

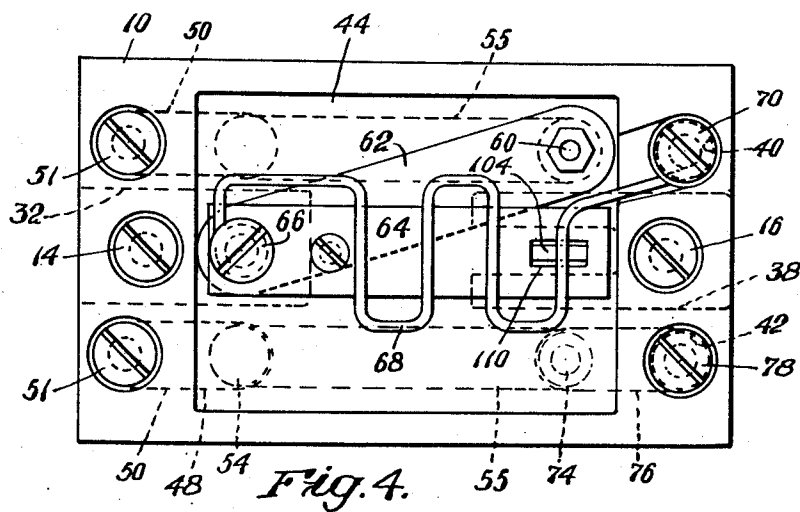
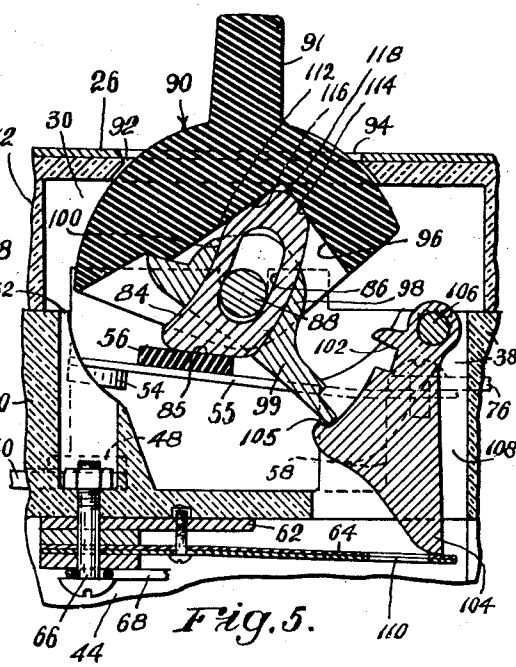
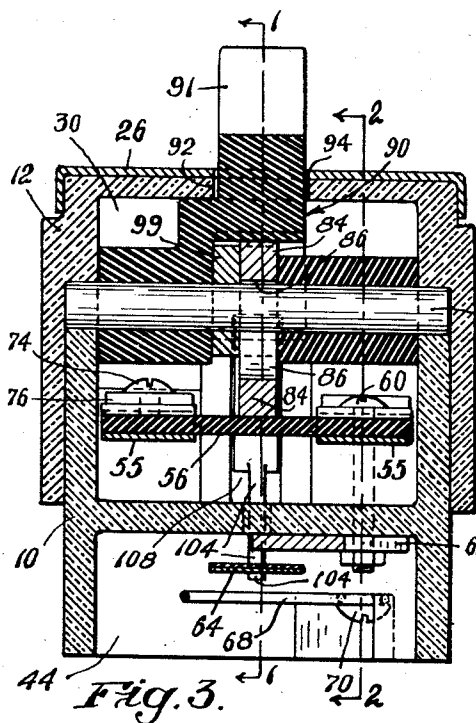
Jan. 31, 1950

E. H. TAYLOR
CIRCUIT BREAKER

2,496,072

Filed May 27, 1947

3 Sheets-Sheet 2



INVENTOR.
Elmer H. Taylor
BY his Atty.,
John H. McKenna

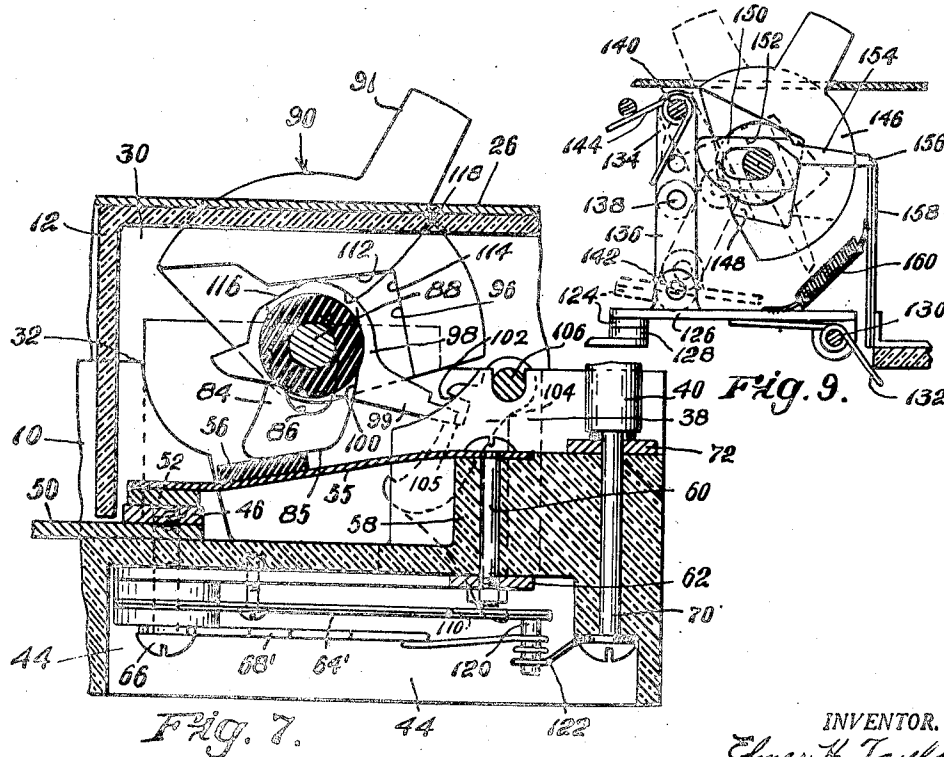
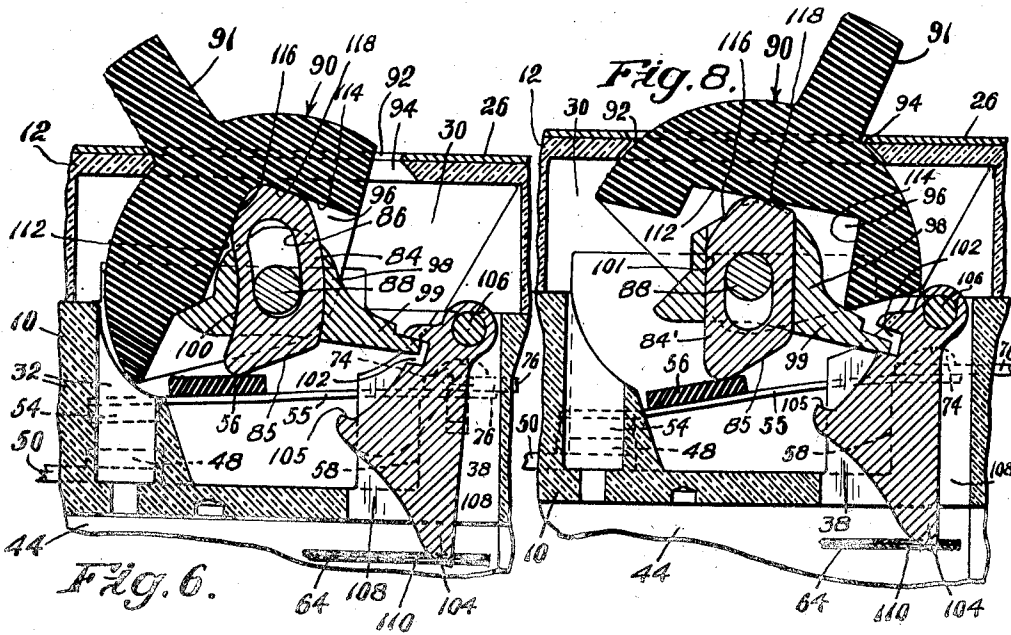
Jan. 31, 1950

E. H. TAYLOR
CIRCUIT BREAKER

2,496,072

Filed May 27, 1947

3 Sheets-Sheet 3



INVENTOR.
Elmer H. Taylor
BY his Atty.
John H. H. H. H.

UNITED STATES PATENT OFFICE

2,496,072

CIRCUIT BREAKER

Elmer H. Taylor, Newburyport, Mass., assignor to
The Chase-Shawmut Company, Newburyport,
Mass., a corporation of Massachusetts

Application May 27, 1947, Serial No. 750,759

19 Claims. (Cl. 200—116)

1

This invention relates to improvements in electric circuit interrupters and more particularly to circuit breakers and switches which are manually operable for manual control of a circuit and which operate automatically to open the circuit in response to overloads of predetermined character.

It is among the objects of the invention to simplify and generally to improve the structure and operation of circuit interrupters of the mentioned general type by providing a compact and effective mechanism wherein an actuator slides in response to manual movements of an operating member thereby to effect manual control of a contact member and rotates in response to an overload of predetermined character thereby to effect a circuit-opening movement of the contact member independently of any manual control.

Another object is to provide a circuit interrupter of the mentioned general type wherein an actuating member is both slidably and rotatably mounted between a biased means and an operating member and normally is conditioned for only sliding movements thereof in response to manual movements of the operating member, thereby to effect operations of the biased means under manual control, said actuating member being adapted to rotate in response to an abnormal condition of predetermined character thereby to effect an operation of the biased means independently of any manual control.

A further object is to provide a circuit interrupter mechanism wherein an actuating member only slides in response to manual operations of the mechanism and rotates in response to automatic operations of the mechanism, said actuating member being manually rotatable following an automatic operation of the mechanism, for re-setting the mechanism.

Yet another object of the invention is to provide a circuit interrupter of the mentioned general type wherein an actuating member is both slidably and rotatably mounted in operative relation to an operating member and constantly is biased for both sliding and rotary movement but normally is maintained against rotary movement so that it can only slide in response to manual movements of the operating member, and wherein there is means for releasing the actuating member for rotary movement thereof in response to a circuit overload of predetermined character.

Still another object is to provide a circuit interrupter of the mentioned general type wherein an operating member and a means which is to be operated are associated together in spaced re-

2

lation with said means constantly biased in general direction toward the operating member, and an actuating member is engaged between the operating member and the biased means and is mounted for both sliding and rotary movement under the urge of said biased means but normally is maintained against rotation so that it can only move by sliding in one general direction in response to a particular movement of the operating member thereby to actuate the biased means in opposition to its bias, there being means for releasing the actuating member for rotation thereof in general direction away from said biased means in response to a circuit overload of predetermined character.

A further object is to provide a circuit interrupter of the mentioned general type wherein a rotatable trip member is biased for rotation in one direction and normally is releasably held against rotation, and wherein an actuating member is slidably engaged by the trip member for sliding movements thereof independently of movement of the trip member and is rotatable with the trip member when the latter is released.

Another object is to provide a circuit interrupter of the mentioned general type wherein a biased actuating member is manually slidable for effecting manual operations of the interrupter, is automatically rotatable for effecting an automatic opening of the interrupter in response to an overload of predetermined character, and is manually rotatable, following a said automatic opening, for re-setting the interrupter.

Still another object is to provide a circuit interrupter of the mentioned general type wherein a biased actuating member is manually slidable for effecting manual operations of the interrupter and is automatically rotatable for effecting an automatic opening of the interrupter in response to an overload of predetermined character with simultaneous movement of an indicating means to a trip-indicating position.

Another object is to provide a circuit interrupter of the mentioned general type wherein a biased actuating member is manually slidable for effecting manual operations of the interrupter and is automatically rotatable to effect an automatic operation of the interrupter in response to thermally responsive means and also in response to electro-responsive means.

It is, moreover, my purpose and object generally to improve the structure and operation of electric circuit interrupters.

In the accompanying drawings:

Fig. 1 is a cross-sectional view through a circuit

interrupter embodying features of the invention with the operating parts in manually opened positions, the section being on line 1—1 of Fig. 3;

Fig. 2 is a cross-sectional view on line 2—2 of Fig. 3 but with the outer casing removed and showing the operating parts in manually closed positions;

Fig. 3 is a cross-sectional view approximately on line 3—3 of Fig. 2;

Fig. 4 is a bottom plan view of Figs. 2 and 3;

Fig. 5 is a view similar to Fig. 1 but with the operating parts in automatically tripped positions, and with portions of the inner casing broken away;

Fig. 6 is a view similar to Fig. 5 but showing the operating parts manually moved to re-setting positions following an automatic tripping;

Fig. 7 is a view similar to Fig. 2 but with portions of the inner casing broken away and showing a modified form in which an electromagnet may actuate the bi-metal strip instead of or in addition to the heater;

Fig. 8 is a view similar to Fig. 6 but showing modified forms of contact member, trip member and actuating member, the latter member and its support being designed so that the sliding movements of the actuating member are rectilinear movements; and

Fig. 9 is a cross-sectional view of a modification in which the movable contact is operated by a toggle mechanism which is biased for coaction with manually movable and automatically responsive operating mechanism comparable to that described in connection with the earlier views.

Referring to the drawings, Figs. 1-8 illustrate the invention embodied in a circuit interrupter which is particularly suited for motor circuit control, although it may have utility for the manual and automatic control of circuits generally. While a two-pole construction is represented, it will be obvious that the features of the invention are as well applicable to single-pole and also to multi-pole circuit interrupters.

The operating parts of the interrupter are mounted within an insulating body which conveniently may comprise the two sections 10, 12 secured together in any suitable manner, as by the screws 14, 16. The insulating body 10, 12 is mounted within an outer casing 18 whose opposite end walls have the inwardly projecting flanges or lugs 20 to which the projecting strap elements 22 on the insulating body are secured, as by the screws 24. The projecting strap elements 22 may be separate from each other or may be integrally connected, and are shown secured to the insulating body section 12 by the same screws 14, 16 which secure the body sections 10, 12 together. An outer casing cover 26 may be secured in place by screws 28 threaded into the projecting strap elements 22.

The insulating body sections 10, 12 fit together to define an interior generally rectangular chamber 30 within which the operating parts are mounted, each end of the composite body having a centrally disposed wall of which the wall 32 at one end extends a substantial distance into chamber 30 and extends outward beyond the end wall of the chamber for separating two exterior terminals 34, 36 and constituting also a convenient place for passage of the screw 14 which secures the sections 10, 12 together at this end. The centrally disposed wall 38 at the other end extends a substantial distance into chamber 30 and extends outward beyond the end wall of the chamber for separating two exterior terminals 40, 42

and also having the screw 16 passing therein for securing sections 10, 12 together at this end. Section 10 of the insulating body is recessed at 44 below chamber 30 for a purpose which later will appear.

Two similar fixed contacts 46, 48 are mounted on the bottom or floor of chamber 30, towards one end of the insulating body, and in laterally spaced relation. Each of the contacts 46, 48 is at the inner end of a different one of two similar rigid conducting elements 50 which are secured, as by screws 51, to projections of the floor of the chamber 30 which extend outward on opposite sides of the central wall 32 with the outer ends of the elements 50 conveniently disposed in laterally spaced relation. Each of the screws 51 serves also as a terminal screw for receiving one of the terminals 34 or 36.

Two similar movable contacts 52, 54 are mounted for coaction with the fixed contacts 46, 48, each being at one end of a different one of two similar conducting arms 55 which are resiliently depressible to engage the movable contacts with the fixed contacts and which are constantly biased in direction to move the movable contacts away from the fixed contacts. An insulating plate member 56 connects the two arms 55 so that they move in unison.

In the embodiment herein represented in Figs. 1-8, each contact-carrying arm 55 is resilient and is generally flat when unstressed, having its end which is opposite the movable contact 52 or 54 anchored on an insulating part 58 which spaces the arm appreciably above the floor of chamber 30. The arm 55 which carries movable contact 52 is anchored or secured in place by a screw 60 which extends through the insulating part 58 of section 10 and is secured to one end of a conducting bar 62 in recess 44. The other end of bar 62 is electrically connected to one end of a bi-metal strip 64 by means of a bolt or screw 66 which anchors the electrically connected ends of bar 62 and strip 64 to the under side of the floor of chamber 30, within the recess 44, and also electrically connects one end of a heater 68 to the bar and strip. The heater 68 has sinuous extent in spaced relation to the bi-metal strip 64 with its end connected to a screw 70 which extends upward through the insulating body section 10 and is threaded through a retaining nut or washer 72 which is disposed at one side of the central wall 38, in line with the contact-carrying arm 55 which carries movable contact 52. The threaded end of screw 70 constitutes also a terminal screw for reception of the terminal 40 or the like.

The contact arm 55 which carries movable contact 54 is anchored or secured in place by a screw 74 which is threaded through the inner end of a conducting member 76, in electrical connection with its arm 55. Conducting member 76 projects outward beyond the end wall of chamber 30, in line with the contact-carrying arm 55, and is secured at this end by a screw 78 which extends upwardly through the exterior portion of section 10 and is threaded through the outer end of conducting member 76. The threaded end of screw 78 serves also as a terminal screw for reception of the terminal 42 or the like.

It will be obvious from the foregoing description, assuming the circuit interrupter to be connected in an electric circuit, that depression of the movable contacts 52, 54 simultaneously into engagement with the fixed contacts 46, 48 will close a circuit through the interrupter with

5

the current in one side of the line passing through the heater 68 in getting from terminal 30 to the terminal 34, and with the current in the other side of the line passing from terminal 42 to the other terminal 36 directly through its contact-carrying arm 55.

According to the invention manual opening and closing of the circuit, and automatic opening of the circuit in response to overloads of predetermined character, are accomplished by novel and effective means which conveniently and compactly may be operatively associated with the parts previously described.

An actuating member 84 is slotted at 86 and is mounted on the fixed pivot rod on pin 88 for both sliding and rotary movements relative to the axis of the pivot rod 88. An operating member is indicated generally at 90 pivotally mounted on the pivot rod 88 and projecting through suitable slots 92, 94 in the outer wall of insulating body section 12 and in the outer casing cover 26 respectively with the handle portion 91 conveniently disposed exteriorly for manual movements of the operating member.

The operating member 90 has one face thereof recessed as at 96 for reception of the actuating member 84, with the actuating member constantly engaged edgewise between the insulating plate member 56 and the abrupt shoulder-walls of the recess 96.

While the actuating member is mounted on pivot rod 88 for both sliding and rotary movements, it normally is held against rotation by a trip member 98 which is pivotally mounted on pivot rod 88 within the recess 96 of the operating member 90. The trip member is grooved at 100 to provide a race-way within which the actuating member 84 is seated and along which it is slidable, and the trip member has the projecting part 99 extending out of recess 96, with its end engageable in a keeper notch 102 of a latch member 104 which is pivoted at 106. The latch member depends from its pivot through an opening 108 in the central wall 38, and the extreme end of the latch member is adapted to engage a wall of slot 110 in the free end portion of the bi-metal strip 64.

When the latch member is engaged in slot 110 of the bi-metal strip, it is held by the strip against counterclockwise movement about its pivot, and the keeper notch 102 is held in position to retain the end of the trip member extension 99 thereby to prevent clockwise rotation of the trip member. However, when the bi-metal strip 64 bows in direction and amount sufficient to release the end of the latch member 104, the latch member is freed for counterclockwise movement, and trip member 98 is thereby freed for clockwise movement.

It will be observed that the recess 96 in the operating member 90 has the two angularly related shoulderwalls 112, 114, both of which are shown as plane surfaces. The actuating member 84 is constantly biased against one or both of the walls 112, 114 by the resiliency of contact-carrying arms 55 and their insulating connecting plate member 56. Also the actuating member and the trip member are biased by the same means for rotation clockwise about pivot rod 88, but are held against rotation so long as the trip member is latched in keeper notch 102. Hence, with the operating member 90 in its circuit open position of Fig. 1, the wall 112 of recess 96 engages flatwise against the inclined flat 116 of the actuating member, with the engagement at a location on

6

the operating member whereby the bias of the actuating member 84 tends to rotate the operating member counter-clockwise. Hence, the operating member is biased to remain in its circuit-open position of Fig. 1. It remains in this circuit open position, rather than moving further counter-clockwise, by reason of the engagement of the cam portion 118 of the actuating member with the angularly related wall 114 of chamber 96.

A manual movement of the operating member 90 from its circuit open position of Fig. 1 to its circuit closed position of Fig. 2 results in movement of wall 112 onto the cam portion 118 of the actuating member which slides the actuating member in general direction toward the insulating member 56, due to the nature of the wall 112 whose portions thus moving onto cam portion 118 are progressively closer to the axis of pivot 88. Hence, the movement of the operating member to its circuit closed position depresses the movable contacts 52, 54 into engagement with fixed contacts 46, 48 against the bias of the resiliency of contact-carrying arms 55, and the engagement of the actuating member with wall 112 in the circuit closed position of the operating member is such that the operating member is biased to remain in its circuit closed position.

If a circuit overload of predetermined character occurs with the interrupter closed as in Fig. 2, the interrupter automatically responds to open the circuit. Such an overload passing through the heater 68 will generate heat sufficient to cause bowing of the bi-metal strip 64 in direction to release the latch member 104. The latch member 104 is thereby freed for counter-clockwise movement under the urge of the trip member 98 which is biased for clockwise rotation and which disengages itself from keeper notch 102 and moves to its trip position as illustrated in Fig. 5, stopped by the shoulder 105 on the latch member 104. Rotation of the trip member simultaneously rotates the actuating member 84 which in turn carries the operating member to its intermediate trip-indicating position, all as illustrated in Fig. 5.

Re-setting of trip member 98, following an automatic opening of the interrupter, conveniently may be effected by a manual movement of the operating member to and slightly beyond its circuit open position, as illustrated in Fig. 6. This effects a counter-clockwise rotation of the operating member, the actuating member and the trip member as a unit to bring the latching end of the trip member into the keeper notch 102 of the latch member 104. If the overload condition no longer exists, the latch member again becomes held in slot 110 of the bi-metal strip 64 and the parts will be restored to their condition of Fig. 1 when the operating member 90 is released.

When the interrupter opens automatically, the actuating member 84 can rotate as described because its portion which normally engages the insulating plate member 56 is a relatively small tip which extends smoothly into an adjacent inclined surface 85 which normally is out of contact with insulating member 56. When the actuating member rotates, this inclined surface 85 moves into engagement with the insulating member 56.

During manual operations of the interrupter, the sliding movements of actuating member 84 may be along a curved path as in the forms of Figs. 1-7, where the actuating member 84 and the race-way groove 100 in the trip member are

curved, or the actuating member and the race-way groove may be straight for rectilinear sliding movements of the actuating member, as indicated at 84' and 101 in Fig. 8. Sliding movement of the actuating member along a curved race-way has the advantage that the action on the insulating member 54 is one of sliding thrust which contributes to a smooth and easy manual operation of the operating member 90. On the other hand, rectilinear sliding movements of the actuating member produce somewhat quicker snap responses of the movable contacts. In either case, however, the final travel of the operating member to manually open and to manually closed positions is a snap movement.

Fig. 7 is generally similar to Fig. 2 with the addition of electromagnetic means for releasing the latch member 104. As represented, the free end of the bi-metallic strip 64' has secured thereon the armature 120, and the heater resistance wire 68' is coiled around the armature as at 122 before extending to the terminal screw 70. By this means, additional to the heater 68', the trip member 104 is electromagnetically responsive for instantaneous tripping in response to overloads of predetermined character as well as being thermally responsive to overloads of other predetermined character. However, the electro-responsive tripping may be employed without the thermal tripping, if desired.

The invention is illustrated in Fig. 9 as it may be employed in a circuit breaker having one or more toggle-actuated movable contacts 124. A movable contact 124 is shown mounted at one end of a rigid arm 126 for coaction with a fixed contact 128. The other end of arm 126 is pivoted at 130 on any suitable support, and a spring 132 constantly biases the arm 126 clockwise about its pivot, or in direction to move the movable contact away from the fixed contact. A toggle, comprising the members 134, 136 pivoted together at 138, has one end pivoted at 140 on any suitable fixed support and has its other end pivotally connected at 142 to the arm 126. A spring 144 constantly biases the toggle in direction from its full line on-center position to its dotted position in which the toggle is broken and the movable contact is separated from the fixed contact.

A manually operable member 146 may be generally similar to the manually operable member 90 previously described excepting that its recess 148 opens laterally generally toward the toggle so that the actuator 150 constantly engages the toggle. As shown, the actuator is straight, and is mounted for rectilinear movements in a straight race-way 152 in a trip member 154 whose projecting end 156 is adapted to be held releasably in its full line operative position by the free end portion of the bi-metallic strip 158. The switch arm 126 and the bi-metallic strip 158 are electrically connected by the pig-tail conductor 160.

The operation of this Fig. 9 form is substantially the same as the operation described in connection with the earlier views excepting that the actuator acts on the toggle instead of directly on the switch arm, the spring 144 constantly urging the toggle against the actuator and the actuator against the interior surfaces of the manually operable member. Manual movements of the manually operable member effect opening and closing movements of the switch arm and bowing of bi-metal strip 158, in response to a circuit overload releases the latch member for rotation of it and the actuator under the urge of

the toggle spring 144. The switch arm spring 132 assists the toggle spring and may or may not be necessary in particular cases.

I claim as my invention:

1. In an electric circuit interrupter having a movable contact, an actuator for said contact, means mounting the actuator for movements of translation and for rotational movements, means biasing the actuator for movement of translation in one direction and also biasing it for rotational movement in one direction, means manually operable to one position for moving the actuator with motion of translation in opposition to the first mentioned bias and manually operable to another position for effecting a movement of the actuator with motion of translation in the direction of the first mentioned bias, and automatically responsive means for effecting a rotational movement of the actuator in the direction of its rotational bias.

2. In an electric circuit interrupter having a movable contact, an actuator for said contact, means mounting the actuator for movements of translation and for rotational movements, means biasing the actuator for movement of translation in one direction and also biasing it for rotational movement in one direction, means releasably maintaining the actuator against movement in the direction of its rotational bias, means manually operable to one position for moving the actuator with motion of translation in opposition to the first mentioned bias and manually operable to another position for effecting a movement of the actuator with motion of translation in the direction of the first mentioned bias, and means automatically responsive to a predetermined circuit condition for releasing said releasable means thereby to effect a rotational movement of the actuator in the direction of its rotational bias.

3. In an electric circuit interrupter having a movable contact, an actuator for said contact, means mounting the actuator for movements of translation in one direction and for rotational movements, means biasing the actuator for movement of translation in one direction and also biasing it for rotational movement in one direction, means releasably maintaining the actuator against movement in the direction of its rotational bias, means manually operable to one position for moving the actuator with motion of translation in opposition to the first mentioned bias and manually operable to another position for effecting a movement of the actuator with motion of translation in the direction of the first mentioned bias, means automatically responsive to a predetermined circuit condition for releasing said releasable means thereby to effect a rotational movement of the actuator in the direction of its rotational bias, and means whereby said manually operable means is manually operable following a said rotational movement of the actuator for effecting a re-setting rotational movement of the actuator in opposition to its said rotational bias.

4. In an electric circuit interrupter having a movable contact, an actuator for said contact, means mounting the actuator for movements of translation in one direction and for rotational movements, means biasing the actuator for movement of translation in one direction and also biasing it for rotational movement in one direction, means releasably maintaining the actuator against movement in the direction of its rotational bias, means manually operable to one po-

sition for moving the actuator with motion of translation in opposition to the first mentioned bias and manually operable to another position for effecting a movement of the actuator with motion of translation in the direction of the first mentioned bias, and means automatically responsive to a predetermined circuit condition for releasing said releasable means thereby to effect a rotational movement of the actuator in the direction of its rotational bias, there being coacting means on the said manually operable means and on said actuator whereby the manually operable means is moved to a trip-indicating position in response to a said rotational movement of the actuator.

5. In an electric circuit interrupter, a contact-carrying member, an actuator therefor, means manually operable to one position for thrusting the actuator with motion of translation in one direction to effect a circuit closing movement of the contact-carrying member, biasing means for thrusting the actuator with motion of translation in the opposite direction to effect a circuit opening movement of the contact-carrying member in response to a manual movement of said manually operable means to another position, and automatically responsive means coacting with said biasing means for effecting rotation of the actuator to effect an automatic circuit opening movement of the contact-carrying member.

6. In an electric circuit interrupter, a fixed contact and a movable contact, an actuator for the movable contact, a manually operable member, means for thrusting the actuator with motion of translation in one direction in response to a manual movement of the manually operable member thereby to effect a movement of the movable contact into engagement with the fixed contact, means for thrusting the actuator with motion of translation in the opposite direction in response to a different movement of the manually operable member thereby to effect a movement of the movable contact away from the fixed contact, and automatically responsive means coacting with the latter said thrusting means for effecting rotation of the actuator thereby automatically to effect a movement of the movable contact away from the fixed contact.

7. In an electric circuit interrupter, an operating member manually movable between circuit open and circuit closed positions, an actuating member constantly engaged by said operating member, means biasing said actuating member in direction to hold it in engagement with said operating member, releasable means rotatably mounted and normally supporting said actuating member for movements only of translation in response to manual movements of said operating member, and means for releasing said releasable means thereby to free said releasable means and said actuating member for simultaneous rotational movement independently of manual movement of said operating member and in response to the bias of said biasing means.

8. In an electric circuit interrupter, an operating member manually movable between circuit open and circuit closed positions, an actuating member constantly engaged by said operating member, means biasing said actuating member in direction to hold it in engagement with said operating member, means supporting said actuating member and holding it against rotation but permitting sliding movements thereof in directions generally toward and from said biasing means in response to manual movements of said

operating member, said supporting means being rotatably mounted and there being means normally holding said supporting means against rotation, and means for releasing said supporting means thereby to free said supporting means and said actuating member for simultaneous rotational movement independently of manual movement of said operating member and in response to the bias of said biasing means.

9. In an electric circuit interrupter, an operating member manually movable between circuit open and circuit closed positions, an actuating member constantly engaged by said operating member, means biasing said actuating member in direction to hold it in engagement with said operating member, releasable means slidably supporting said actuating member and itself rotatably supported and adapted when released to rotate said actuating member, actuated means mounted in the path of sliding movement of the actuating member and adapted to be actuated thereby when the actuating member slides in one direction, there being coacting means on said operating member and on said actuating member whereby a manual movement of said operating member in one direction effects sliding movement of said actuating member in direction to actuate said actuated means and whereby a said rotation of said actuating member effects movement of said operating member to an intermediate indicating position and whereby a subsequent manual movement of said operating member to and slightly beyond its said circuit open position effects a re-setting of said releasable means.

10. In an electric circuit interrupter, a pivoted operating member manually movable between circuit open and circuit closed positions, an actuating member slidably and rotatably mounted on the pivot of said operating member, biased means engaging said actuating member and maintaining it constantly in engagement with said operating member and also constantly biasing said actuating member for rotation in one direction on said pivot, means holding said actuating member against rotation on said pivot but permitting sliding movements thereof, there being cam means on said operating member whereby said actuating member slides on said pivot in response to manual movements of said operating member, and means for releasing said holding means thereby to free said actuating member for rotation on said pivot independently of any manual movement of said operating member and with simultaneous biasing movement of said biased means.

11. In an electric circuit interrupter, an operating member movable between circuit open and circuit closed positions, a relatively fixed contact member, a relatively movable contact member, an actuating member constantly engaged by said operating member, biasing means operatively connected to said movable contact member and constantly maintaining said actuating member in engagement with said operating member, means for effecting a sliding movement of said actuating member in response to a manual movement of said operating member to one of its said positions thereby to operate said biasing means in opposition to its bias, and means including said biasing means for effecting a rotational movement of said actuating member independently of any manual movement of said operating member thereby to effect an operation of said biasing means in the direction of its bias.

12. In an electric circuit interrupter, a pivoted operating member manually movable between circuit open and circuit closed positions, an actuating member slidably and rotatably mounted on the pivot of said operating member, biased means engaging said actuating member and maintaining it constantly in engagement with said operating member and also constantly biasing said actuating member for rotation in one direction on said pivot, means holding said actuating member against rotation on said pivot but permitting sliding movements thereof, there being cam means on said operating member whereby said actuating member slides on said pivot in response to manual movements of said operating member, and means for releasing said holding means thereby to free said actuating member for rotation on said pivot independently of any manual movement of said operating member and with simultaneous biasing movement of said biased means, there being co-acting surfaces on said operating member and actuating member whereby a said rotation of said actuating member effects automatic movement of said operating member to an intermediate trip-indicating position thereof.

13. In an electric circuit interrupter, a pivoted operating member manually movable between circuit open and circuit closed positions, a fixed pivot for said operating member, a slotted actuating member mounted in coacting relation to said operating member with said pivot extending through the slot of said actuating member and with said actuating member both rotatable and slidable relative to said pivot, means holding said actuating member against rotation on said pivot, means biasing said actuating member in one direction about said pivot and also biasing it for sliding movement thereof in one general direction of extent of its slot into constant engagement with said operating member, there being means on said operating member for sliding said actuating member in opposition to its said bias in response to a movement of said operating member to one of its said positions, and means for releasing said holding means thereby to free said actuating member for rotation on said pivot in response to its said bias and independently of any manual movement of said operating member.

14. In an electric circuit interrupter, an operating member, an actuating member and a trip member all mounted in coacting relation for rotation on a common axis, said actuating member being slidably mounted in said trip member and being rotatable only when said trip member is rotated, means constantly biasing said trip member and said actuating member in one direction about the said common axis and also constantly biasing said actuating member for sliding movement in direction generally toward said operating member thereby to maintain said actuating member constantly pressed against said operating member, means releasably maintaining said trip member against rotation and responsive to a circuit abnormality of predetermined character for releasing the trip member for rotation thereby to effect rotation of said actuating member under the urge of said biased member, there being coacting means on said operating member and on said actuating member whereby said actuating member slides in response to manual movements of said operating member when said trip member is maintained against rotation and whereby rotational move-

ment of said actuating member in response to release of said trip member effects movement of said operating member to an indicating position independently of any manual movement thereof.

15. In an electric circuit interrupter, an operating member, an actuating member and a trip member all mounted in coacting relation for rotation on a common axis, said actuating member being slidably mounted in said trip member and being rotatable only when said trip member is rotated, means constantly biasing said trip member and said actuating member in one direction about the said common axis and also constantly biasing said actuating member for sliding movement in direction generally toward said operating member thereby to maintain said actuating member constantly pressed against said operating member, means releasably maintaining said trip member against rotation and responsive to a circuit abnormality of predetermined character for releasing the trip member for rotation thereby to effect rotation of said actuating member under the urge of said biased member, there being coacting means on said operating member and on said actuating member whereby said actuating member slides in response to manual movements of said operating member when said trip member is maintained against rotation and whereby rotational movement of said actuating member in response to release of said trip member effects movement of said operating member to an indicating position independently of any manual movement thereof, and means on said trip member engageable by said operating member to reset the trip member following a releasing thereof and in response to a manual movement of said operating member.

16. In an electric circuit interrupter, a pivoted operating member manually movable between circuit open and circuit closed positions and automatically movable to an intermediate trip position, an actuating member slidably and rotatably mounted in coacting relation to said operating member and constantly biased for sliding movement into engagement with said operating member and also constantly biased for rotational movement, releasable means holding said actuating member against rotation, there being coacting means on said operating member and on said actuating member whereby said actuating member slides in one general direction in response to a manual movement of said operating member to its said circuit closed position and slides in the opposite general direction in response to a manual movement of said operating member to its said circuit open position, and means for releasing said releasable means thereby to free said actuating member for rotational movement in response to its said bias and independently of any manual movement of said operating member, said biased rotational movement of said actuating member effecting movement of said operating member to its said intermediate trip position.

17. In an electric circuit interrupter, a movable contact member operable between circuit open and circuit closed positions, a toggle for operating said contact member and biased in direction to break the toggle and thereby to operate said contact member toward its circuit open position, an actuator mounted for movement of translation and also mounted for rotation, said actuator being constantly biased by the toggle for movement of translation in one direction, and being constantly biased for rotational movement in one direction, means releasably maintain-

13

ing the actuator against rotation, and manually operable means for moving the actuator with movement of translation in direction in opposition to said bias of the toggle thereby to effect a movement of the contact member to its circuit closed position in response to a straightening of the toggle.

18. In an electric circuit interrupter, a contact member movable between circuit open and circuit closed positions, a toggle operable to move said contact to circuit closed position when the toggle is straightened and to move said contact to circuit open position when the toggle is broken, means biasing the toggle in direction to break it, an actuator mounted for sliding movements of translation in directions generally toward and from the toggle, said actuator constantly engaging the toggle, manually operable means against which said actuator constantly is pressed by said toggle under the influence of its said bias, said manually operable means being operable in one direction to slide said actuator to effect a straightening of the toggle in opposition to its said bias, said slidable actuator being also mounted for rotation, and means releasably maintaining the actuator against rotation.

19. In an electric circuit interrupter having a movable contact, an actuator for said contact means mounting the actuator for movements of translation and for rotational movements, means

14

biasing the actuator for movement of translation in one direction and also biasing it for rotational movement in one direction, means manually operable to one position for moving the actuator with motion of translation in opposition to the first mentioned bias and manually operable to another position for effecting a movement of the actuator with motion of translation in the direction of the first mentioned bias, automatically responsive means for effecting a rotational movement of the actuator in the direction of its rotational bias, and a pivot common to said actuator, said manually operable means, and said automatically responsive means.

ELMER H. TAYLOR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,939,132	Moore	Dec. 12, 1933
2,160,236	Taylor	May 30, 1939
2,160,424	Taylor	May 30, 1939
2,270,150	Taylor	Jan. 13, 1942
2,308,401	Taylor	Jan. 12, 1943
2,320,355	Frank et al.	June 1, 1943
2,320,382	Platz	June 1, 1943
2,325,717	Swingle	Aug. 3, 1943