July 11, 1950 R. C. INGWERSEN 2,514,545

CIRCUIT BREAKER

Filed July 11, 1946

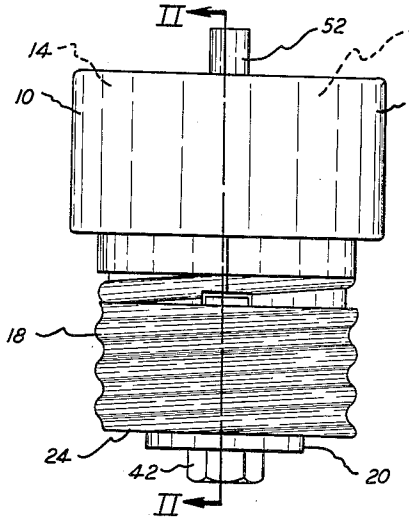

FIG. I.

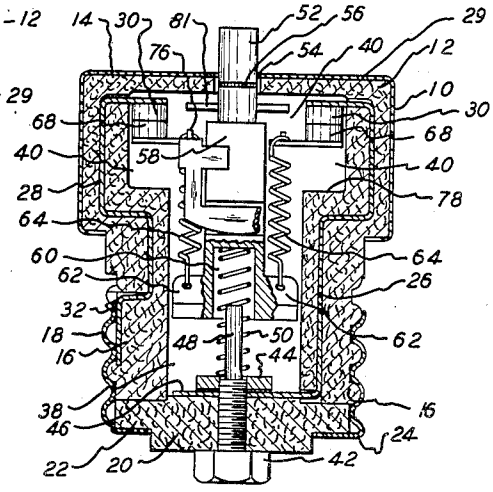

FIG. II.

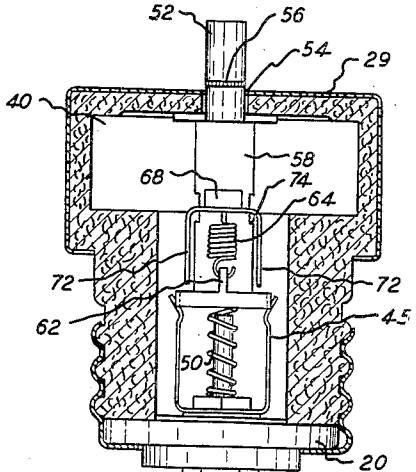

FIG. III.

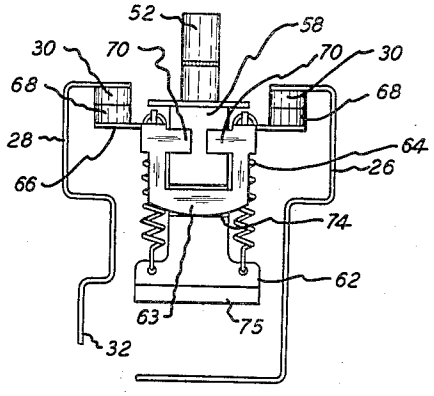

FIG. VI.

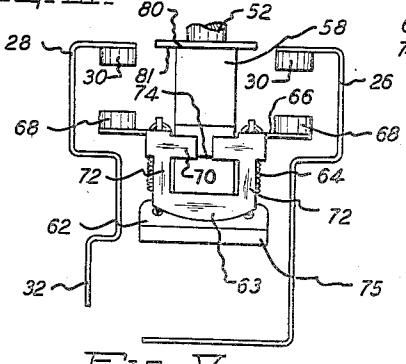

FIG. V.

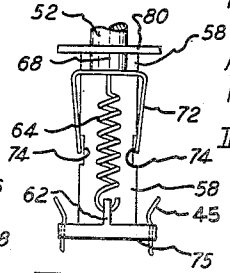

FIG. IV.

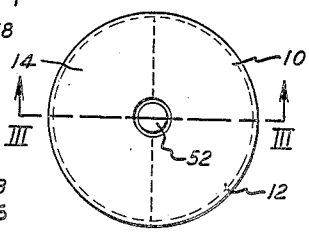

FIG. VII.

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CIRCUIT BREAKER

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4 Claims. (Cl. 200—116)

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The present invention relates to a resettable overload switch, especially designed for installation in home lighting and similar electrical circuits. At the present time inexpensive, non-replaceable fusible link fuses are generally used varying from 15 to 30 amperes in capacity at 110 volts. These devices, although inexpensive, are troublesome to detect following an overload, with most people being timid about removing the same and replacing them with new ones. More particularly, the present invention is an improvement of the construction disclosed and claimed in my co-pending application Serial No. 599,805, filed June 16th, 1945, for Bimetallic Overload Circuit Breaker.

While simple, inexpensive resettable overload switches capable of being inserted into the standard household fuse sockets have heretofore been proposed, their design has not been such as to permit their approval by the fire underwriters. Although overload switches of the type above described are principally designed for and used with alternating current, in order to be approved for installation they are required to function on test under extremely heavy direct current loads.

The circuit breaker according to the present invention and as described in the aforesaid application is resettable after the circuit in which it is included is opened by an overload. However, in the form of the invention disclosed in said application, the resetting provisions under certain conditions permitted an arcing at the contacts due to the relatively slow speed of resetting them. An object of the present invention is to eliminate such arcing by providing a spring member to yieldingly hold movable contacts against engaging fixed contacts until a predetermined resetting force is applied. At such time the spring member releases the movable contact supporting structure suddenly, with the result that the movable contacts are moved at a high rate of speed into engagement with the fixed contacts, thereby minimizing arcing.

The foregoing objects and others residing in the arrangement and combination of parts will be more fully understood from a consideration of the following specification and annexed claims:

In the drawing,

Fig. I is a side elevational view of one form of the circuit breaker,

Fig. II is a cross-sectional view, partly broken away, taken on line II—II of Fig. I,

Fig. III is a cross-sectional view taken on line III—III of Fig. VII,

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Fig. IV is a schematic layout showing the conductive parts with the switch closed,

Fig. V is a view similar to Fig. IV with the switch open,

Fig. VI is an enlarged fragmentary elevational view of a detail of construction, and

Fig. VII is an end view of Fig. I.

Referring to the drawing, in Fig. I is shown the compact form the present invention may take for screw-in installation into a standard outlet for fusible link fuses used in household lighting or other similar circuits carrying normally in the order of 15 to 20 amperes of alternating current.

While I do not wish to be restricted to any specific housing design other than limited by the appended claims, the illustrated form has numerous advantages. The main housing 10 comprises two similar sections 12 and 14 of molded insulating material. The lower ends of the sections 12 and 14 have integral threaded portions 16 to receive the internally and externally threaded metallic conductor ferrule 18. The ferrule performs three functions, namely, that of holding the sections 12 and 14 in assembly, acting as a conductor, and holding a closure plate 20 in abutment with the lower open end of the housing 10. As shown, the plate 20 is of molded insulating material with a flange 22 under which the flange 24 of the ferrule 18 engages.

Conductive inserts 26 and 28, carrying the contacts 30 are recessed in complementary channels in the sections 12 and 14. The inserts 26 and 28 serve to key the sections 12 and 14 together. Insert 28 comes to the outer surface of the section 14 where it is exposed for a solder joint with ferrule 18 at 32. This integral joint at 32 also serves to fix the ferrule 18 and sections 12 and 14 in a permanently assembled state. A metallic cap 29 is disposed over the outer ends of the sections 12 and 14 to further assist in the holding of these sections together.

The cavity 38 defined by the sections 12 and 14 is enlarged at 40 to form the separable contact chamber into which the contacts 30 extend. A conductor stud 42 is threaded through the plate 20 to receive a nut 44 which functions to clamp the lower end of the insert 26 and a spring clip 45 against the plate 20. Through this arrangement the insert 26 is brought into good electrical contact with the conductor stud 42 through the nut 44. As an extension of the stud 42 is a pilot portion 48 for the spring 50.

To describe the switch parts having movement upon overload, at the time of reset, the reset

button 52 projects through the opening 54 in the housing 10. An open switch indicating band 56 provides visual indication of the circuit in which the overload has occurred. As shown in Fig. II, with the switch closed, the band 56 is hidden from view.

The button 52 is enlarged at the lower end to provide a chamber 60 for receiving the upper end of the spring 50. Lateral ears 62 provide anchors for the lower ends of the springs 64.

Loosely mounted upon the shank 58 of the button 52 for both unitary and relative movement is the thermal circuit breaker unit 63. This unit comprises lateral arms 66 carrying the contacts 68 in opposed relation to the contacts 30. The upper portions 70 of the unit 63 embrace the shank 58 and loosely guide the unit 63 thereon. Projecting downwardly on opposite sides of the shank 58 are bimetallic supports 72 normally stressed inwardly to engage notches 74 in the shank 58. The upper ends of the springs 64 are attached to the unit 63 at 76 to stress the unit 63 downwardly with movement resisted by the engagement between the supports 72 and the notches 74.

In Figs. IV and V the relative positions of the principal parts of the switch are shown diagrammatically illustrated in open and closed position. With the switch open as shown in Fig. V, the arms 66 are supported on the shoulder 78 (shown in Fig. II) with the tension springs 64 substantially contracted, as shown in Fig. III. To close the switch, the button 52 is pushed inwardly, compressing the spring 50 and lowering the notches 74 to the position below the lower ends of the portions 72 as shown in Fig. VI. In this position the springs 64 are under tension. At the same time the spring clip 45 will engage the abutment 75 at the bottom of the shank 58 to hold the button 52 against the action of the spring 50. Upon pulling the button 52, the compression of the spring 50 will move the shank 58 upwardly with respect to the unit 63 to seat the supports 72 in the notches 74 and then raise the unit 63 into the position shown in Fig. II, with the contacts 30 and 68 abutting under the stress of the spring 50. The function of the clip 45 is to cause the shank 58 to be suddenly released upon resetting actuation of the button 52 to close the contacts 30 and 68 with a snap action.

In the event of an overload, the excessive current flowing through the divided path defined by the bimetallic supports 72, will result in rapid movement of the portions 72 from the notches 74 into the position shown in Fig. III, releasing the unit 63 to move downwardly under the action of the springs 64. As a result, the contacts 30 and 68 are suddenly separated, the spacing of the contacts being determined by the location of the shoulder 78. At the same time, the spring 50 is free to move the button 52 upwardly to the position shown in Fig. III until the shoulder 80 urges the sealing washer 81 against the housing 10 as a stop. Upon observing the indicating line 56, a person is advised that the contacts 30 and 68 are open and may reset the switch by pushing and then pulling the button 52. This will bring the supports 72 into engagement with the notches 74, providing the overload has been removed. Upon releasing the button 52, the stress in the spring 50 holds the contacts 30 and 68 closed.

Structural features of the present development which contribute substantially to the ability of the unit to handle heavy direct current overloads without damage to the structure, include substantial insulation of conductors 26 and 28, maximum spacing of the contacts 30 and 68 upon overload determined by location of the shoulder 78, and division of thermally active structure between the supports 72. Also, the spring clip 45 results in a closing of the contacts 30 and 68 with a strong snap action to minimize arcing.

The present invention primarily is an improvement over my aforesaid co-pending application, but is not intended to be limited to any particular form. Thus, not only may an equivalent be substituted for the structure of said co-pending application, but also the spring clip 45 may take various forms.

Having thus described my invention, what I desire to cover by Letters Patent and claim is:

1. A resettable overload switch comprising a fixed contact, a movable contact, an actuator, a thermal latch carrying said movable contact and guided upon said actuator for axial movement relative thereto, a catch on said actuator with which said latch normally engages for unitary movement of said latch and actuator in a contact closing direction, a spring continuously biasing said actuator in a contact closing direction to hold said contacts together under spring tension, a spring stretched between said latch and said actuator in a contact opening direction to disengage said contacts and to impart relative axial movement to said latch and actuator upon thermal actuation of said latch out of engagement with said catch, an abutment limiting the movement of said actuator in a contact closing direction upon thermal disengagement of said latch and catch, an abutment with which said latch engages upon movement of said actuator in a contact opening direction to provide relative axial movement between said latch and actuator to stretch said second spring and to bring said latch and catch into re-engagement following an overload, said actuator thereafter being released to the contact engaging action of said first spring, a releasable gripping means for said actuator with which said actuator engages upon movement of said actuator in a direction to re-engage said latch and catch, said means holding said actuator against movement in a contact closing direction under the biasing action of said first spring, said actuator being manually movable in said contact closing direction to overcome said gripping means to close said contacts with snap action.

2. A resettable overload switch as defined in claim 1 wherein said releasable gripping means is in the form of a spring clip engaging with said actuator.

3. A resettable overload switch as defined in claim 1 wherein said actuator and said releasable gripping means are so constructed and arranged to be in operative association with one another during only partial movement of said actuator in contact closing direction.

4. A resettable overload switch comprising a fixed contact, a movable contact, an actuator, a thermal latch mechanism releasably connecting said movable contact with said actuator and normally connecting said movable contact and said actuator for unitary movement in a contact closing direction, a spring incorporated with said thermal latch mechanism and adapted to urge said movable contact to the open position upon release of the latch mechanism from said actuator, a spring continuously acting upon said actuator for biasing said actuator in a contact

closing direction, and a releasable gripping means in which said actuator engages at the end of its movement in a contact opening direction, said actuator being manually moved in a contact closing direction to overcome said gripping means with snap action, whereby said contacts are closed with snap action by said actuator spring when the actuator is so moved and the said gripping means are overcome.

RICHARD C. INGWERSEN.

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