Oct. 24, 1944. E. E. ARNOLD 2,361,162

CIRCUIT INTERRUPTER

Filed Aug. 26, 1942 2 Sheets-Sheet 1

Fig. 1.

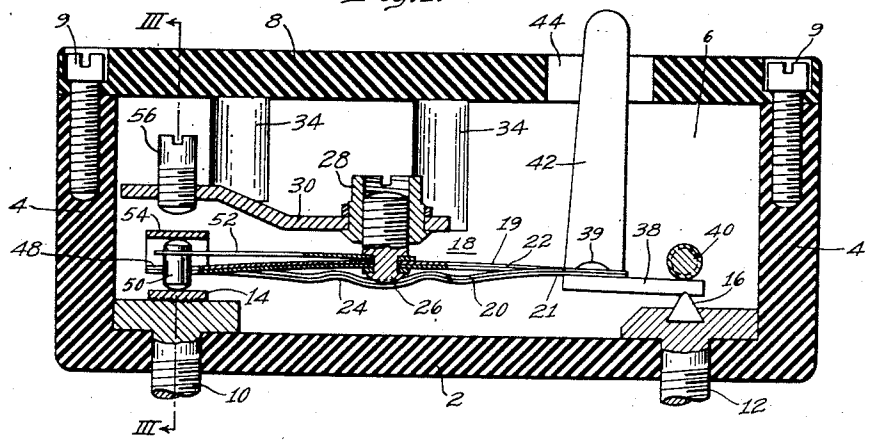


Fig. 2.

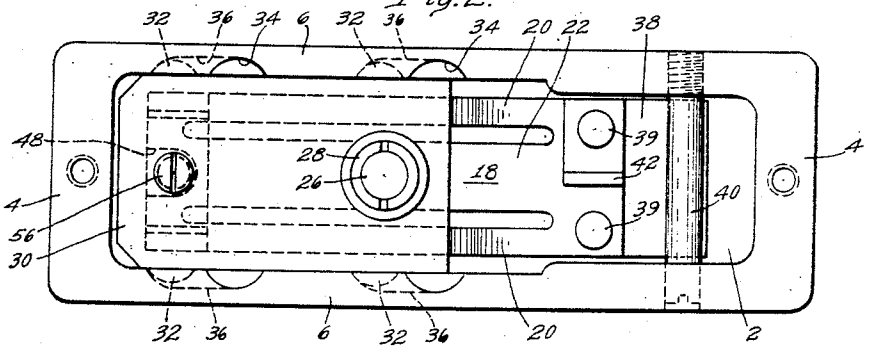
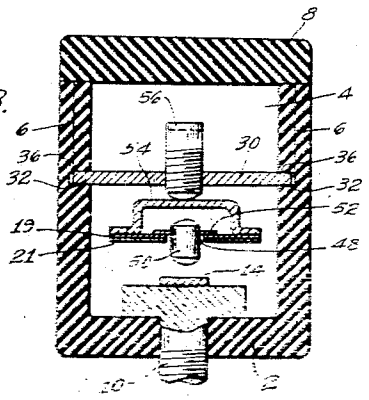


Fig. 3.



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CIRCUIT INTERRUPTER

Filed Aug. 26, 1942 2 Sheets-Sheet 2

Fig. 4.

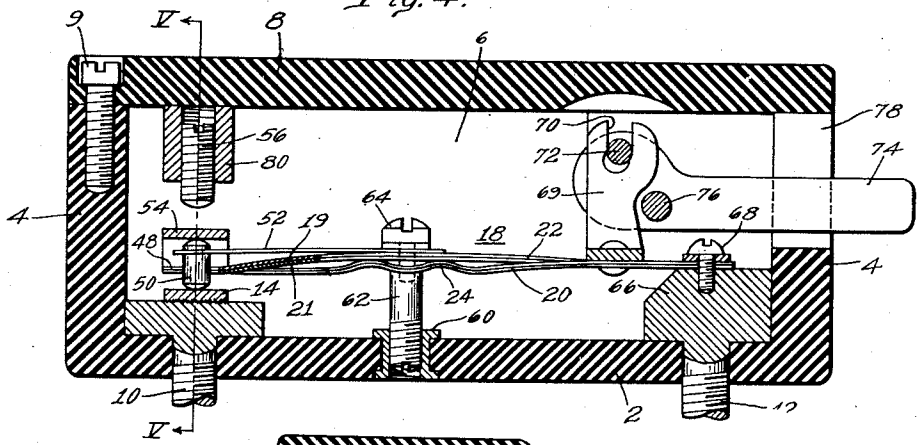


Fig. 5.

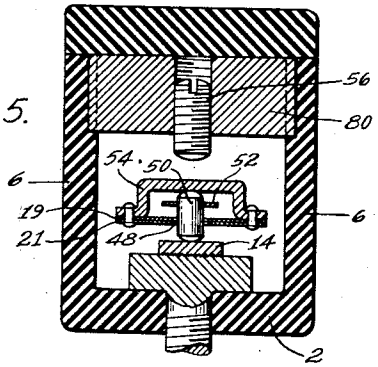
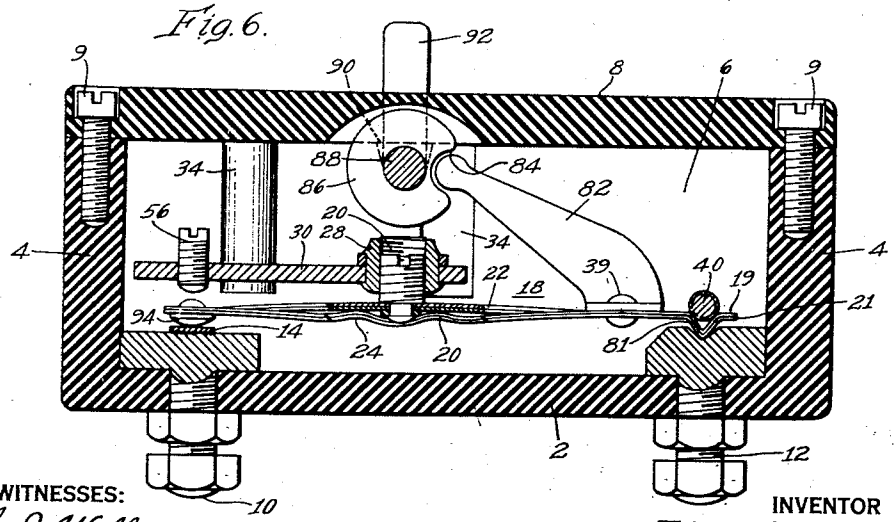


Fig. 6.



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2,361,162

CIRCUIT INTERRUPTER

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Application August 26, 1942, Serial No. 456,195

24 Claims. (Cl. 200—139)

This invention relates to circuit interrupters, in general, and, more particularly, to interrupter contact constructions and to circuit breakers of the type employing snap-acting bimetal elements to obtain a quick-make and quick-break of the circuit.

Accordingly, one object of this invention is to provide a novel circuit breaker construction utilizing a snap-acting bimetal element for actuating the breaker contacts.

Another object of this invention is to provide in a circuit breaker of the type described, a novel arrangement of a snap-acting bimetal contact-actuating element with supporting and actuating means therefor.

Another object of this invention is to provide novel double-break means for a current-carrying contact-actuating member.

Another object of this invention is to provide in a circuit breaker of the type described, novel means for obtaining a double break in the circuit upon a circuit interrupting operation.

Still another object of this invention is to provide a novel circuit breaker which is small in size, while capable of efficiently interrupting relatively high currents.

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

Figure 1 is a longitudinal sectional view of a circuit breaker constructed in accordance with this invention with certain parts of the bimetal broken away and shown in section;

Fig. 2 is a top plan view of the circuit breaker shown in Fig. 1 with the cover for the breaker casing removed;

Fig. 3 is a transverse section through the circuit breaker shown in Fig. 1 taken substantially on the line III—III thereof; with the breaker shown in open position,

Fig. 4 is a longitudinal section like Fig. 1 of a slightly modified form of circuit breaker;

Fig. 5 is a transverse section taken substantially on the line V—V through the breaker shown in Fig. 4; and

Fig. 6 is a longitudinal sectional view like Figs. 1 and 4 of a still further modified form of circuit breaker.

Circuit breakers constructed in accordance with this invention are preferably mounted within a casing of insulating material, such as a molded insulating material, and such a casing may comprise a bottom wall 2, end walls 4, side walls 6, and an open top. The top of the casing may be closed by a removable cover 8 suitably secured in position, for example, as by screws 9. Breaker terminals 10 and 12 extend through the bottom wall 2 of the breaker casing, and have their outer ends threaded for the reception of nuts to secure line conductors thereto. The inner ends of terminals 10 and 12 are preferably enlarged, as shown, for a purpose to be hereinafter described. The inner end of terminal 10 has a contact element 14 secured thereto as by brazing, welding, or the like, and the contact element may be of any arc resistant material, such, for example, as silver, tungsten, or alloys thereof. A wedge-shaped support 16 is provided within a dove-tail groove in the inner end of terminal 12 for a purpose to be described.

A substantially rectangular-shaped bimetal element 18 is provided, and this is formed with a pair of spaced longitudinally extending slots providing side legs 20, and a substantially centrally located leg 22, all extending longitudinally of bimetal element 18. The element 18 is formed of two metallic laminations in a well known manner, such as laminations 19 and 21, of materials having, respectively, relatively low and high coefficients of thermal expansion. Thus, the lamination 19 may be of a material, such as iron, which has a lower coefficient of thermal expansion than brass, which may comprise the material of lamination 21. The two metallic laminations are secured together in any desired relation, such, for example, as by welding. It will be noted that the side legs 20 of bimetal element 18 are provided with bent portions 24 for shortening side legs 20. This will place central leg 22 under compression, and cause it to assume a longitudinally bowed position, as shown, for example, in Fig. 1. The bimetal element 18 when heated, while in the position shown in Fig. 1, will bend towards a position in which it is concave in an upward direction. However, this bending is opposed by central leg 22. Accordingly, a relatively great force is required to bend the bimetal upwardly until side legs 20 pass overcenter with respect to central leg 22, whereupon the central leg 22 reverses its curvature and becomes bowed downwardly and assists further bending of bimetal element 18 in the upward direction. This assistance due to reversal of the curvature of central leg 22 adds to the sudden release of the relatively great force tending to bend the bimetal element upwardly from the position shown in Fig. 1, resulting in movement of the bimtal with a quick or snap-action.

The central leg 22 of bimetal element 18 is provided with a centrally located aperture for receiving a shouldered supporting stud 26 having the end thereof riveted over bimetal element 18 to rotatably secure the bimetal element to the stud. Stud 26 is adapted to be threadedly received within a threaded bushing 28 secured in an aperture in a supporting plate 30. As viewed in Fig. 2, it will be observed that supporting plate 30 is provided with a pair of spaced ears 32 on each side thereof in opposed relation. The ears 32 are for the purpose of securing supporting plate 30 within the circuit breaker casing, and to this end, the opposite side walls 6 of the casing are provided at the inner surfaces thereof with opposed parallel grooves 34 extending from the top of the casing downwardly toward bottom wall 2, and these grooves intersect with grooves 36 extending at right angles thereto. Accordingly, it will be observed that supporting plate 30 may be removed from the casing when cover 8 is removed by shifting plate 30 to the right, as viewed in Fig. 1, until ears 32 come into alignment with grooves 34, whereupon the supporting plate may be lifted out of the casing. Obviously the plate may be inserted in the casing by the reversal of the above procedure.

Bimetal element 18 has secured to one end thereof an extension plate 38, for example, as by rivets 39. The extension plate 38 is provided at the underside thereof with a transversely extending groove for receiving the upper edge of wedge-shaped support member 16. Extension 38 may be maintained in the position shown in Fig. 1 wherein the upper edge of wedge-shaped element 16 is maintained within a transverse groove in the extension, by a threaded retaining pin 40 extending through opposite side walls 6 of the casing to be threadedly engaged in one side wall just above the extension 38 to prevent lateral movement thereof, and provide a loose or pivotal mounting for the outer end of the extension.

An operating handle 42 is secured to the end of bimetal element 18 adjacent extension plate 38 as by one of the rivets 39, and the handle extends upwardly through an aperture 44 provided in cover 8 for manual manipulation thereof from the exterior of the casing. The free end of bimetal element 18 is provided with an opening 48 cut into the end thereof for receiving a bridging contact 50 which is adapted to provide a double break in the circuit when the bimetal element is actuated to open circuit position. Bridging contact 50 has clearance with opening 48 and is secured to one end of a leaf spring 52, the other end of which is secured between bimetal element 18, and the shoulder on supporting stud 26, so as to be fixed with respect to the central portion of central leg 22 of bimetal element 18. Leaf spring 52 is preferably of spring steel which has a higher electrical resistance than the material comprising bimetal element 18, or, if desired, leaf spring 52 may be formed of insulating material. A contact bridge 54 is substantially U-shaped in form with the legs thereof secured at opposite sides of bimetal element 18 and with the base thereof extending across the free end of the bimetal element to form a bridge directly over bridging contact 50. An adjustable stop screw 56 is threadedly mounted in an aperture provided in supporting plate 30, to limit upward movement of the free end of bimetal element 18.

The circuit breaker is illustrated in the closed circuit position in Fig. 1, wherein side legs 20 of the bimetal element are positioned below the center of central leg 22 so that the free end of the bimetal element is biased downwardly and bridging contact 50 engages contact element 14 on terminal 10 at one end, and is engaged by contact bridge 54 at its other end. The circuit through the breaker then extends from one terminal 10 through bridging contact 50, contact bridge 54, bimetal element 18, extension plate 38, wedge-shaped member 16 to terminal 12. In case it is desired to manually operate the breaker to open circuit position, operating handle 42 is moved to the right, as viewed in Fig. 1, thereby raising side legs 20 of the bimetal element past the supporting point of central leg 22 on stud 26, whereupon the bimetal element operates with a snap action, as previously described, to move the free end thereof upwardly. Leaf spring 52 normally maintains bridging contact 50 in the position shown in Fig. 3 of the drawings, wherein it is spaced below contact bridge 54. Accordingly, when the free end of bimetal element 18 moves upwardly, leaf spring 52 maintains bridging contact 50 in engagement with contact element 14, while contact bridge 54 separates from the top of bridging contact 50 until leaf spring 52 engages the outer end of bimetal element 18, whereupon the bridging contact 50 is separated from contact element 14. It will be observed that in the open circuit position, bridging contact 50 is not only spaced from contact element 14, but is also spaced from contact bridge 54 to thereby provide series gaps in circuit, since leaf spring 52 is of high resistance material or insulating material. A further advantage of this contact construction resides in the fact that during initial opening movement of the contacts, when contact bridge 54 separates from bridging contact 50, but before bridging contact 50 separates from contact element 14, a high resistance (resilient element 52) is inserted in the circuit before any gap is actually provided. This, of course, applies only in the case that leaf spring 52 is not of insulating material but is of a material like spring steel which merely has a higher resistance than bimetal element 18. This will, of course, have the effect of limiting the current just prior to separation of the breaker contacts. The circuit breaker may then be manually closed by moving operating handle 42 to the left, as viewed in Fig. 1, to move side legs 20 of the bimetal element below the center support of central leg 22, whereupon the element will operate with a snap action to move the free end thereof to the closed circuit position shown in Fig. 1.

With the breaker in the closed circuit position, it will operate to automatically open the circuit in response to the passage of currents above a predetermined value therethrough by the heating effect caused by such currents. Upon heating of the bimetal element, lamination 21 thereof will expand a greater amount than lamination 19 to thereby tend to force the ends of the bimetal element upwardly, as previously described. Since one end is secured against upward movement by extension plate 38, the free end of the bimetal element is suddenly moved upwardly with a snap action, as in a manual operation. To reclose the breaker following an automatic circuit interrupting operation thereof, it is necessary to actuate handle 42 to the left, as previously described.

An important feature of the breaker illustrated in Figs. 1 to 3 of the drawings resides in the particular construction thereof and assembly of the parts. Thus, the breaker may be readily dis-

sembled by merely removing cover 8 and threaded pin 40. This will permit extension plate 38 to be lifted from wedge-shaped member 16 and the entire unit comprising supporting plate 30 and bimetal element 18 may then be moved to the right, as viewed in Figs. 1 and 2, to move ears 32 on the supporting plate along grooves 36 in the casing until they are in alignment with groove 34, whereupon this unit may be then lifted out of the casing. The only other parts mounted in the casing are terminals 10 and 12, so that the construction disclosed herein provides a single mounting unit comprising a bimetal element and supporting plate therefor which also carries a stop screw 56 for the bimetal element, which unit is readily removable, as described above. To insert a unit in the casing, it is merely necessary to line up ears 32 on supporting plate 30 with grooves 34 in the casing walls, and then insert the unit into the casing until the intersection of grooves 36 is reached, whereupon the entire unit is moved to the left until the transverse groove on extension plate 38 receives the top edge of wedge-shaped member 16, whereupon pin 40 may be inserted in position to hold the unit in operative position within the casing. The top edge of wedge-shaped member 16 being received in a transverse groove provided in the lower surface of extension plate 38, will prevent longitudinal movement of the breaker unit within the casing, and ears 32 on supporting plate 30 being received in longitudinally extending grooves 36 will prevent movement of the unit laterally into and out of the casing.

In the embodiment of the invention shown in Figs. 4 and 5 of the drawings, the bottom wall of the casing is provided with a threaded sleeve 60 for receiving a supporting stud 62 for central leg 22 of the bimetal element, and this leg, together with leaf spring 52, is secured to stud 62 by a screw 64 threadedly engaging a threaded socket in the top of stud 62. The construction includes many parts already described in connection with the embodiment of the invention shown in Figs. 1, 2, and 3, and hence the description of these parts will not be repeated. It will be noted that terminal 12 in this instance is provided with a block-like head 66 on which one end of bimetal element 18 is directly secured as by screws 68. An actuating member 69 is riveted or otherwise secured to the bimetal element between block 66 and supporting stud 62 at one end of legs 20 and 22, and this actuating member is provided with a slot 70 at the upper end thereof for receiving an actuating pin 72 secured to an operating member 74. The operating member 74 is pivotally mounted on a pin 76 extending transversely of the casing and rotatably mounted in side walls 6 thereof. Operating member 74 projects out through an opening 78 provided in the adjacent end wall 4 of the casing for manual operation of the breaker. The adjustable stop screw 56 is separately supported in this instance from the casing, as for example, by a block 80 having the ends thereof seated in slots in opposite side walls 6.

In the operation of the embodiment of the invention shown in Figs. 4 and 5 of the drawings, the breaker may be opened from the closed circuit position shown in Fig. 4 by moving operating handle 74 downwardly. This causes movement of actuating member 69 to the right, as viewed in Fig. 4, because of the action of pin 72 in slot 70, and this will cause upward bending of the portion of bimetal element 18 to which actuating member 69 is secured to move side legs 20 of the bimetal element above the center support of central leg 22 and cause the same to snap to open circuit position, as in the embodiment of the invention already described. The circuit breaker may be closed by moving operating handle 74 upwardly, or in a counter-clockwise direction. Automatic operation of the breaker to open circuit position will take place in exactly the same manner as in the embodiment of the invention shown in Figs. 1 to 3, and, therefore, will not be repeated.

Since in this embodiment of the invention, the bimetal element is not pivotally mounted on terminal 12, it may be a little harder to actuate manually, and that is one reason for utilizing a force-multiplying means, such as operating member 74. However, because of the fixed nature of the mounting of bimetal element 18 on terminal 12, a better electrical connection is obtained and all of the snap-acting movement results in movement of the free end of the bimetal element carrying bridging contact 50 so that a greater throw of the contact is available. This will be accompanied by somewhat greater speed of contact movement, and, consequently, more positive action thereof. It will be noted that the method of assembly of the parts of the breaker shown in Figs. 4 and 5 is different from that of the embodiment of the invention shown in Figs. 1 to 3 in that the bimetal element is supported on stud 62 which is carried by bottom wall 2 of the casing. Furthermore, stop screw 56 is carried by a separate element 80, and the bimetal element is relatively rigidly secured within the casing, so that it is necessary to remove screw 68, as well as stud 62, to remove the bimetal element. Furthermore, operating member 74 is mounted on the casing and can be removed only by removal of pivot pin 76.

In Fig. 6, still another embodiment of the invention is disclosed, but here too, many of the parts used are like the parts used in the previously described embodiments of the invention, so that like reference numerals will be used to designate these parts, and a complete description of such parts will not be given in order to avoid repetition. In this embodiment of the invention, bimetal element 18 is provided at one end thereof with a substantially V-shaped bent portion 81 adapted to be positioned in a groove provided in the head of terminal 12 extending substantially transversely of the breaker casing. This bent portion 81 is maintained in the groove by pin 40 to prevent relative longitudinal movement of the unit comprising bimetal element 18, supporting plate 30, and parts mounted thereon. An actuating member 82 is secured to the bimetal element adjacent pin 40, between this pin and the center support of central leg 22. Actuating member 82 extends upwardly and towards the center of the breaker casing and terminates in a rounded end adapted to be received in a rounded notch 84 provided in an operating member 86 pivotally mounted in the casing. Operating member 86 preferably is secured on an operating pivot shaft 88 which is received in notches 90 provided in the upper edges of opposite casing side walls 6, and has one end extended outside the casing to mount a handle 92. In this embodiment of the invention, but a single contact button 94 is provided on the free end of bimetal element 18 in

place of the double-break bridging contact structure 50 of the previously described embodiments of the invention.

The operation of this embodiment is much like that of the constructions previously described. In this construction, counter-clockwise movement of handle 92 causes clockwise movement of actuating member 82 to move side legs 20 of the bimetal element above the center support of central leg 22 from the position shown in Fig. 6, to cause the bimetal element to snap to an open circuit position. Movement of the operating handle 92 in a clockwise direction will obviously cause closing of the breaker contacts with a snap action. When the breaker is in closed circuit position, it may also automatically operate to open the circuit in the same manner as the previously described embodiments of the invention by thermal action of bimetal element 18.

The method of assembly of the embodiment of the invention shown in Fig. 6 is much like that of the device shown in Figs. 1 to 3, in that the bimetal element 18 and supporting plate 30 form a unit which is removable from the casing merely by removing pin 40 and moving this unit along grooves 36 and 34, as in the embodiment of the invention shown in Figs. 1, 2 and 3. It will be noted that operating member 86 is maintained in notches 90 by cover 8 so that this may be easily lifted out of place merely by removal of the cover.

It is believed apparent from the foregoing that there is disclosed herein a circuit breaker of the type utilizing a snap acting bimetal element for actuating the breaker contacts wherein a novel arrangement of supporting means for such a bimetal element is disclosed for obtaining movement of one end of the bimetal element to actuate the breaker contacts. Furthermore, a novel arrangement of actuating means and bimetal element of the type described is disclosed, as well as a novel double break contact, and novel methods of assembling the parts in an enclosing casing.

Having described preferred embodiments of the invention in accordance with the patent statutes, it should be understood that the invention should not be limited to the particular constructions described inasmuch as it will be obvious, particularly to persons skilled in the art, that many changes and modifications may be made in these particular constructions without departing from the broad spirit and scope of the 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 breaker, a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of said central leg being greater than the effective length of said side legs, whereby said central leg is longitudinally compressed and normally assumes a bowed form and said side legs are under tension, means supporting an intermediate portion of said central leg at a predetermined position, means movably supporting one end of said element, contact means mounted on the other end of said element, a relatively stationary contact cooperating with said contact means, and manually operable means secured to said one end of said element for moving said side legs in opposite directions to opposite sides of the support of said central leg to cause said central leg to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

2. In a circuit breaker, a resilient bimetal element which is elongated in form, said element having an intermediate portion which normally assumes a bowed form, means adjustably supporting said portion of said element, means movably supporting one end of said element, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, and manually operable means secured to said element adjacent said one end thereof for moving at least a portion of said element in opposite directions sufficiently to cause said curved portion to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

3. In a circuit breaker, a resilient bimetal element which is elongated in form, said element having an intermediate portion which normally assumes a bowed form, means supporting said portion of said element, means movably supporting one end of said element, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, and manually operable means rigidly secured to said element adjacent said one end thereof for moving at least a portion of said element in opposite directions an amount sufficient to cause said curved portion to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

4. In a circuit breaker, a resilient bimetal element which is elongated in form, said element having an intermediate portion which normally assumes a bowed form, means supporting said portion of said element, means movably supporting one end of said element, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, actuating means rigidly secured to said one end of said element for moving at least a poriton of said element in opposite directions an amount sufficient to cause said curved portion to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action, and a pivotally mounted actuating handle manually operable for actuating said actuating means.

5. In a circuit breaker, a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of said central leg being greater than the effective length of said side legs, whereby said central leg is longitudinally compressed and normally assumes a bowed form and said side legs are under tension, means supporting an intermediate portion of said central leg, means pivotally supporting one end of said element about an axis extending substantially transversely of said element, contact means mounted on the other end of said element, a relatively stationary contact cooperating therewith, and manually operable means secured to said element at a point intermediate said supporting means for moving said side legs to opposite sides of the support of said central leg to cause said central leg to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

6. In a circuit breaker, a bimetal element which is elongated in form, said element having an in-

termediate portion which normally assumes a bowed form, means supporting said portion of said element, an extension member secured to one end of said element, means movably supporting the outer end of said extension member, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, and manually operable means secured to said element adjacent said one end thereof for moving at least a portion of said element in opposite directions an amount sufficient to cause said curved portion to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

7. In a circuit breaker, a bimetal element which is elongated in form, said element having an intermediate portion which normally assumes a bowed form, means supporting said portion of said element, an extension member secured to one end of said element, means movably supporting the outer end of said extension member, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, and manually operable means secured to said extension member for moving at least a portion of said element in opposite directions an amount to cause said curved portion to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

8. In a circuit breaker, a blade element which is elongated in form, said element having an intermediate portion which normally assumes a bowed form, means supporting said portion of said element, means movably supporting one end of said element, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, manually operable means secured to said one end of said element for moving at least a portion of said element in opposite directions an amount sufficient to cause said intermediate portion to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action, said contact means including a bridging contact, resistance means resiliently supporting said bridging contact on said element at said other end thereof, said bridging contact normally positioned intermediate said element and stationary contact by said resistance means to provide a double break in the circuit when the breaker is in open position, and whereby upon movement of said element to closed circuit position said bridging element is moved into engagement with said relatively stationary contact and is directly engaged by said element.

9. In a circuit interrupter, contact members relatively movable towards and away from each other, a bridging contact, relatively high resistance means resiliently supporting said bridging contact from one of said contact members to normally position said bridging contact intermediate and spaced from said contact members in the open circuit position of said interrupter, whereby upon movement of said contact members towards each other said bridging contact will engage between both of said contact members to shunt out said resistance means, and upon separation of said contact members said resistance means is introduced in series in the circuit before an arc is drawn.

10. In a circuit interrupter, a relatively stationary contact member, a contact member mounted for movement toward and away from said relatively stationary contact member, a bridging contact, relatively high resistance means resiliently supporting said bridging contact from said movable contact member to normally position said bridging contact intermediate and spaced from said contact members in the open circuit position of said interrupter, whereby upon movement of said movable contact member toward said relatively stationary contact member said bridging contact will engage between both of said contact members to shunt out said resistance means, and upon separation of said contact members said resistance means is introduced in series in the circuit before an arc is drawn.

11. In a circuit breaker, a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of said central leg being greater than the effective length of said side legs, whereby said central leg is longitudinally compressed and normally assumes a bowed form and said side legs are under tension, means supporting an intermediate portion of said central leg, means movably supporting one end of said element, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, manually operable means secured to said one end of said element for moving said side legs to opposite sides of the support of said central leg to cause said central leg to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action, said contact means including a bridging contact, a leaf spring having a relatively high resistance supporting said bridging contact from said supporting means for the central leg of said element so that said bridging contact is positioned adjacent said other end of said element and normally intermediate said element and stationary contact to provide a double break in the circuit when the breaker is in open position, and whereby upon movement of said element to closed circuit position said bridging element is moved into engagement with said relatively stationary contact and is directly engaged by said element.

12. In a circuit breaker, a casing having an opening, terminals for said casing having portions extending to the interior of said casing, walls of said casing at opposite sides of said opening provided with substantially parallel grooves extending from the opening toward the opposite wall of said casing, said opposed walls also having substantially parallel grooves intersecting said first mentioned grooves at an angle, movable contact means for bridging said portions of said terminals, operating means for said movable contact means, a unitary support for at least a portion of said means, said support having oppositely projecting tongues for reception in said grooves whereby said support may be inserted through the opening of said casing with said tongues received in said first mentioned grooves and then moved laterally when said tongues are aligned with said intersecting grooves, and means for releasably securing said support against movement of said tongues out of said intersecting grooves for releasably securing said support and means carried thereby in said casing.

13. In a circuit breaker, a casing having an opening, terminals on said casing having portions extending to the interior of said casing,

walls of said casing at opposite sides of said opening provided with substantially parallel grooves extending from the opening toward the opposite wall of said casing, said opposed walls also having substantially parallel grooves intersecting said first mentioned grooves at an angle, movable contact means for bridging said portions of said terminals, operating means for said movable contact means, a unitary support for at least a portion of said means, said support having oppositely projecting tongues for reception in said grooves whereby said support may be inserted through the opening of said casing with said tongues received in said first mentioned grooves and then moved laterally when said tongues are aligned with said intersecting grooves, and means for releasably securing said support against movement of said tongues out of said intersecting grooves including interfitting projection and recess means on said support and casing, respectively, and a readily removable pin mounted in said casing for preventing escape of said projection from said recess means for releasably securing said support and means carried thereby in said casing.

14. In a circuit breaker, a casing having an opening, terminals on said casing having portions extending to the interior of said casing, walls of said casing at opposite sides of said opening provided with substantially parallel grooves extending from the opening toward the opposite wall of said casing, said opposed walls also having substantially parallel grooves intersecting said first mentioned grooves at an angle, movable contact means for bridging said portions of said terminals including a bimetal element, a unitary assembly of said bimetal element and a support therefor, said support having oppositely projecting tongues for reception in said grooves whereby said support may be inserted through the opening of said casing with said tongues received in said first mentioned grooves and then moved laterally when said tongues are aligned with said intersecting grooves, and means for releasably securing said support against movement of said tongues out of said intersecting grooves for releasably securing said support and means carried thereby in said casing.

15. In a circuit breaker, a casing having an opening, terminals on said casing having portions extending to the interior of said casing, walls of said casing at opposite sides of said opening provided with substantially parallel grooves extending from the opening toward the opposite wall of said casing, said opposed walls having substantially parallel grooves intersecting said first mentioned grooves at an angle, movable contact means for bridging said portions of said terminals including a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of said central leg being greater than the effective length of said side legs whereby said central leg is longitudinally compressed and normally assumes a bowed form and said side legs are under tension, means supporting an intermediate portion of said central leg, said supporting means having oppositely projecting tongues for reception in said grooves whereby said support may be inserted through the opening of said casing with said tongues received in said first mentioned grooves and then moved laterally when said tongues are aligned with said intersecting grooves, and means for releasably securing said support against movement of said tongues out of said intersecting grooves for releasably securing said support and means carried thereby in said casing.

16. In a circuit breaker, a casing, a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of said central leg being greater than the effective length of said side legs, whereby said central leg is longitudinally compressed and normally assumes a bowed form and said side legs are under tension, means supporting an intermediate portion of said central leg on one wall of said casing, spaced terminals on said one wall of said casing, means supporting one end of said element on one of said terminals, contact means carried by the other end of said element for movement into and out of engagement with the other of said terminals, and manually operable means secured to said one end of said element for moving said side legs to opposite sides of the support of said central leg to cause said central leg to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

17. In a circuit breaker, a casing, a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of said central leg being greater than the effective length of said side legs, whereby said central leg is longitudinally compressed and normally assumes a bowed form and said side legs are under tension, means supporting an intermediate portion of said central leg on one wall of said casing, spaced terminals on said one wall of said casing, means supporting one end of said element on one of said terminals, contact means carried by the other end of said element for movement into and out of engagement with the other of said terminals, manually operable means secured to said one end of said element for moving said side legs to opposite sides of the support of said central leg to cause said central leg to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action, and stop means supported from another wall of said casing for limiting movement of said other end of said element away from said other terminal.

18. In a circuit breaker, a casing having an opening terminal on said casing having portions extending to the interior of said casing, walls of said casing opposite sides of said opening provided with substantially parallel grooves extending from the opening toward the opposite wall of said casing, said opposed walls having substantially parallel grooves intersecting said first mentioned grooves at an angle, movable contact means for bridging said portions of said terminals including a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of said central leg being greater than the effective length of said side legs, whereby said central leg is longitudinally compressed and normally assumes a bowed form and said side legs are under tension, means supporting an intermediate portion of said central leg, said support including stop means for limiting movement of said element out of bridging relation with re-

spect to said terminals, said support having oppositely projecting tongues for reception in said grooves whereby said support may be inserted through the opening of said casing with said tongues received in said first mentioned grooves and then moved laterally when said tongues are aligned with said intersecting grooves, and means for releasably securing said support against movement of said tongues out of said intersecting grooves for releasably securing said support and means carried thereby in said casing.

19. In a circuit breaker, a resilient bimetal element which is elongated in form, said element being deformed in a manner such that at least an intermediate portion thereof is curved in section, whereby said element is movable with a snap action upon reversal of said curvature, spaced supporting means for one end of said element and said portion, respectively, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, and manually operable means secured to said element intermediate said supporting means for moving at least a portion of said element to cause reversal of curvature of said curved portion and movement of said contact means into and out of engagement with said contact.

20. In a circuit breaker, a bimetal element which is elongated in form, said element having at least one longitudinally extending slot therein defining side legs the effective lengths of which differ whereby at least one of said legs normally assumes a bowed form, spaced means supporting an end of said element and an intermediate portion of said bowed leg, respectively, contact means carried by the other end of said element, and manually operable means secured to said element between said supporting means to flex said element in opposite directions an amount sufficient to cause said bowed leg to reverse its curvature and move said control means in opposite directions with a snap action.

21. In a circuit breaker, a bimetal element which is elongated in form, said element having a pair of spaced, longitudinally extending slots therein defining opposite side legs and a central leg, the effective length of at least one of said legs being greater than another leg whereby said one leg normally assumes a bowed form, spaced means supporting an end of said element and an intermediate portion of said bowed leg, respectively, contact means carried by the other end of said element, and manually operable means secured to said element between said supporting means to flex said element in opposite directions an amount sufficient to cause said bowed leg to reverse its curvature and move said contact means in opposite directions with a snap action.

22. In a circuit interrupter, a resilient blade element which is elongated in form, said element being deformed in a manner such that at least an intermediate portion thereof is normally curved in section whereby said element is movable with a snap action upon a reversal of curvature of said intermediate portion, spaced supporting means for one end of said element and said portion, respectively, contact means carried by the other end of said element, a relatively stationary contact cooperating therewith, and manually operable means secured to said element for moving at least a portion of said element in opposite directions sufficiently to cause reversal of curvature of said curved portion and movement of said contact means into and out of engagement with said contact with a snap action.

23. In a circuit interrupter, a resilient blade element which is elongated in form, said element having an intermediate portion which normally assumes a bowed form, means supporting said portion of said element, contact means carried by one end of said element, a relatively stationary contact cooperating therewith, and manually operable means rigidly secured to said element at a point adjacent the other end thereof for moving at least a portion of said element in opposite directions an amount sufficient to cause said curved portion to reverse its curvature and move said contact means into and out of engagement with said contact with a snap action.

24. In a circuit breaker, a casing having an opening, terminals on said casing having portions extending to the interior of said casing, walls of said casing at opposite sides of said opening provided with substantially parallel grooves extending from the opening toward the opposite wall of said casing, said opposed walls also having substantially parallel grooves intersecting said first mentioned grooves at an angle, movable contact means for bridging said portions of said terminals including a bimetal element, a unitary assembly of said bimetal element and a support therefor, said support having a stop member adjustably mounted thereon so as to be engageable with said bimetal element to limit opening movement thereof, said support having oppositely projecting tongues for reception in said grooves whereby said support may be inserted through the opening of said casing with said tongues received in said first mentioned grooves and then moved laterally when said tongues are aligned with said intersecting grooves, and means for releasably securing said support against movement of said tongues out of said intersecting grooves for releasably securing said support and means carried thereby in said casing.

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