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E. J. WALKER ETAL

3,211,877

CIRCUIT BREAKER SWITCH SEALING MEANS FOR HANDLE OPENING

Filed June 7, 1963

2 Sheets-Sheet 1

Fig. 1.

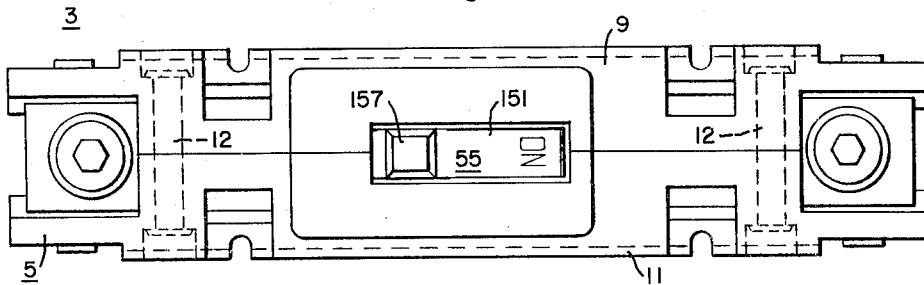
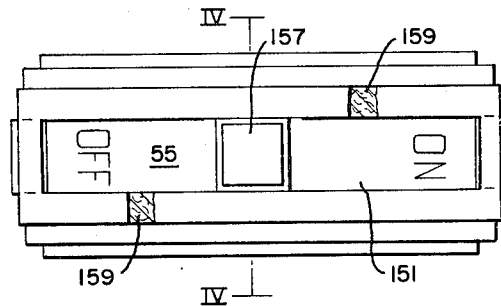


Fig. 3.

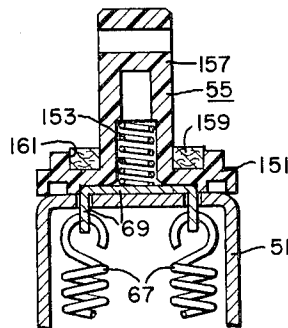


Fig. 4.

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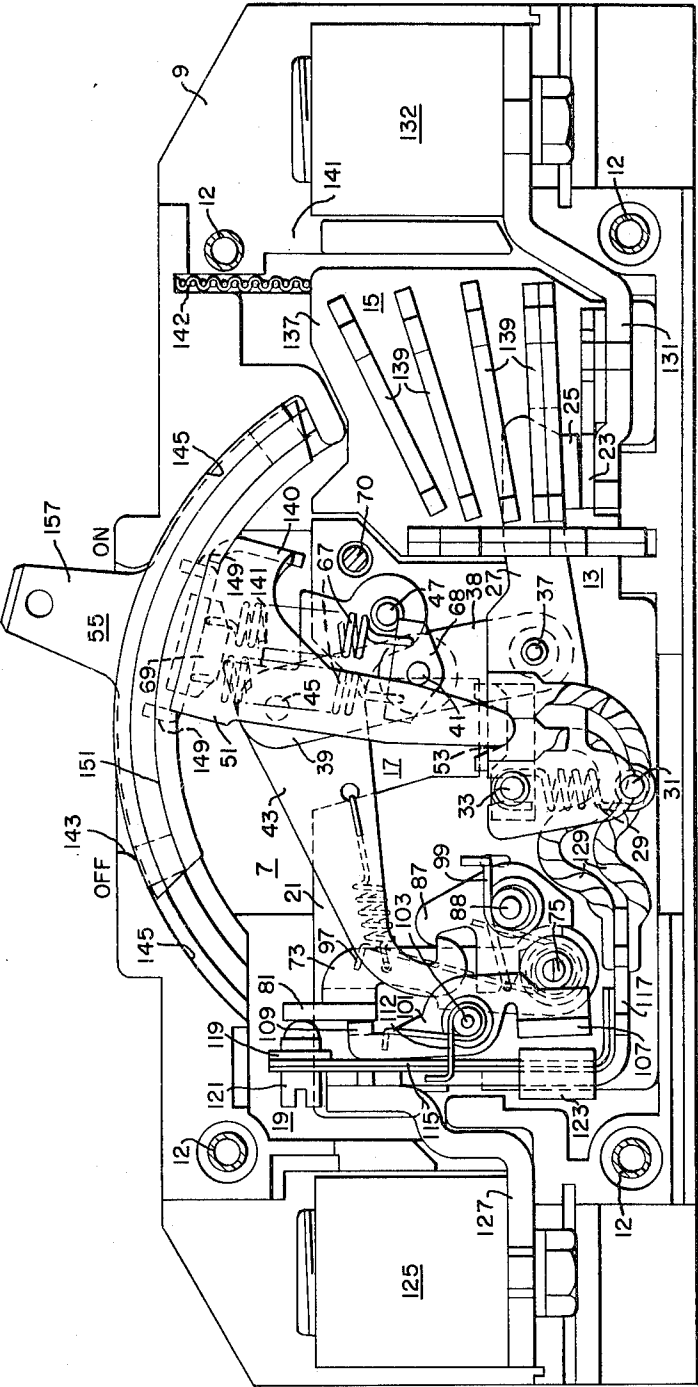


Fig. 2.

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CIRCUIT BREAKER WITH SEALING MEANS FOR HANDLE OPENING

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4 Claims. (Cl. 200-168)

This invention relates generally to circuit breakers and more particularly to circuit breakers of the type comprising an insulating housing having a circuit-breaker mechanism disposed within the housing and an operating handle extending from the housing to provide for manual operation of the breaker.

In the art of insulating-housing or molded-case type circuit breakers, the insulating housing is generally provided with an opening at the front thereof through which a handle extends to provide for manual operation of the breaker. An insulating shield is generally provided to close the opening through which the handle extends. When the circuit breaker interrupts an overload or short circuit current the arc generates hot gases under pressure which gases are vented out at one of the ends of the breaker. Often during circuit interruption particles of hot metal from the contacts or other metallic parts of the circuit breaker mechanism are blown out of the breaker venting means. In order to prevent fire, it is desirable to prevent these hot gases and hot metallic particles from escaping through the front of the circuit breaker. These gases and particles could, for example, ignite lint that tends to collect at the front of the breaker. Escaping hot gases and/or metal particles at the front of the breaker could also burn an operator who might be about to manually operate the breaker at the time the tripping overload or short circuit occurs.

An object of this invention is to provide an improved insulating-housing type circuit breaker with improved means for sealing off the opening that is provided in the front of the housing to permit manual operation of the circuit breaker.

A general object of this invention is to provide an improved safer molded-case circuit breaker.

The invention both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description when read in conjunction with the accompanying drawings.

In said drawings:

FIG. 1 is a top plan view of the circuit breaker of this invention;

FIG. 2 is a side view, enlarged relative to FIG. 1 and with parts broken away, of the circuit breaker seen in FIG. 1;

FIG. 3 is a top plan view, with parts shown in section, illustrating the handle structure seen in FIGS. 1 and 2; and

FIG. 4 is a partial sectional view taken generally along the line IV-IV of FIG. 3.

Certain features of the circuit breaker that is herein illustrated are described and claimed in the copending patent applications of Hiller D. Dorfman et al., Serial No. 112,172, filed May 19, 1961; and William J. Powell, Serial No. 270,335, filed Apr. 3, 1963, both of which applications have been assigned to the assignee of the instant application. Certain features of the circuit breaker that is herein illustrated are described and claimed in the patent to Russell C. Strother et al., Patent No. 3,174,024, issued Mar. 16, 1965.

Referring to the drawings, a circuit breaker 3 is shown

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in FIGS. 1 and 2 which breaker comprises a housing 5 of molded insulating material and a circuit-breaker mechanism 7 (FIG. 2) supported within the housing. As is seen in FIG. 1, the housing 5 comprises two halves 9 and 11 that are secured together by means of tubular rivets 12. The circuit breaker is known in the art as a molded-case or insulating-housing type circuit breaker since the breaker enclosure comprises a molded insulating housing.

The circuit-breaker mechanism 7 comprises a contact structure 13, an arc-extinguishing structure 15, an operating mechanism 17 and a tripping mechanism 19. The circuit-breaker mechanism 7 is supported between two insulating side plates 21 (only one of which is seen in FIG. 2).

The circuit-breaker mechanism 7 comprises a contact 23 and two movable contacts 25. Only one of the movable contacts 25 is seen in FIG. 2. Each of the movable contacts 25 is supported on one end of a movable contact arm 27. One end of a tension spring 29 is supported at the other ends of the two movable contact arms 27 on a pin 31 that connects the two movable contact arms. The other end of the spring 29 is attached to a pin 33 that is supported in suitable openings in the insulating side plates 21. The pin 33 is positioned in suitable slots in the movable contact arms 27 so that the contact arms 27 can move relative to the pin 33 when the contact arms are in the closed position. The spring 29 biases the contact arms 27 about a pivot pin 37 to provide contact pressure when the contacts 23, 25 are in the closed position.

The operating mechanism 17 includes a toggle comprising a lower toggle link 38 that is pivotally connected to the movable contact arms 27 intermediate the ends of the contact arms 27 by means of the pivot pin 37. An upper toggle link 39 is connected at one end to the upper end of the lower toggle link 38 by means of a knee pivot pin 41. The upper end of the upper toggle link 39 is pivotally connected to a releasable trip member 43 by means of a pivot pin 45. The releasable member 43 is pivotally supported between the insulating side plates 21 by means of a pivot pin 47.

An operating member 51, having an inverted generally U-shaped construction, is pivotally supported on the insulating side plates 21 in grooves 53. The free ends of the two legs of the member 51 are held in the grooves 53 by suitable clip means. An operating handle structure indicated generally at 55 is supported on the operating member 51 in a manner to be hereinafter specifically described. Four springs 67 (only two of which are shown in FIG. 2), are connected at one end to two plates 68 (only one being shown) that are connected to the knee pivot 41 of the toggle link 38, 39. The springs 67 are connected at their other ends to an inverted U-shaped plate 69 that is supported at the outer end of the U-shaped member 51.

The contacts 23, 25 are manually opened by movement of the handle structure 55 in a counterclockwise (FIG. 2) direction to the "off" position. This movement carries the line of action of the over-center springs 67 to the left of the pivot 41 causing collapse of the toggle 38, 39 and pivotal movement of the contact arms 27 about the pin 33 to an open position. Opening movement of the contact arms 27 is limited by engagement of the contact arms with a stop 70. Reverse or clockwise movement of the operating handle structure 55 from the "off" to the "on" position moves the knee pivot 41 of the toggle 38, 39 to the right resetting the toggle 38, 39 moving the contact arms 27 back to the position shown in FIG. 2.

The strip structure 19 comprises a latch member 73 that is secured to a generally cylindrical trip bar 75 having

a notch (not shown) therein. A flag portion 81 is supported at the upper end of the latch member 73. The latch member 73 is supported by means of the trip bar 75 that is rotatably supported in suitable openings in the side plates 21. A main latch 87 comprises a pin 88 that is rotatably supported in suitable openings in the side plates 21. The main latch 87 engages the free end of the releasable trip member 43 to hold the releasable trip member 43 in the latched position. The main latch 87 has a portion that engages the periphery of the trip bar 75 just opposite the notch in the trip bar when the parts are in the latched position. The trip member 73 is biased in a counterclockwise direction by means of a torsion spring 97. The main latch 87 is biased in a counterclockwise direction by means of a torsion spring 99. An armature member 101 is pivotally supported by means of a pin 103 that is supported in suitable openings in the side plates 21. An armature 107 is disposed at one end of the member 101 and a projection 109 is disposed at the other end. The armature member 101 is biased in a counterclockwise direction by means of a torsion spring 112.

A bi-metallic member 115 is attached at one end to a conductor 117. The free end of the bi-metal 115 supports a plate 119 having a tapped opening therein through which an adjusting or calibrating screw 121 extends. A U-shaped magnetic yoke 123 is attached to the conductor 117 opposite the armature 107.

The circuit through the circuit breaker extends from a terminal 125 through a conductor 127 that is attached at one end to the terminal and at the other end to the conductor 117, the conductor 117, two flexible conductors 129 that are attached at one end to the conductor 117 and at the other end to the contact arms 27, the contact arms 27, the contacts 25, 23, a conductor 131 to a solderless terminal connector 132.

When an overload current below a predetermined value passes through the circuit breaker, the bi-metallic member 115 is heated and it bends to the right whereupon the screw 121 engages the flag 81 of the latch member 73 rotating the latch member 73 in a clockwise direction. During this movement, the trip bar 75 is moved to move the notch (not shown) that is adjacent the main latch 87 to a position permitting the main latch 87 to move clockwise to a tripping position. During this clockwise movement of the main latch 87, the releasable member 43 is released. When released, the member 43 rotates clockwise about its pivot 47 under the bias of the springs 67 causing collapse of the toggle 38, 39 and opening movement of the switch arms 27 about the pivot 33. During this movement, the handle structure 55 is moved, in a manner well-known in the art, to a tripped position intermediate the "on" and "off" positions, thereby giving a visual indication that a tripping operation has occurred.

Before the contacts can be closed following an automatic opening operation, it is necessary to reset and relatch the mechanism. This is accomplished by moving the handle structure 55 in a counterclockwise direction from the intermediate or tripped position to the extreme "off" position. During this movement, a projection 140 on the U-shaped member 51 engages a shoulder 141 on the releasable member 43 moving the releasable member 43 counterclockwise about the pivot 47. Near the end of this movement, the releasable member 43 engages the main latch 87 and moves the main latch to the latching position. As soon as the main latch 87 reaches the latching position it is positioned adjacent the notch in the trip bar 75 whereupon the trip bar 75 is rotated by means of the torsion spring 97 clockwise to the latching position in which position the periphery of the trip bar 75 engages the main latch 87. The latch portion of the main latch 87 is then in a position to engage the latch part of the releasable member 43 so that upon release of the handle structure 55 the mechanism is latched and the contacts can be closed in the previously described manner by

movement of the handle structure 55 to the "on" position.

Upon the occurrence of an overload current above the predetermined value, the magnetic yoke 123 is energized sufficiently to attract the armature 107 to rotate the armature member 101 clockwise about the pivot 103, whereupon the upper projection 109 on the armature member 101 engages the flag portion 81 of the latch member 73 rotating the latch member 73 clockwise to effect release of the main latch 87 and release of the releasable member 43 to thereby effect a tripping operation in the same general manner hereinbefore described.

When the contacts 23, 25 open, an arc is established between each of the movable contacts 25 and the stationary contact 23. These arcs are extinguished by means of the arc-extinguishing structure 15 which comprises two insulating side plates 137 and a plurality of magnetic arc-extinguishing members or plates 139. The plates 139 are generally U-shaped and the arc is attracted into the plates to be broken up into a plurality of serially related arcs which arcs are rapidly extinguished in a manner well-known in the art. The arc during circuit interruption generates hot gases which expand creating pressure that forces the gases out of the enclosure 9, 11. When the circuit breaker interrupts an overload or short circuit current these gases are forced out under very high pressures. During the interruption of these overload or short circuit currents, it is also possible that particles of metal from the contacts 23, 25 or arc extinguishing plates 139 will be forced out of the circuit breaker housing 9, 11. These hot gases and, in some instances, hot metallic particles are forced out through a vent passage 141 at the arc-extinguishing end of the breaker. A screen 142 is provided at the vent passage to prevent the escape of larger metallic particles.

Means are provided to prevent these expanding hot gases and hot metallic particles from being blown out through the front of the circuit breaker. As was previously described, the circuit breaker is manually operated by means of the handle-operating structure 55. Referring to FIG. 2 it can be seen that there is an opening 143 provided in the front of the circuit breaker housing 9, 11. The circuit breaker housing 9, 11 is provided with an internal arcuate generally smooth surface 145 that surrounds the opening 143. The surface 145 is formed on the housing 9, 11 when the housing is molded. The circuit breaker is manually operated by means of the operating member 51 which is pivoted in the grooves 53 and toggled back and forth between the "on" and "off" positions. This back-and-forth reciprocal toggling movement of the operating member 51 is effected by means of the molded insulating handle structure 55 that is molded with notches at the inner side thereof which notches receive two upstanding projections 149 (FIG. 2) that are part of the operating member 51. The handle structure 55 comprises an arcuate shield 151 that is disposed within the circuit breaker housing 9, 11 to cover the opening 143 in all positions of the handle structure 55. A spring member 153 (FIG. 4) that is disposed within an opening in the handle part 157 of the handle structure 55 biases the handle structure 55 outwardly toward the front of the breaker and away from the operating member 51. A wool felt compressible material 159 (FIGS. 3 and 4) cemented in place in a generally rectangular slot 161 (FIG. 4) in the shield 151. As can be seen in FIGS. 1 and 3, the felt 159 surrounds the opening 143 in the housing 9, 11. As can be seen in FIG. 4, the felt material 159 extends outwardly a distance further than the front surface of the shield part so that the spring 153 operates to compress the felt 159 against the internal front surface 145 of the housing 9, 11 to seal the opening 143 to thereby prevent the passage of hot gases and hot metallic particles out through the front of the circuit breaker housing 9, 11.

The compressible sealing material 159 that is specifically described is a fibrous wool-felt material. This material

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is placed in the slot 161 and cemented in place. It can be understood that any compressible sealing material could be used in accordance with the teachings of this invention so long as the material is not highly combustible.

From the foregoing, it can be understood that there is provided, by this invention, an improved, molded-case or insulating-housing type circuit breaker that is provided with improved means for sealing the opening in the front of the circuit breaker housing through which the operating handle extends.

While the invention has been described in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications may be made in the structural details and arrangement of parts without departing from the spirit of the invention.

We claim as our invention:

1. A circuit breaker comprising an insulating housing having an opening at the front thereof, a circuit-breaker mechanism disposed within said housing and comprising a pair of contacts, said mechanism comprising means operating automatically upon the occurrence of certain overload current conditions to effect opening of said contacts, a handle-structure comprising a shield supported within said housing and a handle extending through said opening, said handle structure being movable between two positions to open and close said contacts, said shield closing said opening in all positions of said handle structure, compressible sealing means, means biasing said shield toward the internal surface of the front of said housing and compressing said sealing means between said shield and said internal surface to seal said opening.

2. A circuit breaker comprising an insulating housing having an opening at the front thereof, a circuit-breaker mechanism supported within said housing and comprising a pair of contacts, said mechanism comprising means operating automatically upon the occurrence of certain overload current conditions to effect opening of said contacts, said mechanism comprising a pivotally supported operating structure manually movable between two positions to open and close said contacts, said housing comprising an arcuate internal surface at the front thereof in proximity to said opening, a handle structure comprising a shield having an arcuate front surface and a handle member extending from said arcuate front surface through said opening, said handle structure being operatively connected to said operating structure and manually movable to move said operating structure, said shield closing said opening in all positions of said handle structure, sealing means disposed between said arcuate front surface of said shield and the internal arcuate front surface of said housing, and resilient means disposed between said operating structure and said handle structure to compress said sealing means between said shield and the internal arcuate front surface of said housing whereby said compressed sealing means serves to prevent the passage of gas out through said opening.

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3. A circuit breaker comprising an insulating housing having an opening at the front thereof, a circuit-breaker mechanism disposed within said housing and comprising a pair of contacts, said mechanism comprising trip means operating automatically upon the occurrence of certain overload current conditions to effect opening of said contacts, said mechanism comprising an operating structure pivotally supported and pivotally movable between two operating positions to open and close said contacts, a handle-structure operatively connected to said operating structure and movable between two positions to operate said operating member, said handle-structure comprising an insulating shield and a handle member operatively connected to said insulating shield, said shield having an arcuate surface at the front thereof, said insulating housing having an internal arcuate surface in proximity to said opening, compressible sealing means disposed between said arcuate shield surface and said internal arcuate housing surface, and means biasing said shield against said internal arcuate housing surface to compress said sealing means to thereby seal said opening.

4. A circuit breaker comprising an insulating housing having an opening at the front thereof, a circuit-breaker mechanism disposed within said housing and comprising a pair of contacts, said mechanism comprising trip means operating automatically upon the occurrence of certain overload current conditions to effect opening of said contacts, said mechanism comprising an operating structure pivotally movable between two positions to open and close said contacts, a handle-structure operatively connected to said operating structure and manually movable to move said operating structure between said two positions, said handle-structure comprising an insulating shield having an arcuate front surface and a handle member extending from said arcuate front surface, said shield being disposed within said housing in proximity to said opening to close said opening in all positions of said handle structure, said shield having a notch therein at the front arcuate surface thereof which notch surrounds said opening, said insulating housing having an arcuate internal surface at the front thereof in proximity to said opening, compressible sealing means disposed within said notch surrounding said opening, and resilient means effecting a bias of said shield against said internal front surface of said housing to compress said sealing means between said shield and said internal front surface of said housing.

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