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J. A. DROBNEY ET AL

2,689,285

CIRCUIT BREAKER

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Fig. 1.

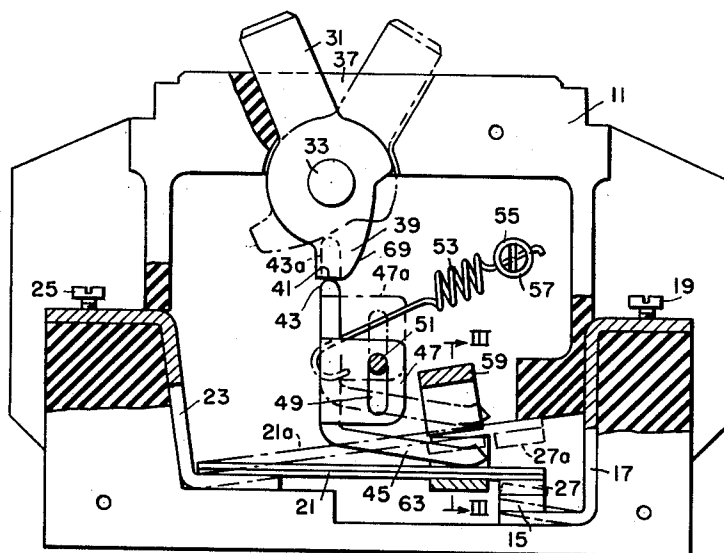


Fig. 2.

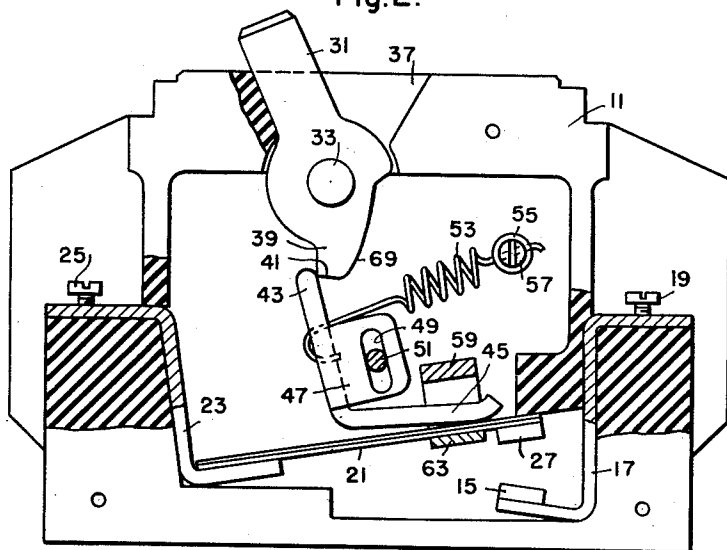
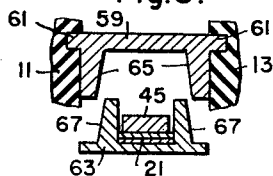


Fig. 3.



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CIRCUIT BREAKER

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12 Claims. (Cl. 200—116)

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This invention relates to circuit breakers and more particularly to circuit breakers which are manually operable to open and close the circuit and which are automatically operated to open the circuit in response to abnormal circuit conditions.

An object of the invention is to provide a circuit breaker embodying a bimetallic switch member which is releasably held in the closed position by a support member having one end releasably engaging an operating handle.

Another object of the invention is to provide a circuit breaker wherein a floating support member forms an operating connection between a breaker operating handle and a bimetallic switch arm.

Another object of the invention is to provide a circuit breaker having a solid current path through the breaker with no braided or laminated flexible connectors or sliding current-carrying joints.

Another object of the invention is to provide a small, compact circuit breaker which is of simple construction, reliable in operation and 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, both as to construction and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description thereof when read in conjunction with the accompanying drawing.

In said drawing:

Figure 1 is an elevational view, partly in section and with the cover removed, of a circuit breaker embodying the principles of the invention.

Fig. 2 is a view similar to Fig. 1 but showing the breaker in the tripped open position.

Fig. 3 is a fragmentary sectional view taken substantially along line III—III of Fig. 1 and looking in the direction of the arrows.

Referring to the drawing, the circuit breaker comprises a casing 11 and a cooperating cover plate 13 (a fragment of which is shown in Fig. 3) both of insulating material. A stationary contact 15 is mounted on a resilient terminal member 17 of conducting material which extends through an opening in one end wall of the casing 11 and has a terminal connector such as a screw 19 at its outer end. A movable switch member or arm 21 constructed of bimetallic material is secured at one end to the inner end of a resilient terminal member 23 which extends through an opening in the other end wall of the casing 11 and has a

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terminal connector such as a screw 25 at its outer end. The switch member 21 at its other end carries a movable contact 27 for cooperating with the stationary contact 15. The switch member 21 is normally biased open by the normal bias of the resilient terminal member 23 on which it is mounted. Instead of using a resilient member 23 the resilience of the switch member 21 may be used for biasing the contacts open.

An operating handle 31 of molded insulating material has opposed trunnions 33 molded integral therewith which engage in suitable bearing openings in the side wall of the casing 11 and in the cover plate 13 to pivotally mount the handle. The handle 31 extends outwardly through an opening 37 in the casing 11. The inner end of the handle 31 is provided with a projection 39 having a surface 41 which, in the closed position of the breaker, releasably engages the rounded upper end of a support member 43. The support member 43 has an angular portion 45 the end of which normally engages the bimetallic switch member 21 to releasably restrain the switch member in closed position. The support member 43 is provided with a pair of spaced ears 47 (only one being shown) formed at right angles thereto and having elongated slots 49 thereon through which extends a pin 51 suitably supported in the side wall of the casing 11 and in the cover plate 13. A spring 53 having one end connected to the support member 43 and the other end adjustably secured to a member 55 by means of a screw 57 biases the support member 43 in a clockwise direction about the pin 51.

A U-shaped magnet yoke 59 (Figs. 1, 2 and 3) is provided with projecting ends 61 engaging in openings in the side wall of the casing 11 and the cover 13 (as clearly shown in Fig. 3) to rigidly support the magnet yoke. An armature 63 is rigidly mounted on the bimetallic switch member 21. The legs of the U-shaped magnet yoke are provided with sloping pole faces 65 which cooperate with corresponding sloping faces 67 on the armature 63. The sloping faces are arranged to permit one of the magnetic members to move into the others. This has the advantage that the air gap is small but permits a relative large movement between the two magnetic members.

In the closed position of the breaker the upper end of the support member 43 bears against the projection 39 on the operating handle 31 and the rounded end of the portion 45 of the support member bears against the bimetallic switch arm 21. One component of the bias on the switch member tends to turn the support member 43

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upwardly and another component tends to rotate the support member 43 counterclockwise about the pin 51. In the closed position the upward component is restrained by the engagement of the end of the support member 43 with the projection 39 of the handle and the bias of the spring 53 is sufficient to hold the switch arm 21 in the closed position against the component tending to rotate the support member 43. In order to manually open the contacts 15—27, the operating handle 31 is rotated clockwise from the full line position to the "off" position shown by dot and dash lines (Fig. 1). This movement of the handle causes the projection 39 on the handle to release the support member 43 whereupon the biasing force of the resilient member 23 moves the switch member 21 to the open position and, aided by the spring 53 moves the support member longitudinally to the position shown by dot and dash lines at 43a in Fig. 1.

The contacts are closed by reverse movement of the handle 31 from the "off" position to the "on" position. During this movement of the handle 31 a cam surface 69 on the projection 39 engages the upper end of support member 43 and cams this member downwardly to move the switch arm 21 to the closed position.

The high expansion side of the bimetallic switch member 21 is on the lower side so that when the bimetal is heated in response to overload currents the contact end of the bimetal element bends upwardly. Consequently, when the bimetal element is heated in response to overload currents below a predetermined value of, for instance, ten times normal rated current, the bimetal element bends upwardly causing counterclockwise rotation of the support member 43 about the pin 51. During the early part of this movement of the support member 43, the handle 31 rotates clockwise until the end of the support member 43 slips off of the surface 41 thereon. As soon as the support member 43 is disengaged from the projection 39 of the handle the biasing force of the spring 23 as of the bimetal element 21 moves the support member 43 upwardly to the left of the projection 39 and the spring 53 rotates the support member slightly clockwise. This results in restoring the handle to its "on" position.

During the early part of the tripping movement and until the support member 43 is disengaged from the projection, the contacts are maintained closed by the resilient spring member 17 which causes the stationary contact 15 to follow in engagement with the movable contact until the support member 43 slips off of the surface 41 on the handle projection 39. At this time the contacts are opened with a snap action.

Should the handle be held in the closed position during the occurrence of an overload current, the force of the thermal binding of the bimetal element 21 would overcome the function between the rounded upper end of the support member 43 and the surface 41 on the handle projection 39 and cause counterclockwise rotation of the support member until the support member is disengaged from the handle. The switch member would then move to the open position with a snap action.

In the closed position of the breaker where the handle opposes the upward component of the force on support member 43, the spring 53 has sufficient force to maintain the support member in the position shown in full lines in Fig. 1 against the normal bias of the resilient member 23.

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With the parts in the position shown in Fig. 2, however, the spring 53 alone is unable to overcome the bias of the resilient member 23 and move the parts to the closed position.

In order to close the contacts following an automatic opening operation, it is necessary to move the handle 31 in a clockwise direction from the position as shown in Fig. 2 to the "off" position indicated in Fig. 1. This movement of the handle causes the projection 39 to move over to the left of the support member to the position shown by dot and dash lines in Fig. 1, whereupon the spring 53 moves the support member 43 to the position shown in dot and dash lines in Fig. 1. The switch member 21 is then moved to the closed position by counter-clockwise movement of the handle back to the "on" position at which time the cam surface 69 engages the end of the support member 43 and cams it downwardly to move the switch member 21 to the closed position.

The circuit breaker is opened instantaneously in response to overload currents above the predetermined value of, for instance, ten times normal rated current or short circuit currents by means of the electromagnet 59—63. Upon the occurrence of such an overload or short circuit current, the electromagnet is energized by the current flowing in the bimetallic switch member 21 and the fixed magnet yoke 59 attracts the armature 63 instantaneously moving the bimetallic switch member 21 to the open position. This movement of the switch member 21 causes counterclockwise movement of the support member 43 and release of the support member from the handle 31. The parts then assume the positions in which they are shown in Fig. 2.

The contacts are closed following an electromagnetic opening operation in the previously described manner by first moving the handle 31 to the reset position and then to the "on" position.

The invention provides a circuit breaker of simple and rugged construction having a minimum number of parts which are mounted in the casing by merely laying the parts in grooves or recesses in the casing and without the use of any frame other than the casing itself. The breaker has a solid current path therethrough without the use of flexible conductors. The bimetallic switch member acts to trip the breaker open after a time delay and electromagnetic means is provided to instantaneously trip the breaker. The circuit breaker is trip-free of the operating handle.

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

We claim as our invention:

1. A circuit breaker comprising a stationary contact, a switch member of bimetallic material biased open and movable to open and close the circuit, means resiliently mounting one end of said switch member, a movable contact on the other end of said bimetallic switch member for cooperating with said stationary contact, an operating handle movable to an open position and to a closed position, a support member disposed between said handle and said bimetallic switch member for normally restraining said switch member in closed position, fixed means mounting said support member for pivotal and longitudinal movement, and said bimetallic switch member

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bending in response to overload currents to cause pivotal movement of said support member about said fixed support means to a position to permit opening movement of said switch member free of said handle.

2. A circuit breaker comprising a stationary contact, a switch member of bimetallic material movable to open and close the circuit, resilient means mounting one end of said switch member and biasing said switch member to open position, a movable contact on the other end of said bimetallic switch member for cooperating with said stationary contact, an operating handle movable to an open position and to a closed position, a support member releasably engaging said handle and engaging said bimetallic switch member, fixed means mounting said support member, said support member being mounted for pivotal and longitudinal movement about said fixed mounting means, movement of said handle to said open position permitting longitudinal movement of said support member to permit said resilient means to move said bimetallic switch member to open position, and thermal bending of said bimetallic switch member causing pivotal and longitudinal movement of said support member about said fixed means to permit said resilient means to move said bimetallic switch member to open position.

3. A circuit breaker comprising stationary contact means, a bimetallic switch member biased open and movable to open and close the circuit, fixedly mounted resilient means mounting one end of said switch member, movable contact means on the other end of said bimetallic switch member for cooperating with said stationary contact means, an operating handle movable to an open position and to a closed position, a support member between said handle and said bimetallic switch member normally restraining said switch member in closed position, movement of said handle to open position releasing said support member from said handle to permit movement of said support member to one position to permit opening movement of said bimetallic switch member, and thermal bending of said bimetallic switch member in response to overload currents pivotally moving said support member to another position to effect opening movement of said switch member free of said handle.

4. A circuit breaker comprising a stationary contact, a switch member of bimetallic material biased open and movable to open and close the circuit, a movable contact on said bimetallic switch member for cooperating with said stationary contact, an operating handle movable to an open position and to a closed position, a support member disposed between said handle and said bimetallic switch member for normally restraining said switch member in closed position, said handle releasably engaging said support member, fixed means mounting said support member for pivotal and longitudinal movement, movement of said handle to said open position effecting longitudinal movement of said support member to permit opening movement of said bimetallic switch member, and thermal bending of said bimetallic switch member pivotally moving said support member about said fixed mounting means to permit opening movement of said bimetallic switch member free of said handle.

5. A circuit breaker comprising a stationary contact, a bimetallic switch member biased open and movable to open and close the circuit, a movable contact on said bimetallic switch member for

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cooperating with said stationary contact, an operating handle movable to an open position and to a closed position to effect opening and closing movement of said bimetallic switch member, a support member having one end engaging said bimetallic switch member and the other end releasably engaging said handle for normally restraining said bimetallic switch member in closed position, said handle when moved to said open position effecting release of said support member from said handle to permit movement of said bimetallic switch member to open position, thermal bending of said bimetallic switch member in response to overload currents below a predetermined value pivotally moving said support member to a position to permit opening movement of said bimetallic switch member, electroresponsive means comprising a fixedly mounted magnet yoke and an armature mounted on said bimetallic switch member to be energized by currents flowing in said bimetallic switch member, and said electroresponsive means being operable when energized by overload currents above said predetermined value to instantaneously move said support member and permit movement of said bimetallic switch member to said open position.

6. A circuit breaker comprising a bimetallic switch member biased to open position and movable to open and close the circuit, an operating handle movable to an open position and to a closed position, a support member engaging said operating handle and said bimetallic switch member, fixed means mounting said support member for pivotal and longitudinal movement, biasing means biasing said support member to a position where it normally restrains said bimetallic switch member in closed position, movement of said operating handle to said open position permitting longitudinal movement of said support member to permit opening movement of said bimetallic switch member, and thermal bending of said bimetallic switch member pivotally moving said support member about said fixed mounting means and against the bias of said biasing means to permit opening movement of said bimetallic switch member.

7. A circuit breaker comprising a bimetallic switch member biased to open position and movable to open and close the circuit, an operating handle movable to an open position and to a closed position, a support member engaging said operating handle and said bimetallic switch member, means mounting said support member for pivotal and longitudinal movement, biasing means biasing said support member to a position where it normally restrains said bimetallic switch member in closed position, movement of said operating handle to said open position permitting longitudinal movement of said support member and opening movement of said bimetallic switch member, and thermal bending of said bimetallic switch member pivotally moving said support member against the bias of said biasing means to permit opening movement of said bimetallic switch member, and adjusting means for adjusting said biasing means to vary the thermal tripping point of said breaker.

8. A circuit breaker comprising a bimetallic switch member biased open and movable to open and close the circuit, an operating handle movable to an open position and to a closed position, a support member engaging said operating handle and said bimetallic switch member, means mounting said support member for pivotal and longitudinal movement, biasing means biasing

said support member to a position to normally restrain said bimetallic switch member in closed position, movement of said operating handle effecting longitudinal movement of said support member to permit opening movement of said bimetallic switch member, thermal bending of said bimetallic switch member in response to overload currents below a predetermined value causing pivotal movement of said support member against the normal bias of said biasing means to permit opening movement of said bimetallic switch member free of said handle, adjusting means for adjusting said biasing means to vary the thermal tripping point of said bimetallic switch member, and electroresponsive means operable in response to overload currents above said predetermined value to cause pivotal movement of said support member and instantaneous movement of said bimetallic switch member to open position.

9. A circuit breaker comprising a stationary contact, a bimetallic switch member movable to open and close the circuit, a movable contact on one end of said bimetallic switch member cooperating with said stationary contact, resilient means mounting the other end of said bimetallic switch member and biasing said bimetallic switch member in opening direction, an operating handle movable to an open position and to a closed position, a support member having one end releasably engaging said handle and the other end engaging said bimetallic switch member, spring means biasing said support member to a predetermined position to normally hold said bimetallic switch member in closed position, said resilient means in said predetermined position of said support member biasing said bimetallic switch member about said support member to provide contact pressure, movement of said handle to the open position releasing said support member and causing movement of said support member to one position to permit said resilient means to move said bimetallic switch member to open position, and thermal bending of said bimetallic switch member pivotally moving said support member to another position to permit said resilient means to move said bimetallic switch member to the open position.

10. A circuit breaker comprising a stationary contact, a bimetallic switch member having a movable contact on one end thereof and movable to open and close the circuit, resilient means mounting the other end of said bimetallic switch member and biasing said switch member in opening direction, an operating handle movable to an open position and to a closed position, a support member having one end engaging said bimetallic switch member and the other end releasably engaging said handle to normally restrain said bimetallic switch member in closed position, said resilient means in the closed position of said breaker biasing said bimetallic switch member about said one end of said support member to provide contact pressure, and thermal bending

of said bimetallic switch member disengaging said support member from said handle and moving said support member and said handle to a position to permit said biasing means to move said bimetallic switch member to open position free of said handle.

11. A circuit breaker comprising a stationary contact, a switch member of bimetallic material biased open and movable to open and close the circuit, a movable contact on said bimetallic switch member for cooperating with said stationary contact, an operating handle movable to an open position and to a closed position, a support member releasably engaging said handle and engaging said bimetallic switch member for normally restraining said switch member in closed position, fixedly mounted means supporting said support member for pivotal and longitudinal movement, said bimetallic switch member bending in response to overload currents to pivotally move said support member about said fixedly mounted means and disengage said support member from said handle to permit opening movement of said switch member free of said handle, and resilient means supporting said stationary contact to maintain said stationary contact in engagement with said movable contact during thermal bending of said bimetallic switch member and until said support member is released from said handle.

12. A circuit breaker comprising a stationary contact, a bimetallic switch member biased open and movable to open and close the circuit, a movable contact on said bimetallic switch member for cooperating with said stationary contact, an operating handle movable to an open position and to a closed position, a support member disposed between said handle and said bimetallic switch member and releasably engaging said handle for normally restraining said switch member in closed position, movement of said handle to said open position effecting longitudinal movement of said support member to permit opening movement of said bimetallic switch member, thermal bending of said bimetallic switch member pivotally moving said support member and disengaging said support member from said handle to permit opening movement of said bimetallic switch member free of said handle, and resilient means supporting said stationary contact to maintain said stationary contact in engagement with said movable contact at least during thermal bending of said bimetallic switch member.

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