Feb. 22, 1949. E. G. WISE 2,462,244

CIRCUIT BREAKER

Filed Nov. 16, 1944

Fig. 1.

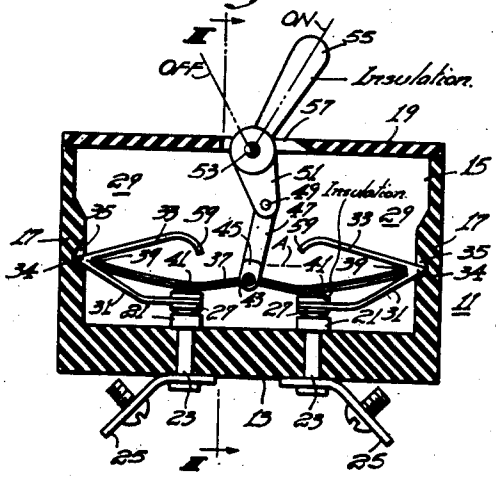


Fig. 2.

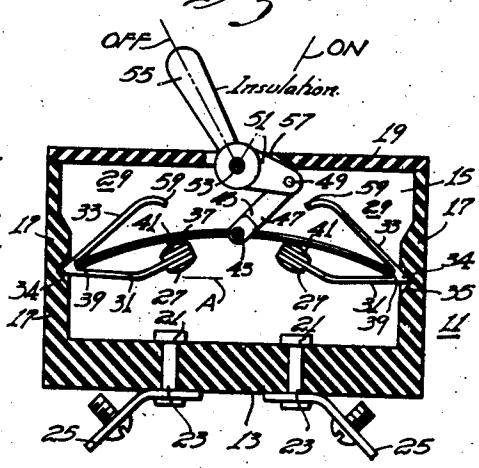


Fig. 3.

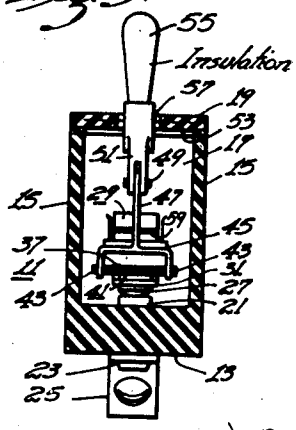


Fig. 4.

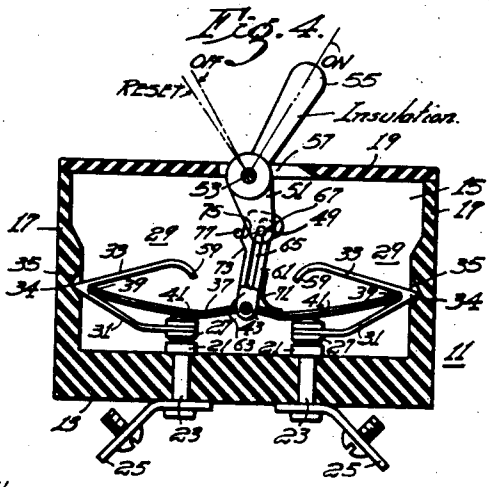


Fig. 6.

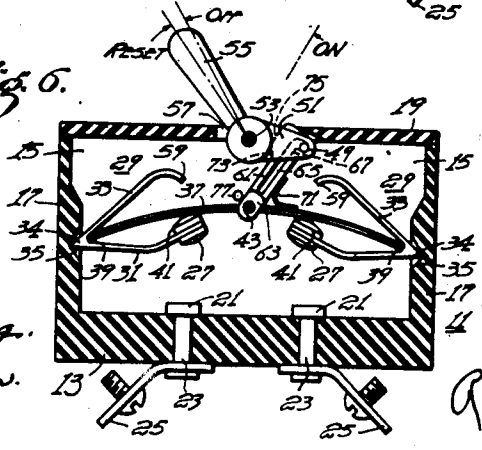
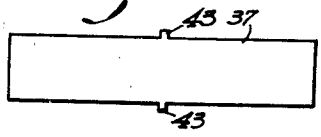


Fig. 5.



WITNESSES:

E. Guiding.

Paul B. Harlow.

INVENTOR

Ernest G. Wise,

BY

Ralph W. Swingle

ATTORNEY

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CIRCUIT BREAKER

Ernest G. Wise, Chicago, Ill., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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18 Claims. (Cl. 200—113)

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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 an improved circuit breaker having a current responsive snap-acting bimetal element for automatically opening the contacts and an operating handle for manually operating the bimetal element to open and close the contacts.

Another object of the invention is the provision of an improved circuit breaker wherein the contacts are automatically opened by a snap-acting bimetal element and are opened manually by means of an operating handle arranged to actuate the bimetal element.

Another object of the invention is the provision of an improved circuit breaker having a current responsive snap-acting bimetal element for automatically opening the contacts and means for preventing separation of the contacts until the bimetal element has moved substantially to its open position.

Another object of the invention is to provide an improved circuit breaker having a snap-acting bimetal element for automatically opening and closing the contacts with means engageable by the bimetal element after said bimetal element has moved overcenter to open the contacts with a snap action.

Another object of the invention is to provide an improved circuit breaker having a snap-acting bimetal element mounted in members which maintain the contacts closed until after the bimetal element has moved overcenter, the bimetal then engaging said members to cause opening of the contacts with a snap action.

Another object of the invention is the provision of a circuit breaker as previously described wherein the mechanism is trip-free of the operating handle.

Another object of the invention is the provision of a circuit breaker as previously described which is simple, inexpensive to manufacture and reliable in operation.

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 of several embodiments thereof when read in conjunction with the accompanying drawing, in which:

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Figure 1 is a vertical sectional view of a circuit breaker embodying the principles of the invention, the breaker being shown in the closed position,

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

Fig. 3 is a sectional view taken on line III—III of Fig. 1 and looking in the direction of the arrows,

Fig. 4 illustrates a modification of the invention wherein the mechanism is trip-free of the operating handle,

Fig. 5 is a detailed view of the bimetal element, and

Fig. 6 is a sectional view of the Fig. 4 modification of the invention showing the breaker in the automatically opened position and with the handle moved to the reset position.

Referring to the drawing, the breaker mechanism is mounted in a housing 11 of molded insulating material comprising a base portion 13, side walls 15 and end walls 17. A cover plate 19 also of insulating material is suitably secured to the housing. Rigidly mounted on the base portion 13 is a pair of spaced stationary contacts 21 secured to the base by means of rivets 23 which extend through the base and serve to secure terminal connectors 25 to the base and to the contacts 21. Movable contacts 27 for cooperating with the stationary contacts 21 to open and close the circuit are mounted on carriers indicated generally at 29 of generally V-shape. Each of the carriers 29 comprises a contact carrying arm 31 and an actuating arm 33. The apex of each of the carriers 29 is formed into a knife edge as at 34 and engages in the apex of a generally V-shaped recess 35 in the adjacent end wall 17 of the housing. While the members 29 have been shown as supported by their apexes engaging the recesses 35 in the housing, other known methods of supporting the members may be used.

The carriers are held in place in engagement with the recesses 35 by means of a bimetal element 37, the ends of which engage the inner apexes 39 of the carriers 29. The bimetal element 37 has a slight reverse bend and is given an initial compression and an inward bow substantially as shown in Fig. 1. The ends of the bimetal 37 engage the inner apexes 39 of the carriers 29 slightly below the points at which the knife edges 34 engage the apexes of the recesses 35, consequently, the inherent force of the bimetal 37 which tends to straighten the bimetal also tends to rotate the carriers 29 inwardly to-

ward the base 11 thus maintaining the contacts closed and providing contact pressure.

Buttons 41 of insulating material are mounted on the contact arms 31 to insulate the bimetal element from the free ends of the contact arms and compel the current to traverse the entire length of the bimetal element over the circuit extending as follows: from one of the terminals 25 through the rivet 23, corresponding stationary contact 21 and movable contact 27, the contact arm 31, the length of the bimetal 37, the opposite contact arms 31 and the associated movable and stationary contacts 27—21, and through the rivet 23 to the other terminal 25.

The bimetal element 37 is provided with integral projections 43, one disposed on each edge near the midportion thereof and extending outwardly therefrom. These projections engage openings in the spaced arms of a yoke member 45 which straddles the bimetal 37 (Fig. 3). A link 47 integral with or otherwise suitably secured to the yoke 45 is pivotally connected by means of a pivot pin 49 to the bifurcated end of an arm 51. The arm 51 is mounted for rotation on a rod 53 supported in the side walls 15 of the housing 11 and has a handle 55 of insulating material extending outwardly through an opening 57 in the cover plate 19. The link 47 and the arm 51 form an underset toggle connecting the handle 55 and the bimetal 37.

Referring to Fig. 1, it can be seen that the toggles formed by the ends of the bimetal 37 and the apexes 34 of the carriers 29 are slightly overcenter below a line A drawn through the apexes of the recesses 35. The initial tension under which the bimetal is placed in its downward bowed condition applies a force through these toggles to maintain the contacts closed under normal circuit conditions.

When an overload occurs in the circuit, the bimetal becomes heated, and when heated a predetermined amount, operates to move from its downwardly bowed position (Fig. 1) to the upwardly bowed position (Fig. 2). This movement, at first, is slow and with the ordinary construction, would tend to slightly separate the contacts and thereby cause arcing and burning of the contacts. In accordance with the invention, the force applied by the bimetal 37 through the carriers 29 maintains the contacts closed until the bimetal moves overcenter above the line A. When the bimetal moves upwardly across the line A, it moves to the full upwardly bowed position with a snap action. As the bimetal passes over the center line A, it strikes projections 59 on the carriers 29 and causes the carriers to open the contacts with a snap action, the breaker being shown in the full open position in Fig. 2. In the open position, the toggles formed by the ends of the bimetal and the apexes 34 of the carriers are overcenter above the line A and tension of the bimetal exerted thereon maintains the carriers in the full open position. Operation of the bimetal to the Fig. 2 position, acting through the link 47 and arm 51 rotates the handle 55 counterclockwise to the "off" position.

In order to close the contacts, the handle 55 is rotated clockwise from the Fig. 2 position to the Fig. 1 position. This movement, through the members 51 and 47, moves the bimetal downwardly to the Fig. 1 position. As the bimetal moves below the center line A, it operates to its lower bowed position and actuates the carriers 29 to close the contacts with a snap action.

According to the modification of the invention

illustrated in Figs. 4 and 6, the bimetal actuator is operable to automatically open the contacts trip-free of the handle, that is, the bimetal when heated in response to an overload current will function to open the contacts even though the handle is held in the closed position. The parts in Figs. 4 and 6 which are identical with the corresponding parts in Fig. 1 have been given the same reference numerals.

Referring to Fig. 4, the bimetal element 37 is connected to the arm 51 of the operating handle by means of a slotted link 61. The link 61 is formed integral with or suitably secured to a yoke 63 which straddles the bimetal element and is provided with openings engaging the projection 43 of the bimetal. The link 61 is also provided with an elongated slot 65 through which extends the pin 49 carried by the arm 51. The upper end of the slot 65 has an offset portion or recess 67 which is adapted to be engaged with the pin 49 in order to close the contacts following an automatic opening operation.

The automatic opening operation of the Fig. 4 modification in response to overload currents is essentially the same as that of the Fig. 1 modification, except that the handle remains in the "on" position, the link 61 sliding over the pin 49 as the bimetal element moves to its upwardly bowed position.

Before the contacts can be closed, it is necessary to connect the handle to the link 61. This is effected by moving the handle 55 counterclockwise from its Fig. 4 position, slightly past the "off" position to the reset position in which pin 49 in the arm 51 is in line with the offset portion 67 of the slot 65 in the link 61. As the pin 49 arrives opposite the recess 67, a leaf spring 71 secured to the bimetal element moves the link 61 clockwise about its pivot on the projections 43 of the bimetal thus engaging the shoulder, formed by the offset recess 67, with the pin 49. The bimetal element is then operated to close the contacts by movement of the handle 55 clockwise to the "on" position. When the bimetal has moved overcenter below the line A, it snaps to the closed position, drawing the link 61 downwardly therewith. As the mechanism moves to the closed contact position, a cam face 73 formed on a projection 75 of the link 61 engages a pin 77 supported in the side walls 15 of the housing and cams the link 61 clockwise about the projection 43 to disengage the recess 67 from the pin 49 so that if the breaker has been closed in against a fault, the bimetal element can again function to effect opening of the contacts irrespective of the position of the handle.

The contacts of the modification illustrated in Fig. 4 may be opened manually in substantially the same manner as described in connection with the Fig. 1 modification. Counterclockwise movement of the handle from the "on" to the "off" position first engages the pin 49 with the upper end of the slot 65 and manually actuates the bimetal to open the contacts. Shortly after the link 61 starts its upward movement, the projection 75 is moved clear of the pin 77 whereupon the spring 71 acts to engage the offset portion 67 of the slot 65 with the pin 49 so that the breaker may be immediately reclosed if desired.

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. It is desired, therefore, 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 relatively movable contacts, operating means therefor comprising a snap-acting bimetal element operable when heated a predetermined amount to move from one position to another and cause automatic opening of said contacts with a snap action, movable means disposed at each end of said bimetal element for movably supporting both ends of said bimetal element in a manner to maintain the contacts closed until the bimetal element has moved a substantial distance toward said other position, and means on said support means engageable by said bimetal element when said bimetal element moves to said other position to effect opening of said contacts.

2. A circuit breaker comprising relatively movable contacts, operating means therefor comprising a thermally responsive bimetal element operable when heated a predetermined amount to move from one position to another and cause automatic opening of said contacts, manual means for operating said bimetal element to effect manual opening and closing of said contacts, movable support means disposed to movably support the ends of said bimetal element in a manner to maintain the contacts closed until the bimetal element has moved a substantial distance toward said other position and said bimetal element during its movement to said other position causing movement of said support means to open said contacts.

3. A circuit breaker comprising relatively movable contacts, operating means therefor comprising a thermally responsive bimetal element operable when heated a predetermined amount to move from one position to another and cause automatic opening of said contacts, manual means for operating said bimetal element to effect manual opening and closing of said contacts, and movable means movably supporting each end of said bimetal element in a manner to maintain the contacts closed until the bimetal element has moved a substantial distance toward said other position, said bimetal element being operable when heated a predetermined amount by overload current to cause movement of said supporting means and automatic opening of said contacts irrespective of the position of said manual means.

4. A circuit breaker comprising spaced stationary contacts, movable contacts co-operating with said stationary contacts to open and close an electrical circuit, movable actuating means supporting said movable contacts and operable to open and close said circuit, a thermally responsive element movably supported at each end by said movable actuating means and disposed to normally maintain said actuating means in closed contact position, said thermally responsive element being operable when heated a predetermined amount in response to overload current to move from one position to another, and said thermally responsive element near the end of its movement to said other position engaging and moving said actuating means to open said contacts with a snap action.

5. A circuit breaker comprising relatively movable contacts, operating mechanism therefor comprising a bimetallic strip operable when heated a predetermined amount in response to overload currents to move from one position to another to cause automatic opening of said contacts, means disposed at each end of said bimetallic strip for movably supporting said bimetallic strip, said bimetallic strip being placed under initial compression and applying a force to said support means for maintaining said contacts closed, and said bimetallic strip when moved to said other position in response to predetermined heating actuating said support members to open said contacts with a snap action.

6. A circuit breaker comprising relatively movable contacts, operating mechanism therefor comprising a bimetallic strip operable when heated a predetermined amount to move from one position to another to cause automatic opening of said contacts, pivoted means disposed at each end of said bimetallic strip for movably supporting said bimetallic strip, said bimetallic strip being placed under initial compression and applying a force to said support means for maintaining said contacts closed, manual means for moving said bimetallic strip to said other position to effect manual opening of said contacts, and said bimetallic strip when moved to said other position in response to predetermined heating actuating said support members to open said contacts with a snap action irrespective of the position of said handle.

7. A circuit breaker comprising stationary and movable contact means, contact members supporting said movable contact means operable to open and close said contact means, a thermally responsive member disposed between said contact members to be supported thereby and normally applying a force to said contact members to maintain said contacts closed, said thermally responsive member being operable from one position to another to effect opening of said contact means, an operating handle operatively related to said thermally responsive member and operable to move said thermally responsive member to thereby operate said contact members and effect manual opening of said contact means, and said thermally responsive member being operable when heated a predetermined amount to automatically move to said other position to thereby effect automatic operation of said contact members and opening of said contact means.

8. A circuit breaker comprising relatively movable contacts, operating mechanism for said contacts comprising a pair of spaced actuating members each provided with a projection, a bimetallic element disposed between said actuating members normally applying a force to each of said actuating members biasing said contacts closed, said actuating members forming the sole supporting means for said bimetallic element, said bimetallic element when heated a predetermined amount in response to overload current deflecting and striking said projections to operate said actuating members to automatically open said contacts.

9. A circuit breaker comprising relatively movable contacts, operating mechanism for said contacts comprising a plurality of pivoted actuating members each provided with a projection, a bimetallic element disposed between said actuating members to be supported thereby and normally applying a force to said actuating members biasing said contacts closed, said bimetallic element when heated a predetermined amount in response to overload current deflecting and engaging said projections to operate said actuating members to automatically open said contacts, and

manual means for operating said bimetallic element to effect manual opening and closing of said contacts.

10. A circuit breaker comprising a casing having opposed recesses in the walls thereof, stationary contacts mounted in said casing, movable switch members having movable contacts mounted thereon for co-operating with said stationary contacts, a thermally responsive element supported solely by said movable switch members and disposed to bias said switch members into engagement with said recesses and to bias said contacts closed, said thermally responsive element being operable when heated a predetermined amount to actuate said switch members and cause opening of said contacts with a snap action.

11. A circuit breaker comprising a casing provided with opposing recesses therein, stationary contacts mounted in said casing, switch members engaging said recesses each switch member carrying a movable contact co-operating with said stationary contacts to open and close an electrical circuit, a bimetallic member supported solely by said switch members disposed to resiliently hold said switch members in engagement with said recesses and normally biasing said switch members to closed contact position, said bimetallic member being operable when heated a predetermined amount in response to overload current to actuate said switch members to cause opening of said contacts.

12. A circuit breaker comprising a casing provided with opposing recesses therein, stationary contacts mounted in said casing, switch members engaging said recesses each switch member carrying a movable contact co-operating with said stationary contacts to open and close an electrical circuit, a bimetallic member disposed to resiliently hold said switch members in engagement with said recesses and normally biasing said switch members to closed contact position, an operating handle related to said bimetallic member for operating said bimetallic member to effect manual opening and closing of said contacts, said bimetallic member being operable when heated a predetermined amount in response to overload current to actuate said switch members to cause automatic opening of said contacts irrespective of the position of said handle.

13. A circuit breaker comprising a casing provided with opposing recesses therein, stationary contacts mounted in said casing, switch members engaging said recesses each switch member carrying a movable contact co-operating with said stationary contacts to open and close an electrical circuit, a bimetallic member disposed to resiliently hold said switch members in engagement with said recesses and normally biasing said switch members to closed contact position, an operating handle related to said bimetallic member for operating said bimetallic member to effect manual opening and closing of said contacts, said bimetallic member being operable when heated a predetermined amount in response to overload current to actuate said switch members to cause automatic opening of said contacts irrespective of the position of said handle.

14. A circuit breaker comprising a casing having recesses therein, stationary contacts mounted in said casing, a plurality of V-shaped actuating members each having a pair of arms, movable contacts mounted on one arm of said actuating members for co-operating with said stationary contacts, a thermally responsive element having its ends disposed in the inner apexes of said actuating members for biasing the outer apexes of said actuating members into engagement with the recesses in said casing, said thermally responsive element normally biasing said actuating members to closed contact position, and said thermally responsive element being operable when heated a predetermined amount in response to overload currents to engage the other arms of said actuating members and operate said members to open the contacts with a snap action.

15. A circuit breaker comprising a casing having recesses therein, stationary contacts mounted in said casing, a plurality of V-shaped actuating members each having a pair of arms, movable contacts mounted on one arm of said actuating members for co-operating with said stationary contacts, a thermally responsive element having its ends disposed in the inner apexes of said actuating members for biasing the outer apexes of said actuating members into engagement with the recesses in said casing, said thermally responsive element normally biasing said actuating members to closed contact position, said thermally responsive element being operable when heated a predetermined amount in response to overload currents to engage the other arms of said actuating members and operate said members to automatically open the contacts with a snap action, and an operating handle related to said thermally responsive element and operable to cause said element to engage said other arms of said actuating members to effect manual opening of said contacts.

16. A circuit breaker comprising a casing having recesses therein, stationary contact means mounted in said casing, a plurality of V-shaped actuating members each provided with a pair of arms, movable contact means mounted on one arm of said actuating members for co-operating with said stationary contact means, a bimetal element having its ends engaging said actuating members for biasing said actuating members into engagement with said recesses, said bimetal element normally biasing said contacts closed, an operating handle operatively related to said bimetal element and operable to cause said element to engage the other arms of said actuating members to effect manual opening of the contacts with a snap action, and said bimetal being operable in response to overload currents to engage said other arms of said actuating members to cause automatic opening of said contacts with a snap action irrespective of the position of said handle.

17. In a circuit breaker comprising relatively movable contacts, operating means therefor comprising a bimetal element operable when heated a predetermined amount to move from one position to another, movable means for movably supporting said bimetal element in a manner to maintain the contacts closed until the bimetal element has moved a substantial distance toward said other position, and means on said movable support means engageable by said bimetal element when said bimetal moves to said other position to effect opening of said contacts.

18. In a circuit breaker comprising relatively movable contacts, operating means therefor comprising a bimetal element operable when heated a predetermined amount to move from one position to another, movable means disposed at an end of said bimetal element for movably

supporting at least one end of said bimetal element in a manner to maintain the contacts closed until the bimetal element has moved a substantial distance toward said other position, and means on said movable support means engageable by said bimetal element when said bimetal moves to said other position to effect opening of said contacts.

ERNEST G. WISE.

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