

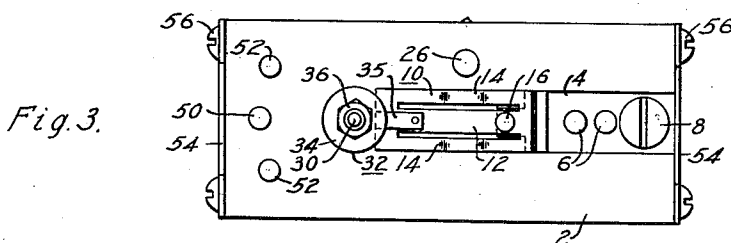
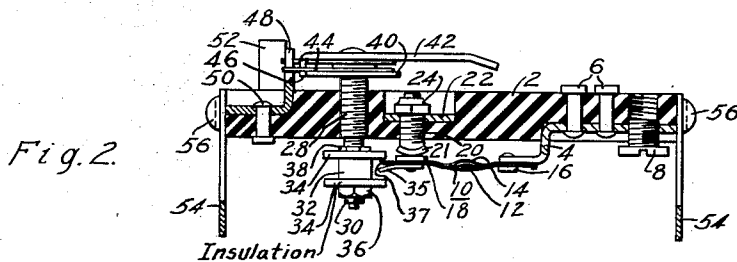
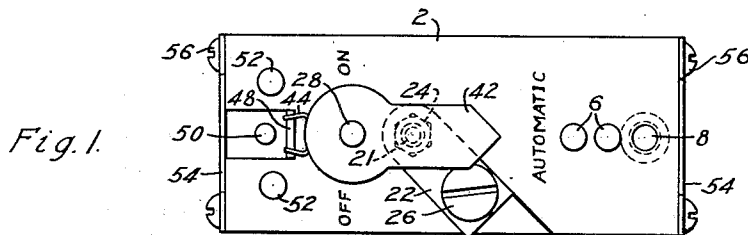
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2,374,022

CIRCUIT INTERRUPTER

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CIRCUIT INTERRUPTER

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This invention relates to electric circuit interrupters in general, and more specifically to automatic circuit breakers.

One object of this invention is to provide a novel form of circuit breaker utilizing a snap-acting bimetal element as the means for automatically opening the circuit.

Another object of this invention is to provide in a circuit breaker of the type described, novel manually operable actuating means thereof.

In certain circuit breaker applications where emergencies may arise rendering automatic operation of circuit breakers undesirable, such as in aircraft, it is necessary that some means be provided to prevent such breaker operation.

Accordingly, another object of this invention is to provide novel manual operating means for a circuit breaker which is operable to prevent automatic operation of the breaker and is self-restoring to permit such operation of the breaker.

Another object of this invention is to provide a circuit breaker with novel manual operating means having two positions at which the breaker contacts are closed, so that at one of the two closed positions of the handle the breaker contacts are free to open automatically, and at the other closed position of the handle the breaker contacts are prevented from opening.

Another object of this invention is to provide in a circuit breaker having manual means for opening and closing the breaker contacts, and having means for automatically opening the breaker contacts, a novel construction whereby the contacts cannot automatically close, but may be manually held closed, and which will automatically open unless manually held closed.

Another object of this invention is to provide novel actuating means for a snap-acting switch element.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of a preferred embodiment thereof when taken in connection with the attached drawing, in which:

Figure 1 is a plan view of a circuit interrupter embodying this invention;

Fig. 2 is a longitudinal section taken substantially centrally through the interrupter shown in Fig. 1; and

Fig. 3 is a bottom plan view of the interrupter shown in Figs. 1 and 2.

The embodiment of the invention shown on the drawing comprises an interrupter adapted to be supported on a base plate 2, which may be of any desired insulating material, preferably a

molded insulating material. A terminal bracket 4 has one end thereof seated in a recess on the bottom of base plate 2 and secured therein as by rivets 6. A terminal screw 8 is threaded in an aperture provided in the outer end of terminal bracket 4, for securing a conductor to the bracket, and the base plate is provided with an aperture aligned with terminal screw 8 to receive the screw when it is turned down. The inner offset end 10 of terminal bracket 4 has a bimetal element 10 secured thereto at one end.

The bimetal element 10 is formed, as shown more particularly in Fig. 3, with a pair of spaced longitudinally extending slots forming a central leg 12 and side legs 14 integrally joined at their opposite ends. The side legs of bimetal element 10 are preferably deformed—for example, as by corrugating side legs 14 intermediate the ends thereof to reduce the length of the side legs and thereby exert a compressive force on central leg 12, so that the central leg will assume a bowed position, as shown in Fig. 2. Bimetal element 10 is secured to the inner offset end of terminal bracket 4 by a rivet 16 passing through one end of central leg 12 of the bimetal element. A contact member 18 is secured to the opposite end of the bimetal element 10—for example, as by welding or the like, and the contact member is preferably of some good conducting arc-resistant material, such for example, as silver or a silver alloy. Contact member 18 is adapted to engage a cooperating contact member 21 welded on the end of a contact adjusting screw 20. Contact adjusting screw 20 is threadedly engaged in an aperture provided in supporting base plate 2, for adjustment toward and away from contact member 18 on the bimetal element. Adjusting screw 20 also extends freely through an aperture provided in a terminal strap 22 mounted in a recess formed in base plate 2. Contact adjusting screw 20 may be locked in any desired adjusted position by lock nut 24 adapted to engage terminal strap 22. As shown in Fig. 1, terminal strap 22 extends at an angle to the base plate and is provided at its outer end with a terminal screw 26 for securing a conductor thereto.

Because of the initial stress set up in bimetal element 10 by deformation of side legs 14 thereof, in the closed circuit position, central leg 12 will be bowed downwardly, as shown in Fig. 2, to maintain contact member 18 in engagement with stationary contact member 21. If the free end of bimetal element 10 is moved downwardly, the outer ends of side legs 14 will pass below the line of action of central leg 12 causing this leg

to suddenly reverse its curvature, and move contact member 18 out of engagement with contact member 21 with a quick snap action. Because central leg 12 reverses its curvature on separation of contact members 18 and 21, the bimetal element 10 will remain in open circuit position until the outer end thereof is moved upwardly, whereupon the reverse action takes place, and contact member 18 engages contact member 21 with a quick snap action upon a second reversal of curvature of central leg 12. Bimetal element 10 is preferably constructed of a pair of metal laminations in a well known manner, with the upper lamination of a material having a greater coefficient of expansion than the lower lamination, as viewed in Fig. 2, with the two laminations rigidly secured together as by welding, so that upon heating of the bimetal element it will deflect downwardly to separate contact members 18 and 21 and thereby open the circuit. Since the bimetal element is in series in the circuit through the interrupter, it may be self-heating so as to deflect in response to currents passing through the circuit in excess of a predetermined value. Obviously a separate heater may be used for the bimetal element, if desired, or it may respond to changes in ambient temperatures.

In order to manually actuate bimetal element 10, there is provided means comprising an operating screw 28 threadedly mounted in an aperture in base plate 2. Operating screw 28 is provided with a reduced threaded end 30 on which is threaded an operating bushing 32 of insulating material, preferably a molded insulating material. The operating bushing 32 is provided with integral flanges at the opposite ends thereof adapted to receive therebetween the outer free end of bimetal element 10. As shown in Fig. 2, bimetal element 10 is provided with an embossed portion 37 adapted to be engaged by upper flange 34 to open the circuit; and the underside of bimetal element 10 has secured at the outer end thereof a leaf spring 35, the outer end of which extends towards the lower flange 34 to be engaged thereby upon closing the circuit to prevent undue deformation of the bimetal element. Operating bushing 32 is secured in position on adjusting screw 28 by lock nuts 36 and 38 at opposite sides thereof.

The upper end of operating screw 28 is also reduced in section to provide a shoulder on which rests a washer 40. A handle member 42 is secured on the extreme upper end of operating screw 28—for example, as by riveting or the like. A handle biasing spring 44 is coiled about the upper end of operating screw 28 and located between handle 42 and washer 40 which serves to support the spring 44. The ends of spring 44 are crossed and brought out from beneath handle 42 at opposite sides of a lug 46 integral with handle 42 and projecting downwardly therefrom. The ends of the spring 44 also are positioned at opposite sides of a spring stop lug 48 having an angularly related portion secured in a depression formed in base plate 2—for example, as by a rivet 50. Spaced stop members 52 are secured to base plate 2 and project upwardly therefrom for limiting rotating movement of handle 42. If desired, base plate 2 may be supported by U-shaped supporting brackets 54 having the leg portions thereof secured to the ends of base plate 2, as by screws 56.

In the operation of the embodiment of the invention described above, the handle member 42

is normally maintained by spring 44 at the central position shown in Figs. 1 and 2 and labeled "automatic." At this position, the contact carrying end of bimetal element 10 is free to flex downwardly in response to heating. This will effect reversal of the curvature of the leg 12 with a snap-action to automatically separate contact members 18 and 21 and open the circuit. The space between bushing flanges 34 permits sufficient movement of the outer end of bimetal element 10 to accomplish this without hindrance. Assuming that the bimetal element has become heated sufficiently to open the circuit as previously described, the circuit may then be closed even though the bimetal may still be heated, by rotating handle 42 in a counterclockwise direction, as viewed in Fig. 1, to the "on" position. This will cause upward movement of operating screw 28, as viewed in Fig. 2, and thereby move the outer end of bimetal element 10 towards contact member 21 until the central leg of the bimetal element reverses its curvature with a snap action to engage contact member 18 with contact 21. As soon as handle 42 is released, it will be restored to the "automatic" position by spring 44 and the contacts will remain in closed position. The circuit may be opened manually by movement of handle 42 in a clockwise direction, as viewed in Fig. 1, to thereby move bushing 32 downwardly and cause bimetal element 10 to snap to an open circuit position, as previously described. On an automatic circuit opening operation, the bimetal element 10 will remain in open circuit position after the bimetal has cooled, so that in order to reclose the circuit it will be necessary to move handle 42 to the "on" position. After this has been done, the handle may be released and bimetal element 10 will remain at the "on" position until moved to open circuit position by either heating thereof or a manual operation. It is thus possible to prevent automatic separation of contact members 18 and 21 by moving handle 42 to the "on" position and holding it there for emergency operations. However, the normal condition of the interrupter is such that bimetal element 10 is free to move to automatically open the circuit upon sufficient heating thereof, unrestrained by the manual means. Furthermore, after manual actuation of bimetal element 10, the manual operating means is automatically restored by spring 44 to the normal condition wherein bimetal element 10 is free of any restraint thereof.

The handle spring 44 may be omitted, if desired, so that the handle 42 will remain in whichever of the three positions it has been manually placed until the device is operated to move the handle to one of its other positions.

From the foregoing it is apparent that this invention provides a circuit breaker wherein the breaker contacts may be manually opened and closed, and may open automatically but do not close automatically. The breaker contacts may be manually closed following an automatic opening thereof, and may be manually held closed, although if not so held closed they may separate automatically.

More specifically, it is apparent that this invention provides a manual operating means for the free end of a snap-acting bimetal element which is adapted to engage opposite sides of the bimetal element to move the element in opposite directions, respectively, but normally the manually operable means is held out of engagement with the bimetal element by a spring. With this ar-

range ment, the bimetal is always free of any restraint whatsoever, especially from manual actuating means, unless the manually operable means is moved to and held at one of its manual positions. A boss of limited area is provided on the bimetal element to be engaged by the actuating means in moving the element to open circuit position to thereby provide a single point of engagement and thus obtain a uniform action which will have a long life. Also when the manually operable means is moved to close the circuit, it is engageable with a leaf spring provided on the bimetal so as to prevent undue distortion of the bimetal element when closing the contact.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it should be understood that the invention is not to be limited to this particular embodiment, since it will be obvious to persons skilled in the art that many modifications may be made therein without departing from the broad spirit and scope of this invention. Therefore, it is desired that the invention be interpreted as broadly as possible and that it be limited only as required by the prior art.

I claim as my invention:

1. In a circuit interrupter, an elongated snap-acting bimetal element, means supporting said element adjacent one end thereof, contact means mounted on said supporting means, cooperating contact means carried adjacent the other end of said element and adapted to engage said contact means at one static position of said element, said element being movable with a snap action to a second static position at which said contact means are separated, said element being responsive to heating thereof to separate said contact means, manually operable control means engageable with said element adjacent said other end thereof to actuate the same into and out of engagement with said contact means, said control means having sufficient lost motion relative to said element as to permit the latter to move to open circuit position independent of movement of said control means when said control means is at an intermediate position, and means biasing said control means to said intermediate position.

2. In a circuit interrupter, an elongated snap-acting bimetal element, means supporting said element adjacent one end thereof, contact means mounted on said supporting means, cooperating contact means carried adjacent the other end of said element and adapted to engage said contact means at one static position of said element, said element being movable with a snap-action to a second static position at which said contact means are separated, said element being responsive to predetermined condition to separate said contact means and move to said second static position, manually operable control means engageable with opposite sides of said element adjacent said other end thereof to actuate the same into and out of engagement with said contact means, and said element when at said second static position being incapable of returning to said one static position and reclosing said contacts, except when moved by said manually operable control means.

3. In a circuit interrupter, an elongated snap-acting bimetal element, means supporting said element adjacent one end thereof, contact means mounted on said supporting means, cooperating contact means carried adjacent the other end of said element and adapted to engage said contact means at one static position of said element, said element being movable with a snap action to a

second static position at which said contact means are separated, said element being responsive to currents above a predetermined value in the circuit to separate said contact means, manually operable control means having spaced abutments positioned to engage opposite sides of said element, respectively, at points adjacent said other end of said element to move said contact means into and out of engagement when said control means is actuated to spaced positions, respectively, and whereby said element is movable between said abutments to automatically open the circuit when said control means is at an intermediate position.

4. In a circuit interrupter, an elongated snap-acting bimetal element, means supporting said element adjacent one end thereof, contact means mounted on said supporting means, cooperating contact means carried adjacent the other end of said element and adapted to engage said contact means at one static position of said element, said element being movable with a snap action to a second static position at which said contact means are separated, said element being responsive to predetermined conditions to separate said contact means, manually operable control means having spaced abutments positioned to engage opposite sides of said element, respectively, at points adjacent said other end of said element to move said contact means into and out of engagement when said control means is actuated to spaced positions, respectively, whereby said element is movable between said abutments to automatically open the circuit when said control means is at an intermediate position, and means biasing said control means to said intermediate position, whereby said element is normally automatically movable independently of said control means.

5. In a circuit interrupter, an elongated snap-acting bimetal element, means supporting said element adjacent one end thereof, contact means mounted on said supporting means, cooperating contact means carried adjacent the other end of said element and adapted to engage said contact means at one static position of said element, said element being movable with a snap-action to a second static position at which said contact means are separated, said element being responsive to predetermined conditions to separate said contact means, manually operable control means having spaced abutments positioned to engage opposite sides of said element, respectively, at points adjacent said other end of said element to move said contact means into and out of engagement when said control means is actuated to spaced positions, respectively, whereby said element is movable between said abutments to automatically open the circuit when said control means is at an intermediate position, and resilient means cushioning engagement of said element and one of said abutments.

6. In a circuit interrupter, an elongated snap-acting bimetal element, means supporting said element adjacent one end thereof, contact means mounted on said supporting means, cooperating contact means carried adjacent the other end of said element and adapted to engage said contact means at one static position of said element, said element being movable with a snap action to a second static position at which said contact means are separated, said element being responsive to heating thereof to separate said contact means, manually operable control means having spaced abutments positioned to engage opposite sides of

said element; respectively, at points adjacent said other end of said element to move said contact means into and out of engagement when said control means is actuated to spaced positions; respectively, whereby said element is movable between said abutments to automatically open the circuit when said control means is at an intermediate position, resilient means cushioning engagement of said element and one of said abutments, and a projection of limited area on one member forming the engaging part of said element and the other of said abutments.

7. In a circuit breaker, a support, relatively fixed and movable contacts on said support, means responsive to predetermined conditions for automatically moving said movable contact out of engagement with said fixed contact, manually operable actuating means for said movable contact having lost motion therewith, whereby at one position of said actuating means said movable contact is movable to open and close the circuit by movement relative to said actuating means, and resilient means biasing said actuating means to said one position.

8. In a circuit breaker, a support, relatively fixed and movable contacts on said support, means responsive to predetermined conditions for automatically moving said movable contact out of engagement with said fixed contact, manually operable actuating means for said movable contact, said actuating means mounted on said support for movement into engagement with said movable contact to actuate the same, and resilient means normally maintaining said actuating means spaced from said movable contact and out of the range of automatic movement thereof.

9. In a circuit interrupter, a support, a contact mounted on said support, a bimetal element mounted on said support, said element having a portion adapted to engage said contact and automatically movable out of engagement in response to the passage of currents above a predetermined value through the circuit, manually operable actuating means for said element, said actuating means mounted on said support for movement into engagement with said element to actuate the same, and resilient means normally maintaining said actuating means spaced from said element and out of the range of automatic movement thereof.

10. In a device of the type described, a snap-acting resilient switch element adapted to be supported at one portion thereof for movement of another portion with a snap action upon flexure of said element, contact means on said other portion of said element, manually operable actuating means for flexing said element to actuate said contact means, and said other portion of said element having a resilient cushioning member at one side thereof positioned to be engaged by said actuating means.

11. In a device of the type described, a snap-acting resilient switch element adapted to be supported at one portion thereof for movement of another portion with a snap action upon flexure of said element, contact means on said other portion of said element, manually operable actuating means for flexing said element to actuate said contact means, and said other portion of said element having a resilient cushioning member at one side thereof and a limited area projection on the opposite side thereof positioned to be engaged by said actuating means, upon movement thereof in opposite directions.

12. In a device of the type described, a snap-

acting bimetal switch element adapted to be supported at one portion thereof for movement of another portion with a snap action upon flexure of said element, contact means on said other portion of said element; manually operable actuating means for flexing said element to actuate said contact means, and said other portion of said element having a resilient cushioning member at the low expansion side thereof positioned to be engaged by said actuating means.

13. In a device of the type described, a snap-acting bimetal switch element adapted to be supported at one portion thereof for movement of another portion with a snap action upon flexure of said element, contact means on said other portion of said element, manually operable actuating means for flexing said element to actuate said contact means, and said other portion having a resilient cushioning member at the low expansion side thereof and a limited area projection on the opposite side thereof positioned to be engaged by said actuating means, upon movement thereof in opposite directions.

14. In a circuit control device, the combination of relatively movable contacts for opening and closing the circuit, means responsive to a predetermined condition for causing automatic opening of said contacts, manually operable means for opening and closing said contacts at will and having two positions in which said contacts are closed, said manually operable means when in one of said two positions maintaining said contacts closed irrespective of the occurrence of said predetermined condition and when in the other of said two positions permitting opening of said contacts by said means responsive to a predetermined condition, and means biasing said manually operable means to said other position.

15. In a circuit control device, the combination of relatively movable contacts for opening and closing the circuit, a snap-acting bimetal element responsive to predetermined heating thereof for causing automatic opening of said contacts with a snap action, manually operable means for opening and closing said contacts at will and having two positions in which said contacts are closed, said manually operable means when in one of said two positions maintaining said contacts closed irrespective of said bimetal element being heated said predetermined amount and when in the other of said two positions permitting opening of said contacts by said bimetal element in response to said predetermined heating thereof, and means biasing said manually operable means to said other position.

16. In a circuit control device, the combination of relatively movable contacts for opening and closing the circuit, a bimetal element which is capable of flexing from one static position to another with a snap action, said bimetal element being responsive to predetermined heating thereof to flex to one of its static positions to open said contacts with a snap action for causing an automatic opening of said contacts, manually operable means for opening and closing said contacts at will and having two positions in which said contacts are closed, said manually operable means when in one of said two positions maintaining said contacts closed irrespective of said bimetal element being heated said predetermined amount and when in the other of said two positions permitting opening of said contacts by said bimetal element in response to said predetermined heating thereof.

17. In a circuit control device, the combina-

tion of relatively movable contacts for opening and closing the circuit, means responsive to a predetermined condition for causing automatic opening of said contacts, manually operable means for opening and closing said contacts at will and having two positions in which said contacts are closed, said manually operable means when in one of said two positions maintaining said contacts closed irrespective of the occurrence of said predetermined condition and when in the other of said two positions permitting opening of said contacts by said means responsive to a predetermined condition, and said condition responsive means being incapable of closing said contacts, whereby said contacts when opened by said condition responsive means will remain open until closed by said manually operable means.

18. In a circuit interrupter, supporting means, separable contacts mounted on said supporting means, operating means for said contacts threadedly mounted in said supporting means on an axis extending at an angle to the direction of relative movement of said contacts, whereby rotation of said operating means produces movement thereof in the direction of relative movement of said contacts for actuating said contacts into and out of engagement.

19. In a circuit breaker, the combination of relatively movable contacts for opening and closing the circuit, means responsive to the passage of currents through the circuit above a predetermined value for causing an automatic opening of

said contacts, manually operable means for opening and closing said contacts at will, said manually operable means having two positions in which said contacts may be closed, said manually operable means at one of said two positions maintaining said contacts closed irrespective of the passage of currents through said circuit above said predetermined value and when in the other of said two positions permitting opening of said contacts by said current-responsive means, and means biasing said manually operable means away from said one position.

20. In a circuit breaker, the combination of contacts which are relatively movable to open and closed circuit positions, means responsive to the passage of currents through the circuit above a predetermined value for causing an automatic opening of said contacts, manually operable means for opening and closing said contacts, said manually operable means having two extreme positions at which said contacts are maintained at one of their aforesaid positions irrespective of the passage of currents through said circuit above said predetermined value, said manually operable means having an intermediate position wherein said current-responsive means is permitted to open said contacts, and means biasing said manually operable means when in either extreme position towards said intermediate position.

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Disclaimer

2,374,022.—*Paul R. Lee*, Mansfield, Ohio. CIRCUIT INTERRUPTER. Patent dated Apr. 17, 1945. Disclaimer filed Mar. 12, 1949, by the assignee, *Westinghouse Electric Corporation*.

Hereby enters this disclaimer to claims 7, 8, and 9 of said patent.

[*Official Gazette April 19, 1949.*]