Oct. 26, 1943. H. G. BAXTER 2,332,496

CIRCUIT BREAKER

Filed Jan. 28, 1942

Fig.1.

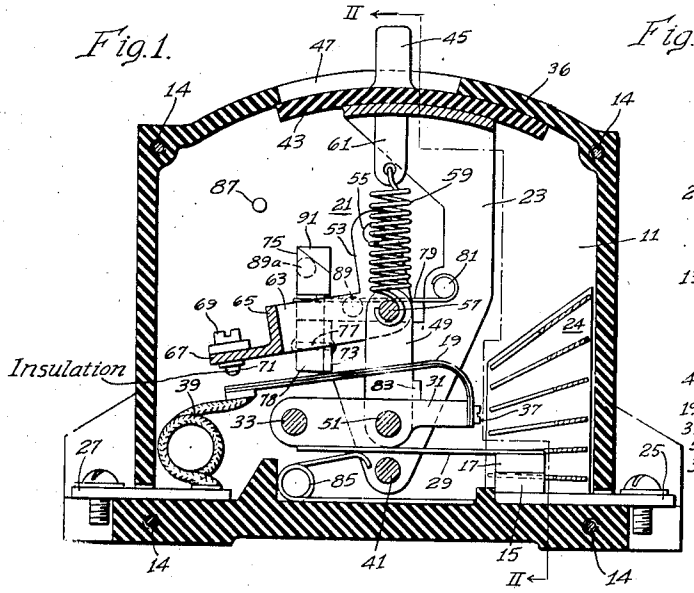


Fig.2.

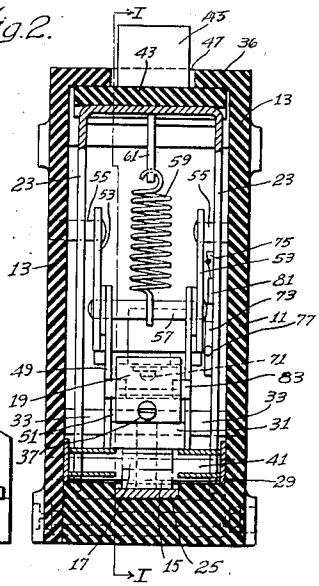


Fig.3.

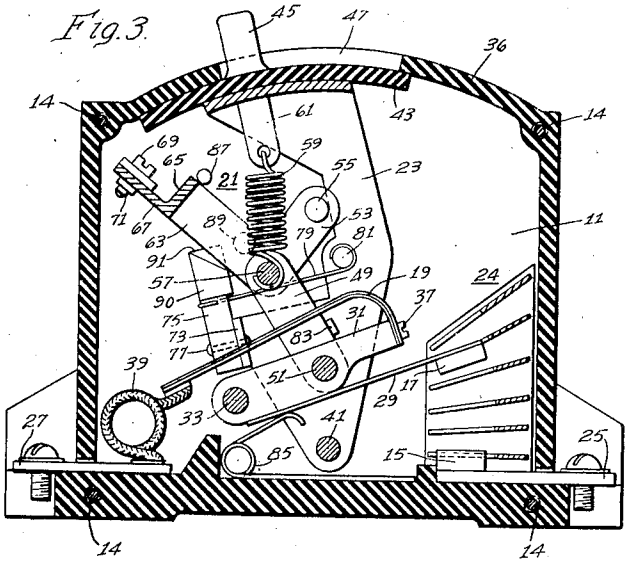
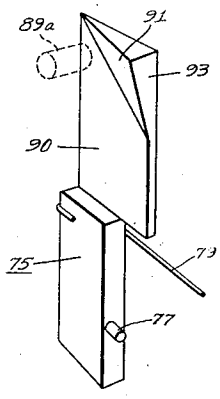


Fig.4.



WITNESSES:

C. J. Weller.

Paul O. Harlow.

INVENTOR

Harold G. Baxter.

BY

Ralph W. Swingle

ATTORNEY

Patented Oct. 26, 1943

2,332,496

UNITED STATES PATENT OFFICE

2,332,496

CIRCUIT BREAKER

Harold G. Baxter, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application January 28, 1942, Serial No. 428,484

12 Claims. (Cl. 200—116)

This invention relates to circuit breakers and, more particularly, to circuit breakers of the type which are opened and closed manually and which are opened automatically in response to predetermined circuit conditions.

One object of the invention is to provide an improved manually and automatically operable circuit breaker that is characterized by the absence of any latching means.

Another object of the invention is to provide an improved trip free circuit breaker wherein a thermal trip element functions to operate a toggle to cause opening of the breaker irrespective of the position of the manual operating member.

Another object of the invention is to provide an improved trip free circuit breaker wherein a switch member is movable to open and close the circuit through the agency of a toggle mechanism and in which a bimetal element, mounted on the switch arm for movement therewith, is operable to positively operate the toggle to initiate automatic opening operation of the switch member.

Another object of the invention is to provide an improved circuit breaker having an operating mechanism including a manual operating member, an overcenter spring and a toggle operable to move a switch member to open and closed positions, and a bimetal element mounted on the switch member for movement therewith operable to positively move the toggle in a direction to initiate an opening movement by the switch member, the manual operating member having a member pivotally mounted thereon for movement therewith which is operable upon closing movement of said manual member to positively initiate movement of the toggle in a direction to close the switch member.

Another object of the invention is the provision of an improved manually and automatically operable trip free circuit breaker which does not require any manual resetting operation after an automatic opening operation.

Another object of the invention is to provide a circuit breaker embodying an improved operating mechanism which is simple, efficient and reliable in operation, and which is inexpensive to manufacture.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims; the invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following description of one embodiment thereof when read in conjunction with the accompanying drawing in which:

Figure 1 is a vertical sectional view through a circuit breaker embodying the principles of the invention, the section being taken substantially on line I—I of Fig. 2;

Fig. 2 is a transverse sectional view through the circuit breaker taken substantially on line II—II of Fig. 1;

Fig. 3 is a vertical sectional view similar to Fig. 1, but showing the breaker mechanism manually operated to open contact position; and

Fig. 4 is an enlarged perspective view of the resetting member.

Referring to Fig. 1, the circuit breaker comprises in general a two part housing including an open sided housing member 11 of molded insulating material, and a cooperating side cover plate 13 also of molded insulating material removably secured to the housing member 11 by means of bolts 14, a stationary contact 15, a movable contact 17, a thermally responsive trip member 19 comprising a strip of bimetallic material, an operating mechanism indicated generally at 21 including an operating lever 23, and an arc extinguisher 24. Terminals 25 and 27 are provided for connecting the breaker in an electrical circuit.

The stationary contact 15 is mounted on the inner end of the terminal 25 and cooperates with the movable contact 17, which is mounted on the free end of a resilient contact arm 29 secured to a pivoted switch member 31 of conducting material. The switch member 31 is pivotally supported on a pivot pin 33 mounted in the side wall of the housing member 11, and in an opening in the cover plate 13. One leg of an L-shaped bimetal element 19 is secured by means of a screw 37 to the free end of the switch member 31, and the other leg of the bimetal element extends toward the left (Fig. 1) to a point slightly beyond the pivot point of the switch member. A flexible conductor 39 connects the free end of the bimetal element 19 to the inner end of the terminal 27, completing the electrical circuit for the breaker which extends from the terminal 25 through the contacts 15 and 17, the resilient contact arm 29, the switch member 31, the bimetallic trip member 19, and the flexible conductor 39 to the terminal 27.

The operating lever 23 comprises a U-shaped lever, the two legs of which are pivotally mounted at their inner ends on a pivot pin 41 supported in the housing member 11 and in the cover plate 13. At its outer end, the operating lever 23 has

secured thereto, by suitable means, an arcuate insulating shield 43 from which a manual operating handle 45, also of insulating material, projects through an opening 47 in the outer wall 36 of the closure.

The operating mechanism 21 includes a toggle comprising a pair of toggle links 49 one disposed on each side of the switch member 31 and pivotally connected thereto by means of a pivot pin 51, and a pair of toggle links 53, which are pivotally supported at their outer ends on pins 55 one of which is supported in and projects inwardly from the housing member 11, the other pin 55 being supported in the cover plate 13. The toggle links 49 and 53 are pivotally connected by a knee pivot pin 57, and an overcenter spring 59, having one end hooked over the knee pin 57 and the other end hooked through an opening in a projection 61 integral with the operating lever 23, at all times exerts a tension force between the knee of the toggle and the outer end of the operating lever.

The toggle links 53 are L-shaped and each is provided with an arm 63 projecting toward the left (Fig. 1) from the knee of the toggle. The arms 63 are rigidly connected at their free ends by a cross-member 65, which has an extension 67 in which is mounted an adjusting screw 69 having an insulating button 71 on its end with which the free end of the bimetal element 19 is adapted to cooperate to trip the breaker.

One leg of the U-shaped operating lever 23 has an ear 73 formed at right angles thereto and on which a member 75 is pivotally mounted for transverse movement by means of a pivot pin 77. The member 75 is biased to a normal position parallel to the wall of the housing by a spring 79 secured by means of a projecting stud 81 to the leg of the operating lever 23 which carries the member 75. The stud 81 extends across the plane of one of the toggle links 53. The purpose of the member 75 will be described later.

With the parts in the position shown in Fig. 1, the overcenter spring 59 biases the knee of the toggle 49—53 over center to the right of a line drawn through the center of the pins 51 and 55 and in this position the toggle maintains the contact 17 in engagement with contact 15. The overcenter movement of the toggle is limited by a stop member 83 projecting from the toggle link 49 and which engages the switch member 31. In this position, contact pressure is provided by the resilient contact arm 29.

Upon the occurrence of an overload current in the circuit of the breaker, the bimetal element 19 is heated by the excessive current flowing therethrough, and when heated a predetermined amount, it flexes in a direction away from the switch member 31. After flexing a predetermined amount, the free end of the bimetal element engages the insulating end 71 of the screw 69 and rocks the L-shaped toggle links 53 clockwise (Fig. 1) about their pivot pins 55. This operates the toggle 49—53 over center in a direction to cause its collapse. During this movement, the line of action of the spring 59 passes over center to the left (Fig. 1) of the line 57—55, whereupon the spring exerts a force on the knee of the toggle in a direction to complete collapse of the toggle. As the toggle 49—53 collapses, the switch member 31 is moved in a counterclockwise direction about its pivot 33, opening the contacts with a snap action. The clockwise or opening movement of the toggle links 53 is limited by one of the arms 63 striking a limit stop 87 projecting inwardly from the side wall of the housing 11. A coil spring 85, having one end disposed against the base of the housing 11 and the other end tensioned against the contact arm 29, biases the switch member 31 and the contact arm in the opening direction and assists the spring 59 in opening the contacts.

During the movement of the toggle 49—53 to collapsed position, the line of action of the spring 59 moves over center to the left (Fig. 1) of a line drawn through the center of the pivot pin 41 for the operating lever 23 and the point of anchorage of the spring 59 to the projection 61. As soon as the spring 59 passes to the left of the center line 41—61, it moves the operating lever 23 counterclockwise to its "off" position in which it appears in Fig. 3, the counterclockwise movement of the operating lever 23 being limited by engagement with the pivot pins 55 for the toggle links 53. The mechanism is now ready to be closed. It will be noted from the above that the mechanism does not require any manual resetting operation after the breaker has been tripped.

The switch member 31 is rotated in a clockwise or closing direction to close the contacts by manual movement of the operating lever 23 from its Fig. 3 position in a clockwise direction toward its "on" position. During this movement of the operating lever 23, the upper corner 91 of the previously mentioned member 75 mounted thereon engages a projection 89 on one of the arms 63 and starts the toggle 49—53 toward its overcenter or in toggle position. Continued clockwise movement of the operating lever 23 after engagement of the member 75 with the projection 89 causes the line of action of the spring 59 to pass over center to the right of the line 57—55, whereupon the toggle 49—53 moves over center to its Fig. 1 position, closing the contacts with a snap action.

The contacts are opened manually by moving the handle 45 counter-clockwise, during which movement the stud 81, which, as previously stated, extends across the path of movement of the toggle link 53, engages said link and positively starts the toggle 49—53 in a direction to cause its collapse. As soon as the line of action of the spring 53 moves over center to the left of the line 57—55, the spring causes collapse of the toggle and opening of the contacts with a snap action. The contacts are closed in the previously described manner.

The circuit breaker is trip-free of the handle; that is, if the contacts should be closed against an overload in the circuit, the bimetal element 19 will be heated by the excessive current, and when heated a predetermined amount, will move the toggle 49—53 over center in opening direction. When the bimetal has moved the toggle through dead center in opening direction the line of action of the spring 59 is such as to complete the collapse of the toggle and cause opening of the contacts even though the handle is held in the "on" position. In this event, when the toggle 49—53 collapses and the toggle link 53 moves to the position in which it appears in Fig. 3, it will carry the projection 89 on the arm 63 to substantially the position indicated at 89a by the dotted line in Fig. 1. In order to permit the projection 89 to pass the member 75 when the handle is held in the "on" position, said member has a portion 90 of reduced thickness. If the handle is held in the "on" position during opening of the contacts in response to an overload, the operating lever 23 and, consequently, the member 75 will remain in their Fig. 1 positions

while the toggle **49—53**, the switch member **31** and the contact arm assume their Fig. 3 positions. With the breaker in this condition, it is necessary, in order to close the contacts, to first allow the operating lever to move to the "off" position. During this movement, a beveled face **91** of the member **75** (Fig. 4) wipes by the projection **89**, rotating the member **75** slightly clockwise (Fig. 2) until it clears projection. The spring **79** then restores the member **75** to its normal position, wherein a face **93** is in position to engage the projection **89** and start the toggle **49—53** over center in a direction to close the contacts when the handle **45** is rotated to its "on" position.

The arc extinguisher **24** may be of any suitable type, preferably of the type comprising a stack of slotted plates of magnetic material wherein the arc drawn by rupture of the current is broken up into a series of short arcs which are quickly cooled and extinguished in a manner well known in the art.

From the foregoing description, it can be seen that I have provided a simple and inexpensive trip free circuit breaker having relatively few parts and no latching mechanism. The bimetal element has to overcome only the force necessary to move the toggle through dead center to trip the breaker, and the bimetal is then free to continue its flexing movement while heated without any opposition which might tend to give it a set.

Having described the invention in accordance with the patent statutes, it is to be understood that various changes and modifications may be made in the structural details disclosed without departing from some of the essential features of the invention. It is, therefore, desired that the language of the appended claims be given as reasonably broad interpretation as the prior art permits.

I claim as my invention:

1. A circuit breaker comprising a switch member movable to open and closed positions, operating means for moving said switch member to open and to closed position with a snap action, said operating means including an operating member movable to open and closed positions, a toggle having one end pivoted to a fixed support and the other end pivotally connected to the switch member, an overcenter spring connecting the operating member to the knee of the toggle, and current-responsive means mounted on and movable with the switch member and operable in response to predetermined conditions to engage a portion of the toggle and move said toggle over center to cause opening movement of said switch member.

2. A circuit breaker comprising a switch member movable to open and to closed position, operating mechanism for moving said switch member to open and to closed position including an operating handle movable to open and closed positions, a toggle having one end pivoted to a fixed support and the other end pivotally connected to said switch member, an overcenter spring connecting the knee of said toggle to the operating handle, and a bimetal element mounted on said switch member for movement therewith, said bimetal being operable when heated a predetermined amount to flex in a direction to engage a portion of said toggle and move said toggle over center in a direction to cause opening movement of the switch member.

3. A circuit breaker comprising a switch member movable to an open and a closed position, operating means for moving said switch member to open and to closed position with a snap action, said operating means including an operating handle movable to an open and to a closed position, a toggle pivoted at one end to a fixed support and having a pivoted connection with said switch member at the other end for restraining the switch member in closed position, an overcenter spring connecting the knee of the toggle to the operating handle, an a thermally-responsive means mounted on said switch member and operable in response to predetermined conditions to engage a portion of the toggle and move said toggle over center in a direction to cause movement of the switch member to open position irrespective of the position of the operating handle.

4. A circuit breaker comprising a movable switch member, operating means for moving said switch member to an open position and to a closed position, said operating means including an operating handle movable to an open and to a closed position, a toggle having one end pivoted to a fixed support and the other end pivotally connected to the switch member, an overcenter spring connecting the knee of said toggle to the operating handle, and a bimetal element mounted on said switch member for movement therewith, said bimetal element being heated in response to the current of the circuit and operable when heated a predetermined amount to flex in a direction to engage the toggle and move said toggle over center in a direction to cause movement of the switch member to open position irrespective of the position of the operating handle.

5. A circuit breaker comprising a pivoted switch member movable to open and to closed position, operating means for said switch member including an operating handle movable to open and closed positions, a toggle having one end pivoted to a fixed support and the other end pivoted to said switch member, an overcenter spring connecting the knee of said toggle to the operating handle, a current responsive element mounted on said switch member for movement therewith, said current responsive element being operable to engage a part of the toggle and move said toggle over center in a direction to cause opening movement of the switch member, and means on the operating handle for engaging the toggle when said handle is moved to closed position to initiate movement of the toggle over center in a direction to cause closing movement of the switch member.

6. A circuit breaker comprising a switch member movable to open and closed positions, operating means for said switch member including an operating handle movable to open and closed positions, a toggle operable to cause movement of said switch member to open and closed positions, an overcenter spring connecting the knee of the toggle to the operating handle, a bimetal element mounted on the switch arm for movement therewith, said bimetal element being operable when heated a predetermined amount to positively move the toggle over center in a direction to cause opening movement of said switch member, and a member movably supported on the operating handle and engageable with the toggle when said handle is moved toward closed position to positively initiate movement of said toggle in a direction to cause closing movement of said switch member.

7. A circuit breaker comprising a switch member movable to open and closed positions, operating mechanism for said switch member including an operating handle movable to open and closed positions and a toggle operable to cause opening and closing movements of said switch member, a bimetal element mounted on the switch member for movement therewith, said bimetal element being operable when heated a predetermined amount to positively operate the toggle in a direction to cause opening movement of the switch member, a member movably mounted on the operating handle for movement therewith, said member being operable upon movement of said handle to closed position to positively initiate movement of the toggle in a direction to cause closing movement of said switch member, said bimetal element being operable to initiate operation of the toggle to cause opening movement of the switch member irrespective of the position of the handle.

8. A circuit breaker comprising a switch member movable to open and closed positions, operating mechanism for said switch member including an operating lever movable to open and closed positions and a toggle operable to cause movement of said switch member to open and closed positions, an overcenter spring connecting the knee of the toggle to the operating lever, a bimetal element operable when heated a predetermined amount to positively operate the toggle in a direction to cause opening movement of the switch arm, a member movably mounted on the operating lever for movement therewith in opening and closing directions and for movement in another direction at an angle to its movement in opening and closing directions, said member being operable to engage the toggle when the operating lever is moved toward closed position for initiating movement of said toggle in a direction to cause closing movement of the switch member, and said member being movable in said other direction to permit said member to pass the toggle when the operating lever is moved to open position following an operation of the toggle by the bimetal element.

9. A circuit breaker comprising a switch member movable to an open and to a closed position, operating means for moving said switch member to open and to closed position with a snap action, said operating means including an operating handle movable to an open and to a closed position, a toggle pivoted at one end to a fixed support and having a pivoted connection with the switch member at the other end for restraining said switch member in closed position, an overcenter spring connecting the knee of the toggle to the operating handle, and current responsive means operable in response to predetermined conditions to engage a portion of the toggle and move said toggle over center in a direction to cause movement of the switch member to open position, said handle being automatically moved to open position by the overcenter spring upon automatic opening movement of the switch member and said mechanism being then operable to move the switch member to closed position without requiring any manual resetting operation.

10. A circuit breaker comprising a switch member movable to open and closed positions, operating mechanism for said switch member including an operating lever movable to open and closed positions and a toggle operable to cause movement of said switch member to open and closed positions, a bimetal element operable when heated a predetermined amount to positively operate the toggle in a direction to cause opening movement of the switch arm, a member movably mounted on the operating lever for movement therewith in opening and closing directions and for movement in another direction at an angle to its movement in opening and closing directions, said member being operable to engage the toggle when the operating lever is moved toward closed position for initiating movement of said toggle in a direction to cause closing movement of the switch member, and said member being movable in said other direction to permit said member to pass the toggle when the operating lever is moved to open position following an operation of the toggle by the bimetal element.

11. A circuit breaker comprising a pivoted switch member movable to open and to closed position, operating means for said switch member including an operating handle movable to open and closed positions, a toggle having one end pivoted to a fixed support and the other end pivoted to said switch member, a current responsive element, said current responsive element being operable to move said toggle over center in a direction to cause opening movement of the switch member, and means on the operating handle for engaging the toggle when said handle is moved to closed position to initiate movement of the toggle over center in a direction to cause closing movement of the switch member.

12. A circuit breaker comprising a pivoted switch member movable to open and to closed position, operating means for said switch member including an operating handle movable to open and closed positions, a toggle having one end pivoted to a fixed support and the other end pivoted to said switch member, a current responsive element, said current responsive element being operable to move said toggle over center in a direction to cause opening movement of the switch member, and means on the operating handle for engaging the toggle when said handle is moved to closed position to initiate movement of the toggle over center in a direction to cause closing movement of the switch member, said means on the operating handle disengaging the toggle when in closed position and permitting said toggle to move the switch member to open position upon operation of the current responsive element even though the operating handle is held in closed position.

HAROLD G. BAXTER.