will be understood that the construction could be readily incorporated in any desired size or shape of casing and although specific embodiments of the invention have been shown and described, it will be apparent that many modifications may be made by those skilled in the art. Such modifications may be made in the details of construction and arrangement of parts without departing from the scope of the invention as set forth in the appended claims.

We claim:

1. In a circuit breaker, the combination comprising a housing of insulating material, a shell of electrical conducting material on said housing, a fixed contact mounted in said housing and connected to said shell, a spring contact arm having one end fixedly mounted in said housing and a free end movable therein, a movable contact mounted on the free end of said arm and being engageable with said fixed contact, latching means engaging said arm and being movable between operative and inoperative positions, a heating element electrically connected to said movable contact, thermally responsive means mounted in said housing and being operable between active and inactive positions in response to said heating element, an axially movable member between said thermally responsive means and said latching means for moving said latching means to its inoperative position when said thermally responsive means is operated to its active position in response to a predetermined temperature condition of said heating element, and manually operable means for moving said latch means to its opera-

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tive position upon movement of said thermally responsive means to its inactive position.

2. In a circuit breaker; the combination comprising a housing of insulating material; a shell of electrical conducting material on said housing; a fixed contact mounted in said housing and connected to said shell; a spring contact arm having one end fixedly mounted in said housing and a free end movable therein; a movable contact mounted on the free end of said arm and being engageable with said fixed contact; latching means engageable with said arm and being movable between operative and inoperative positions; a heating element electrically connected to said movable contact; thermally responsive means mounted in said housing and being movable between active and inactive positions in response to said heating element; an operable connection between said thermally responsive means and said latching means to move the same to its inoperative position when said thermally responsive means is moved to the active position in response to a predetermined temperature condition of said heating element; a manually operable reset means having one portion engaging said spring contact arm to move said movable contact into engagement with said fixed contact and having another portion engaging and moving said latch means into its operative position when said thermally responsive means returns to the inactive position; and means normally biasing said reset means away from engagement with said latch means and said spring contact arm.

3. In a circuit breaker, the combination comprising a housing of insulating material, a shell of electrical conducting material on said housing, a pair of mating contacts disposed in said housing and connected to said shell, a resilient contact arm normally biased to separate said contacts, latching means engaging said arm and being movable between operative and inoperative positions and engaging said contact arm when in its operative position to retain said contacts in mating engagement, a heating element electrically connected to said movable contact, thermally responsive means mounted in said housing and being operable in response to said heating element, a ram member operable between an active and an inactive position and engageable with said latching means when in its active position to move the same to its inoperative position in response to a predetermined temperature condition of said heating element, a manually operable reset means movable when said ram member is in the inactive position to engage simultaneously the said resilient contact arm to move said contacts into their engaged position and said latching means for movement thereof into its operative position, and means normally biasing said reset means away from engagement with said latch means and said spring contact arm.

4. In a circuit breaker, the combination comprising a housing of insulating material, a shell of electrical conducting material on said housing, a heat motor carried by said housing and having a terminal base cooperable with said shell for electrically connecting the breaker in the cir-

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cuit, said heat motor including an axially movable member responsive to an overtemperature condition of said heat motor for actuation to an operative position, electrical heating means for said heat motor and being subject to overload to produce said overtemperature condition, a pair of separable contacts in said housing and engageable for completing a circuit through said shell and said terminal to said heating means, resilient means normally biasing one of said contacts to a disengaged position, and a second axially movable member carried by said housing for manual actuation to an operative position in opposed relation to the first said axially movable member, said second member including a latching element operatively engageable with said resilient means for establishing said contact engagement in the absence of said overtemperature condition.

5. The combination recited in claim 4 wherein said first and second members are carried in axial alignment from opposite ends of said housing, and said resilient means comprises a yieldable plate having a free end portion extending substantially parallel with an inner wall of said housing for slidable engagement with said latching element.

6. The combination recited in claim 5 wherein said housing defines a switch chamber and a heat motor chamber in overlying relationship, said latching element comprising a yieldable bar supported at one end in said switch chamber and having a free end engaging said free end portion, said first and second members being operative on opposite sides of said bar.

7. The combination recited in claim 6 wherein said second member and an inner wall of said switch chamber have interengaging members effective upon said manual actuation of said second member for overcoming the bias of said resilient means to cause said contact engagement.

8. The combination recited in claim 5 wherein said latching element comprises an abutment on said second member movable axially therewith into and out of engagement with said free end portion.

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