Oct. 27, 1942. W. L. BUTLER 2,300,202

CIRCUIT BREAKER

Filed April 28, 1941 2 Sheets-Sheet 1

Fig. 1.

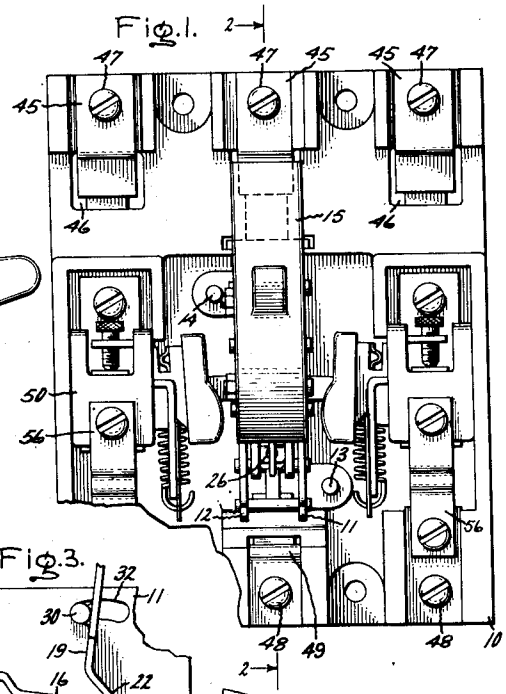


Fig. 2.

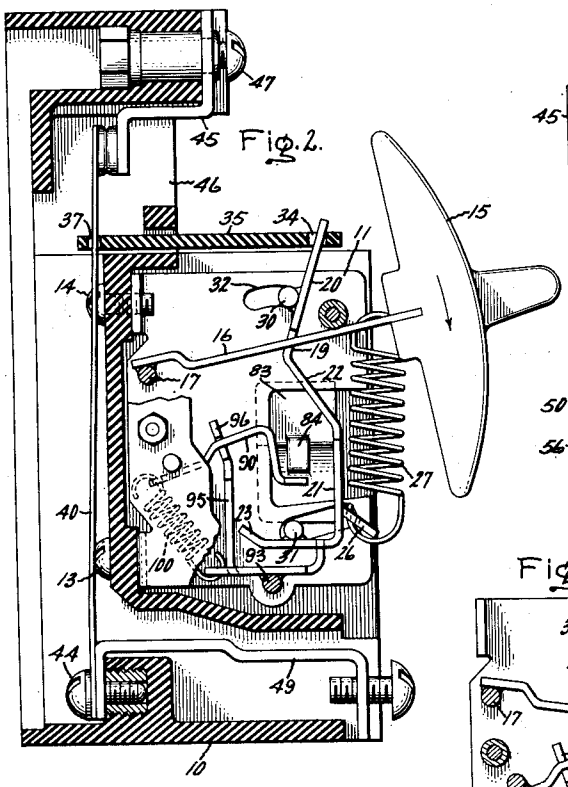


Fig. 3.

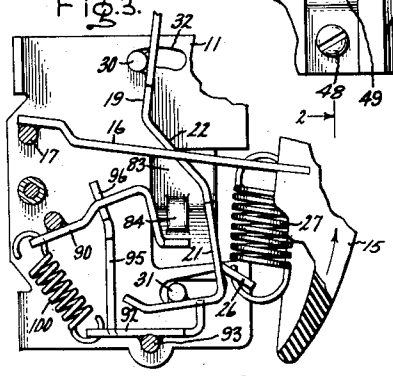


Fig. 4.

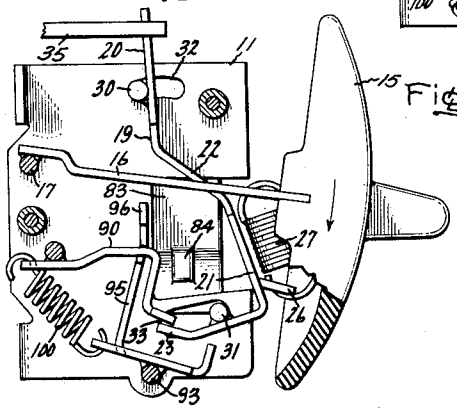
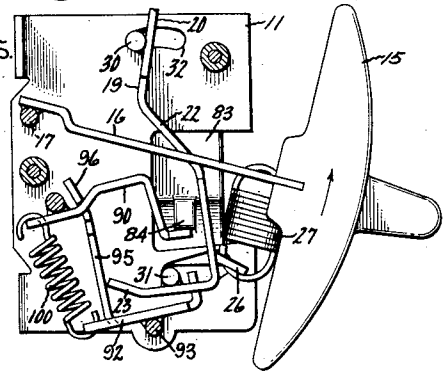


Fig. 5.



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Filed April 28, 1941 2 Sheets-Sheet 2

Fig. 6.

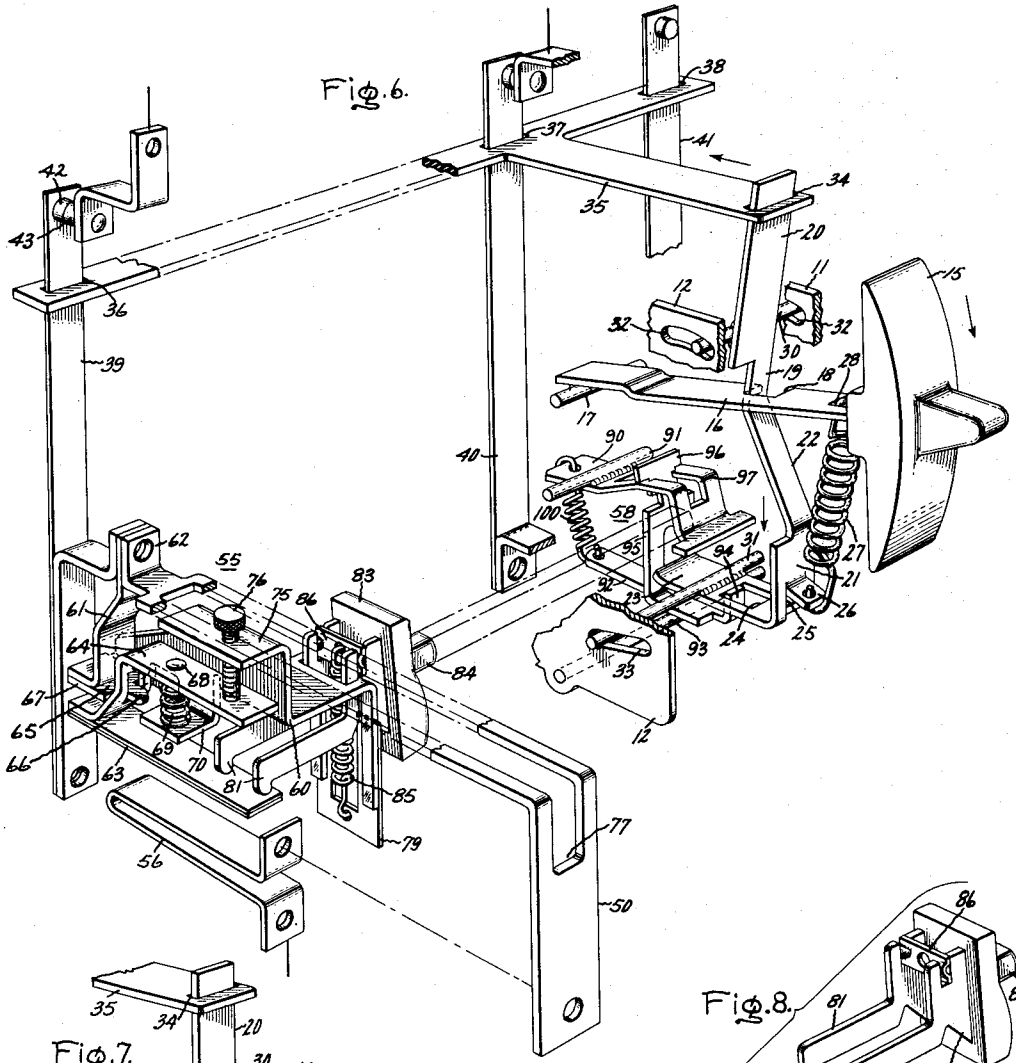


Fig. 7.

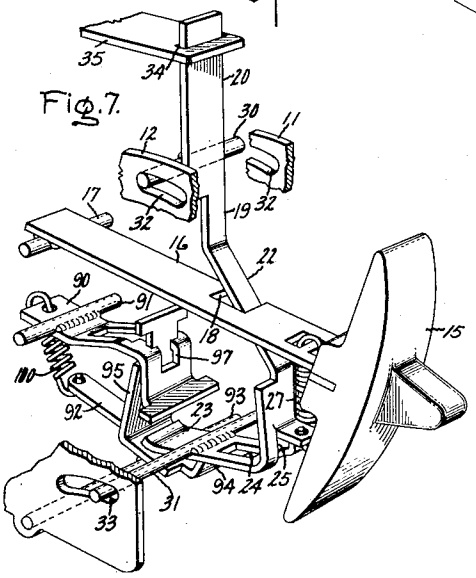
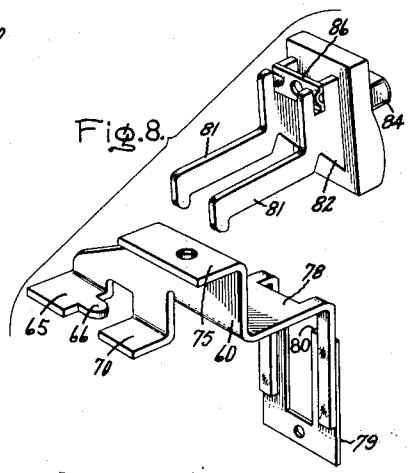


Fig. 8.



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Patented Oct. 27, 1942 2,300,202

UNITED STATES PATENT OFFICE

2,300,202

CIRCUIT BREAKER

William Lawrence Butler, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

Application April 28, 1941, Serial No. 390,643

19 Claims. (Cl. 200—116)

My invention relates to circuit breakers, and more particularly it relates to a new and improved form of manually operated over-current trip circuit breaker of the general class described in my Patent 2,230,713, isued February 4, 1941, upon an application filed October 25, 1939.

The principal object of my invention is to provide a simple and reliable manually operable current responsive circuit breaker which is trip free in its automatic operation and which may be easily manufactured in large quantities and at low cost.

My invention is especially useful in manually operated current responsively tripped circuit breakers used in the connection of small motors directly across a supply source without starting resistance. These devices are of small physical dimension and, at the present time, are used with motors up to five horse power at 440 volts.

To the attainment of the foregoing and other objects and advantages, my invention is preferably embodied in the detailed construction to be hereinafter more fully described and claimed, and is illustrated in the accompanying drawings in which Fig. 1 is a front view of a three-phase automatic motor starting switch embodying my invention; Fig. 2 is a slightly enlarged sectional view taken along the line 2—2 of Fig. 1 looking in the direction of the arrows showing the operating mechanism in its "on" position; Fig. 3 is a side elevation of the operating mechanism with one of the lateral supporting plates removed to show the mechanism in its manual "off" position; Fig. 4 is a view similar to Fig. 3 showing the operating mechanism in its automatic "trip" position; Fig. 5 is a view similar to Figs. 3 and 4 showing the operating mechanism in its "reset" position; Fig. 6 is an exploded perspective view having various parts broken away to show the automatic over-current trip mechanism and the operating mechanism, the operating mechanism being shown in its "on" position; Fig. 7 is a perspective view of the operating mechanism only in its "trip" position; and Fig. 8 is a detailed perspective view of an over-center toggle construction forming part of the current-responsive tripping mechanism.

Referring to the drawings, my invention in the form shown comprises a base 10 made of electrically insulating material such as a molded compound. The base 10 has an irregular shape for convenience in supporting various parts of the device. The switch actuating mechanism is borne upon two supporting plates 11 and 12 which are secured rigidly to the base, as by bolts 13 and 14, respectively, and project therefrom in parallel spaced relation, the operating mechanism being mounted between the plates on suitable pivots supported therein. An operating handle 15, preferably made of a suitable molded insulating material, is secured on the end of a metallic operating lever 16, the other end of which is rigidly attached as by welding to a fixed pivot pin 17 which is pivotally mounted in the two supporting plates 11 and 12. The operating lever 16 is slotted at one side as at 18 for sliding cooperation with a movable switch member 19.

As best shown at Fig. 6, the movable switch member 19 is mounted as a floating lever and is of irregular shape for the accomplishment of a number of functions which will appear hereinafter. Fundamentally, the lever 19 consists of substantially parallel end portions 20 and 21 joined by an offset portion 22 which forms a cam surface cooperating with the slot 18 in the manually operable lever 16. From Fig. 5 it may be seen that the offset portion 22 is of reduced cross section for interlocking engagement with the slot 18 of the manually operable lever. A latching portion 23 of the floating lever 19 forms substantially a right angle with the end portion 21 of the lever and is apertured at 24 to form a latching slot. The end portion 21 of the floating lever is slotted at 25 and bent to form a projecting ear 26 for attachment to a main spring 27, the other end of which is fastened to the manually operable lever 16 by passing through a slot 28 in the lever. The portions 20 and 23 of the floating lever 19 are rigidly attached as by welding to pins 30 and 31, respectively, which are slidably supported in slots 32 and 33, respectively, in the supporting plates 11 and 12. For reasons which will appear more clearly hereinafter, the pin 31 is located closely adjacent the latching slot 24.

The free end portion 20 of the floating lever 19 is fitted as a tongue into a slot 34 formed in the upper end of a slidable link 35. The link 35 is of rigid insulating material and comprises the slotted position; Fig. 5 is a view similar to Figs. 3 and 4 and transverse arm slotted at three points 36, 37 and 38 for the reception of resilient contact carrying members 39, 40, and 41 respectively. This construction is best shown at Fig. 6. Each contact carrying member 39, 40 and 41 is formed of electrically conducting spring material, such as an alloy of copper, and carries at its one end a contact member 42 for cooperation each with a fixed contact 43. The opposite end of each contact carrying member 39, 40, and 41 is rigidly at-

tached to the base 10, as by a bolt 44 best shown at Fig. 2.

As shown at Figs. 1 and 2, the fixed contact 43 is mounted upon a conducting strip 45 one end of which projects into a recess 46 in the base 10 and the other of which is mechanically and electrically connected to a terminal 47. The opposite terminals 48 of the breaker are electrically connected to the fixed ends of the resilient contact carrying members as by jumpers 49 and 50 of Figs. 2 and 6 respectively.

It will be understood that each of the two outside phases of the three phase switch are provided with current responsive tripping mechanisms designated generally as 55. For this reason the jumper 49 for the center phase shown in Fig. 2 has a somewhat different contour than the jumper 50 shown in Fig. 6. The jumper 49 connects directly to the center switch terminal 48 while each outside jumper 50 is connected to the associated terminal 48 through an electric heater 56. (Figs. 1 and 6.)

While only a single current responsive tripping mechanism 55 is illustrated in Fig. 6, and only one such mechanism will be described in detail, it will be understood that each outside phase of the switch is provided with an identical tripping mechanism. A single current-responsive latching mechanism 58 is provided in connection with the single centrally mounted floating lever mechanism, and is adapted to be independently operated by either current responsive tripping mechanism 55 as will appear hereinafter.

Referring now particularly to Figs. 6 and 8, the current responsive tripping mechanism is supported upon a metallic base plate 60 of irregular shape. The base plate 60 is fixedly attached, as by welding, to a metal strip 61 which is bolted to a flange 62 of the jumper 50. A strip 63 of bimetallic thermosensitive material is welded or otherwise rigidly attached to a mounting strip 64 of such shape as to form with the bimetallic strip a U-shaped structure adapted for detachable connection to the mounting plate 60. For mounting the supporting strip 64 upon the plate 60 the strip 64 is slotted at its base 65 for cooperation with an ear 66 projecting from a ledge 67 formed upon the plate 60, and is provided with a spring seat 68 for positioning a spring 69, the other end of which is seated upon a second ledge 70 of the mounting plate 60. The mounting plate 60 is also provided with a flange 75 threaded to receive an adjusting screw 76. From Fig. 6 it may be seen that the spring 69 engages the mounting strip 64 intermediate its ends and biases the base of the strip 64 into engagement with the ear 66 and the other end of the strip into engagement with the adjusting screw 76 to hold the bimetallic strip 63 in a predetermined position. The position of the bimetallic strip at any given temperature may be changed by adjusting the setting of the screw 76. From the broken line at Fig. 6 it may be observed that the jumper 50 is slotted at 77 to afford access to the knurled head of the adjusting screw 76.

The mounting plate 60 is also provided with a bifurcated flange 78 arranged to support an over-center lever, one end of which is positioned to be engaged by the bimetallic strip 63 and the other end of which is arranged to engage a latch member for tripping the breaker. As best shown in Fig. 8 the depending arms of the bifurcated flange 78 are fixedly attached as by welding to a U-shaped plate 79, the sides of which are wider than the depending arms of the flange 78. The sides of the U-shaped plate 79 overhang the inner edges of the depending arms of the flange 78 to form adjacent each arm a knife edge 80 adapted to support a trip arm 81 by seating in a notch 82 in the arm. The two trip arms 81 are rigidly attached to a latch arm base 83 which may be of molded insulating compound so formed as to provide a latch arm 84 projecting from the other side thereof. The latch arm and trip arm assembly is given a snap action in pivoting upon the knife edges 80 by an over-center spring 85 fastened at one end to the base of the U-shaped plate 79 and at the other end to a cross arm 86 mounted between the trip arm 81 adjacent the latch arm base 83.

Since each outside phase of the breaker is provided with a current responsive tripping mechanism of the type described above, there is a latch arm 84 projecting toward the latch mechanism 58 from each side thereof. As shown by the broken line projection in Fig. 6, the latch arms 84 are positioned to engage and independently to operate a pivoted latch member or latch lever 90. The latch lever 90 is welded to a pivot pin 91 which is received in and supported by the side supporting plates 11 and 12. The latch lever 90 is arranged to hold in latched position a second pivoted latch member or trip lever 92 which is likewise supported in the plates 10 and 11 by a pivot pin 93 to which it is welded. The trip lever 92 is provided with a detent 94 for engagement with the latching slot 24 of the floating lever 19. This construction is best shown at Figs. 6 and 7.

For latching the trip lever 92 in position the member 92 is provided with an arm 95 having an extending tongue 96 formed of three contiguous portions of different widths. The tongue 96 passes through and is in latching engagement with a slot 97 in the latch lever 90. The widest portion of the tongue 96 serves only as a cross bar for preventing disengagement of the slot with the tongue. For cooperation with the other two contiguous portions of the tongue 96 the slot 97 has two contiguous portions of corresponding widths, the narrowest portion being adapted to receive the narrowest portion at the base of the tongue 96 and the wider portion of the slot being adapted to receive the tongue portion of intermediate width. The shoulder between the two contiguous portions of the slot 97 is located just beyond a slightly offset center portion of the latch lever 90 for a purpose which will appear hereinafter. On the same side of each of the pivot pins 91 and 93 a latching spring 100 is connected between the latch lever 90 and the trip lever 92 to bias the lever 90 into latching engagement with the lever 92 and simultaneously to bias the lever 92 into latch releasing position with respect to the floating lever 19.

Referring now particularly to Fig. 6, the operation of my new and improved circuit breaker will be clear. In Fig. 6 the mechanism is shown in the manual closed position. In this position the pivot pin 31 of the floating lever 19 is held at the base of the slot 33 by engagement of the detent 94 with the slot 24 of the lever, while the free end 20 of the floating lever and the slidable link 35 are held in raised position by engagement of the floating lever with the notch 18 in the operating lever 16. The floating lever is held firmly against the base of the slot 18 by the resilience of the contact carrying members 39, 40, and 41 which are slightly deformed in the

closed position of the switch. The main spring 27 also tends to rotate the floating lever 19 about the pin 31 in a counterclockwise direction as viewed in the drawings, and this assists in holding the lever adjacent the base of the slot 18. In this position the manual operating lever 16 is biased to the open position by the main spring 27, but is held against movement to this position by frictional engagement between the floating lever 19 and the base of the slot 18. The pressure of the lever 19 against the base of the slot 18 aids in making this friction catch effective. For this purpose also the portion 20 of the floating lever is so disposed in the closed position of the switch that movement of the lever 16 to its open position produces a slight additional movement of the switch slidable link 35 in the closing direction against an increasing bias of the contact carrying members 39, 40, and 41 before the free end 20 of the floating lever is permitted to move toward the base of the slot 32 to open the contacts. This latter latching effect is produced by so positioning the operating lever 16 in the "on" position that it is slightly beyond the transverse bend between the free end 20 and the cam surface 22 of the floating lever, as shown at Figs. 2 and 6.

The contacts may be opened manually by moving the handle 15 and lever 16 to the position shown at Fig. 3, thereby to permit the lower surface of the cam portion 22 to slide over the base of the slot 18 while the entire floating lever 19 pivots about the pin 31 under the influence of the main spring 27.

Manual closing operation of the switch is simply the opposite of the opening action described immediately above. In manual closing operation the floating lever pivots about the attached pivot pin 31 while the manually operable handle lever 16 raises the free end 20 of the lever as the base of the slot 18 moves along the lower surface of the camming portion 22 of the floating lever. The camming and latching action between the floating lever and the manually operable lever 16 during manual opening and manual closing operation is clearly illustrated in Figs. 2, 3 and 5.

Beginning with the mechanism in the closed position as shown in Figs. 2 and 6, a predetermined excessive current will operate the overcurrent tripping and latching mechanisms to place the parts in their trip position, as shown in Figs. 4 and 7. The occurrence of a predetermined excessive current first deforms the bimetallic strip 63 and causes its free end to move the trip arm 81 in a clockwise direction about the knife edges 80 as viewed in Fig. 6. As soon as the spring 85 is carried over-center the trip arm and latch arm assembly continues its movement with a snap action under the influence of the over-center spring. This snapping movement of the latch arm 84 causes it to engage the free end of the latch lever 90 with a hammer blow and to move this end downwardly about its pivot pin 91. This movement of the latch lever 90 removes the shoulder between the two contiguous portions of the slot 97 of the latch lever from engagement with the intermediate portion of the tongue 96 of the trip lever 92. It will be noted that latch releasing movement of the member 90 has applied additional tension to the latching spring 100. As soon as the tongue 96 is released the trip lever 92 is free to rotate about its pivot pin 93 under the influence of the spring 100 and in the same direction as the movement of the latch lever 90. The force exerted by the spring 27 and the contact spring tending to rotate the floating lever 19 about its point of engagement with the operating lever 16 pulls upward on the detent 94 and also tends to rotate the lever 92 clockwise. Such movement of the trip lever 92 causes the detent 94 to disengage the slot 24 in the floating lever 19.

Upon disengagement of the detent 94 and the latching portion 23 of the floating lever, the lever 19 is free to rotate about its point of engagement with the manually operable lever 16 under the influence of the main spring 27. This rotation of the floating lever 19 causes its free end 20 to move downwardly and carry with it the slidable link 35, thereby opening the breaker contacts. As may now be clearly observed from Fig. 4, when the pivot pin 30 of the floating lever has reached the base of the slot 32 the biasing force of the movable switch members 39, 40, and 41, which formerly held the floating lever in engagement with the base of the slot 18 in the handle 16, is no longer present. Furthermore, the free end 20 of the floating lever 19 has taken up such a position that the transverse bend in the lever no longer offers any resistance to the movement of the manually operable handle 16 along the camming portion 22 of the lever under the influence of the main spring 27. Thus, the ear 26 of the floating lever and the manually operable lever 16 are drawn together by the main spring 27, so that in the "trip" position the handle 15 takes up a position intermediate its manual "on" and "off" positions, as shown at Fig. 4. However, the handle 15 is only loosely held in its "trip" position, so that no harm would come to an operator in attempting to retain the handle in the manual "on" position while the over-current trip mechanism functioned.

To reset the breaker mechanism after an automatic tripping operation as described above, the operating handle 15 must be moved beyond its manual open position in the opening direction. As best shown at Fig. 5, this movement depresses the portion 21 of the floating lever by engagement of the upper surface of the slot 18 in the lever 16 with the upper portion of the camming surface 22 of the floating lever. During this movement the projecting end 23 of the floating lever engages the arm 95 of the trip lever 92 and rotates the trip lever about its pivot pin 93 in a counter-clockwise direction as viewed in Fig. 5. Continued movement of the trip lever 92 and the floating lever 19 in this direction will eventually bring the detent 94 into engagement with the latching slot 24 of the floating lever and will also move the tongue 96 of the trip lever 92 downwardly in the slot 97 of the latching member 90 until the wider portion of the tongue comes adjacent the wider portion of the slot. As soon as the shoulder between the adjacent portions of the tongue 96 is removed from engagement with the narrow portion of the slot 97 of the member 90 the member 90 is permitted to rotate about its pivot point 91 under the influence of the latching spring 100 to raise the member 90 to the position shown at Figs. 2 and 5. To fully reset, however, the handle 15 must be pressed still further back to rotate the trip lever counter-clockwise beyond its normal latching position, as is shown in the "reset" position of Fig. 5. In moving to the position of Fig. 5 the tongue 96 of the trip lever 92 engages the offset central section of the latch lever 90 which now acts as a cam surface to rotate the

latch lever 90 counter-clockwise beyond its normal latching position. As is shown at Fig. 5 this additional movement of the member 90 causes it to engage the latch arm 84 of the over-current mechanism to reset the over-center spring 85, the trip arms 81, and the latch arm 84, if the bimetallic strip 63 has cooled and returned to its normal position. Upon release of the handle 15 the latch spring 100 rotates both the members 90 and 92 clockwise through a small angle until the tongue 96 engages the shoulder between adjacent portions of the slot 97, as shown at Fig. 3. This last small movement of the trip lever 92 raises the fixed end 21 of the floating lever so that the pin 31 is slightly above the base of the slot 33. The floating lever 19 in so moving to the position of Fig. 3 moves the handle 15 back to its manual open position of Fig. 3. All the parts are now fully reset as in Fig. 3 and prepared for manual operation to close the breaker as at Figs. 2 and 6.

While I have described but a single preferred embodiment of my invention, many modifications will occur to those skilled in the art. For example, while I have illustrated my invention as applied to a three-phase motor starting switch provided with two over-current trips for three-phase protection, it will be understood that my operating and latching mechanism may be used to operate any desired number of switch contacts and may be combined with any desired number of my independent over-current trip mechanism. I, therefore, wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A circuit breaker comprising cooperating switch contacts, a floating lever having a first end connected to move one of said contacts, means for slidably supporting said lever at at least one end, a manually operable operating lever pivoted at a fixed point and slidably and interlockingly engaging said floating lever intermediate its ends, latch means for normally retaining the other end of said lever in a position fixed with respect to said fixed point, said floating lever providing frictional means arranged to engage said operating lever to retain said floating lever in a contact closing position, and a spring connected between said floating lever and said operating lever to bias said floating lever to a contact opening position and said operating lever to an off position while also biasing said frictional means into engagement with said operating lever.

2. A circuit breaker comprising cooperating switch contacts, a floating lever having one end connected to move one of said contacts and formed to provide a camming portion intermediate the ends thereof, means for slidably and pivotally supporting the other end of said floating lever, an operating lever pivoted at a fixed point and slidably and interlockingly engaging said camming portion, said camming portion providing a friction catch for retaining said operating lever in a contact closing position, releasable latch means for retaining said other end of said floating lever in fixed position with respect to said fixed point, spring means connected between said floating lever and said operating lever for biasing said operating lever to an off position and said floating lever to a contact opening position and into engagement with said friction catch, and means responsive to the current traversing said contacts for releasing said latch means.

3. A circuit breaker comprising cooperating switch contacts, a floating lever for moving one of said contacts, said floating lever having a normally fixed end and a free end connected by an intermediate portion providing a camming surface, a pin and slot connection for slidably and pivotally supporting said normally fixed end of said floating lever, releasable latch means for normally restraining sliding movement of said normally fixed end, a manually operable operating lever having one end pivotally mounted at a fixed point and provided at its other end with an operating handle, means associated with said operating lever between said fixed pivot and said handle for interlockingly engaging said intermediate portion of said floating lever, spring means connected between said operating lever and said normally fixed end of said floating lever for biasing said operating lever to an off position, and means associated with said floating lever for retaining said operating lever in an on position against the bias of said spring means, thereby to retain said floating lever in a contact closing position.

4. A circuit breaker comprising a fixed contact, a resiliently mounted movable contact, a pair of slotted lateral supporting plates, a floating lever having a free end connected to move said movable contact and a normally fixed end spaced from said free end and joined thereto by an offset intermediate portion forming a camming surface, a pin attached to said normally fixed end of said floating lever and arranged for slidable and pivotal engagement with said lateral supporting plates, stop means for limiting movement of said free end of said floating lever, an operating lever having one end pivotally mounted at a fixed point in said supporting plates and having at its other end an operating handle, said operating lever providing means intermediate its ends for interlocking engagement with said intermediate portion of said floating lever, current responsive latch means for releasably retaining said normally fixed end of said floating lever against sliding movement, a main spring connected between said fixed end of said floating lever and the movable end of said operating lever thereby to bias said operating lever to an off position and said floating lever to a contact opening position, a friction catch for releasably retaining said operating lever in an on position against the bias of said main spring whereby both said main spring and said resiliently moutned contacts apply pressure to said friction catch to retain said floating lever in a contact closing position.

5. A circuit breaker comprising a support, a fixed contact mounted on said support, a floating lever having its ends slidably and pivotally mounted upon said support, current responsive latch means for normally restraining sliding motion of one end of said floating lever, a movable contact operatively associated with the other end of said floating lever, an operating lever pivotally mounted upon said support and engaging said floating lever intermediate its ends to rotate said floating lever about said one end and thereby manually to engage and disengage said contacts, and biasing means connected between one end of said floating lever and said operating lever normally to bias said floating lever to a switch opening position and to bias said operating lever to an "off" position, said biasing means being operable upon release of said latch

means to rotate said floating lever about its point of engagement with said operating lever thereby to disengage said contacts regardless of the position of said operating lever.

6. A circuit breaker comprising a slotted support, a fixed contact mounted upon said support, a floating lever having at each end a pin arranged slidably and pivotally to engage said slotted support, current responsive latch means for normally restraining sliding movement of one end of said floating lever, a resiliently mounted movable contact operatively connected to the other end of said floating lever, said floating lever intermediate the ends thereof being formed to provide a camming surface, an operating lever pivotally mounted at a fixed point upon said support, means associated with said operating lever for engaging said camming surface to constrain said floating lever to pivot about said one end for engaging and disengaging said contacts, biasing means connected between said floating lever and said operating lever and operable upon release of said latch to rotate said floating lever about its point of engagement with said operating lever to disengage said contacts regardless of the position of said operating lever, and means associated with said operating lever to engage said camming surface for constraining said floating lever to pivot about said other end to reset said latch means.

7. A circuit breaker comprising a base of insulating material, a pair of supporting plates attached to said base in parallel spaced relation, a fixed contact mounted upon said base, a movable contact mounted upon one end of a resilient strip of conducting material having its other end fixed to said base, a floating lever having a normally fixed end and a free end both of which are slidably and pivotally mounted in said supporting plates, said floating lever having an offset intermediate portion formed to provide a camming surface, a latch member arranged to engage one end of said floating lever normally to restrain said one end against sliding movement relative to said supporting plates, a slidable member connecting said strip of conducting material to the other end of said floating lever, an operating lever having one end pivotally mounted at a fixed point of said supporting plates and provided at its other end with an operating handle, a spring connected between said operating lever and said one end of said floating lever, means intermediate the ends of said operating lever arranged to engage said camming surface to rotate said floating lever about said one end against the bias of said spring thereby to move said movable contact, frictional means associated with said resilient strip and said spring for retaining said operating lever in an on position against the bias of said spring to retain said contacts engaged, current responsive means for releasing engagement of said latch member with said one end of said floating lever to permit said floating lever to pivot about its point of engagement with said operating lever under the influence of said spring thereby to disengage said contacts regardless of the position of said operating lever, and means associated with said operating lever intermediate the ends thereof to engage said camming surface for rotating said floating lever about said other end thereby to reengage said latch member and said floating lever.

8. An automatic circuit breaker comprising a support, cooperating switch contacts, a movable swich member for moving one of said contacts, a first latch member pivotally mounted upon said support and having a detent normally engaging said switch member, a tongue attached to said first latch member and formed to provide contiguous portions of different widths, a second latch member pivotally mounted upon said support and provided with a slot having contiguous portions of different widths for interlocking cooperation with said tongue, a spring connecting said latch members for biasing said second latch member to secure said first latch member and biasing said first latch member to release said switch member, and means responsive to the current through said switch contacts for actuating said second latch member in opposition to said spring thereby to release said switch member.

9. An automatic circuit breaker comprising a support, cooperating switch contacts, a movable switch member for moving one of said contacts, a first latch member pivotally mounted upon said support and having a detent normally engaging said switch member, a tongue attached to said first latch member and formed to provide contiguous portions of different widths, a second latch member pivotally mounted upon said support and provided with a slot having contiguous portions of different widths for interlocking cooperation with said tongue, one end of said second latch member being offset away from said first latch member, a spring connecting said latch members for biasing said second latch member to secure said first latch member and biasing said first latch member to release said switch member, an over-center lever for actuating said second latch member in opposition to said spring thereby to release said switch member, and means associated with said switch member for engaging said tongue to reset said first and second latch members and said over-center lever.

10. An automatic circuit breaker comprising a support, cooperating switch contacts, a movable switch member for moving one of said contacts, a trip lever pivotally mounted upon said support and being provided at one side of its pivot point with a detent normally engaging said switch member, a projecting tongue attached to said trip member and formed to provide contiguous portions of different widths, a latch lever pivotally mounted upon said support and having a portion on one side of its pivot point offset away from said trip lever said latch lever being provided with a slot having contiguous portions of different widths to form a shoulder positioned at the top of said offset portion for interlocking cooperation with corresponding portions of said tongue, a tension spring connecting the other ends of said trip lever and latch lever thereby to bias said latch lever to secure said trip lever and to bias said trip lever to release said detent, an over-center lever for actuating said latch lever in opposition to said spring thereby to release said trip lever, thermal means responsive to the current passing through said contacts for actuating said over-center lever, and means associated with said switch member to engage said tongue for resetting said trip lever, said latch lever and said over-center lever.

11. An automatic circuit breaker comprising a support, cooperating switch contacts, a movable switch member for moving one of said contacts, a trip lever pivotally mounted upon said support and having a detent arranged to engage said switch member, a projecting arm connected to said trip lever and provided with an extend-

ing tongue having contiguous portions of different widths, a latch lever pivotally mounted upon said support having an end portion offset away from said trip lever, said latch lever having a slot comprising two contiguous portions of different widths forming a shoulder upon said offset portion thereby interlockingly to engage corresponding portions of said tongue, a tension spring connected between said trip lever and said latch lever to bias said latch lever to secure said trip lever in latching position and to bias said trip lever to disengage said detent, over-center spring means responsive to the current through said switch contacts for actuating said latch lever in opposition to said spring thereby to disengage the wider portion of said tongue from said shoulder and permit said spring to actuate said trip lever to release said switch member, and means associated with said switch member for engaging said projecting arm to actuate said trip lever against the bias of said spring to reengage said detent and to permit said spring to actuate said latch lever thereby to reengage said portion of said tongue to said shoulder.

12. An automatic circuit breaker comprising a support, a fixed contact mounted upon said support, a resiliently mounted movable contact, a floating lever slidably and pivotally mounted upon said support, said floating lever having a free end connected to said movable contact and a normally fixed end provided with a latching portion, a trip lever pivotally mounted upon said support and having a detent arranged to engage said latching portion and an extending tongue having contiguous portions of different widths, a latch lever pivotally mounted upon said support and provided with a slot having contiguous portions of different widths positioned for interlocking cooperation with corresponding portions of said tongue, a spring connecting said trip lever with said latch lever and arranged to bias said latch lever to secure said trip lever in latching position and to bias said trip lever to disengage said detent from said latching portion, current responsive means for actuating said latch lever in opposition to said spring thereby to disengage a first portion of said tongue from a first portion of said slot and permit said spring to actuate said trip lever to release said floating lever, and means for rotating said normally fixed end of said floating lever about said free end thereby to cause said latching portion to engage said trip lever to rotate said trip lever in opposition to said spring to reset said trip lever and said latch lever.

13. An automatic circuit breaker comprising a support, cooperating switch contacts, a movable switch member for moving one of said contacts, a trip lever pivotally mounted upon said support and having a detent arranged to engage said switch member, a projecting arm associated with said trip lever and provided with an extending tongue having contiguous portions of different widths, a latch lever pivotally mounted upon said support provided with a slot having contiguous portions of different widths arranged for interlocking engagement with corresponding portions of said tongue, a spring connecting said trip lever with said latch lever and arranged to bias said latch lever to secure said trip lever in latching position and to bias said trip lever to disengage said detent, means responsive to the current through said switch contacts for actuating said latch lever in opposition to said spring thereby to disengage a portion of said tongue from said slot and permit said spring to actuate said trip lever to release said switch member, and means associated with said switch member for engaging said projecting arm to actuate said trip lever against the bias of said spring to reengage said detent and to permit said spring to actuate said latch lever thereby to reengage said portion of said tongue with said slot.

14. An automatic circuit breaker comprising an insulating base, a pair of supporting plates mounted upon said base in spaced parallel relation, a fixed contact mounted upon said base, a floating lever slidably and pivotally mounted upon said plates, a movable contact operatively connected with a free end of said floating lever, a pivoted operating lever engaging said floating lever intermediate its ends for manual actuation of said floating lever to engage and disengage said contacts, a projection extending from a normally fixed end of said floating lever, said projection being provided with a latching portion, a trip lever pivotally mounted in said supporting plates and having a detent arranged to engage said latching portion, a projecting arm attached to said trip lever provided with an extending tongue having contiguous portions of different widths, said arm being positioned for engagement with said projection, a latch lever pivotally mounted upon said supporting plate and provided with a slotted offset end portion having a shoulder, said latch lever being positioned for interlocking latching engagement with said tongue, a tension spring connecting said latch lever with said trip lever simultaneously to bias said latch lever to secure said trip lever and to bias said trip lever to secure said floating lever, over-center current responsive means arranged to engage said latch lever to actuate said latch lever in opposition to said spring thereby to release the wider portion of said tongue from said shoulder and to permit said spring to actuate said trip lever to disengage said detent from said latching portion, and means associated with said operating lever to rotate said floating lever about its free end to engage said arm thereby to rotate said trip lever and reset said trip lever, said latch lever, and said over-center means.

15. A circuit breaker comprising a pair of cooperating switch contacts, a movable switch member for moving one of said contacts, a latch member normally engaging one end of said movable switch member a pivoted arm for moving said latch member to disengage said switch member, a base plate providing means for pivotally supporting said arm, said base plate having a plurality of parallel ledges positioned in different planes, an adjusting bolt extending through one of said ledges, a mounting strip and a bimetallic strip connected together at one end to form a U-shaped assembly, the free end of said bimetallic strip being positioned to engage said arm upon deformation of said strip by the application of heat, and a helical spring seated upon one of said ledges and engaging said mounting strip to hold it against another of said ledges and said adjustable bolt.

16. A circuit breaker comprising a pair of cooperating switch contacts, a floating lever for moving one of said contacts, a latch member normally engaging one end of said floating lever, a pivoted arm for moving said latch member to disengage said lever, a base plate providing means for pivotally supporting said arm, said base plate having a plurality of parallel ledges

positioned at different planes, an over-center spring connected between said arm and said base plate, an adjusting bolt extending through one of said ledges, a mounting strip bent transversely and apertured at its base, a bimetallic strip having one end fixedly secured to the base of said mounting strip, the free end of said bimetallic strip being positioned to engage said arm when deformed by the application of heat, a helical spring seated upon one of said ledges arranged to engage said mounting strip to hold said apertured base in engagement with a projecting ear on one of said ledges to hold the other end of said mounting strip in engagement with said adjustable bolt, and an electric heater positioned in heat conducting relation with said bimetallic strip and connected in circuit with said cooperating switch contacts.

17. A circuit breaker comprising a switch operating member, means for supporting said member for pivotal movement and for transverse slidable movement, a handle provided with spaced apart operating surfaces, an intermediate portion on said member between said operating surfaces, current-responsive means for securing a first end of said member against transverse movement, a spring connected to said handle and to said member at a point spaced from said current-responsive means so as to bias said first end for transverse movement and said member for pivotal movement about said current-responsive means to a first circuit position and bias said handle to a first position with one of said operating surfaces against one side of said intermediate portion, said other operating surface engaging the other side of said intermediate portion when said handle is moved against the tension of said spring to a second position thereby to move said member about said current-responsive means to a second circuit position, and a projection on said member cooperating with said other operating surface thereby to hold said handle in said second position against its bias, said first end of said member when released by said current-responsive means being moved transversely by said spring thereby to release said projection from said handle whereupon said handle is moved by said spring to said first position and said member returned to said first circuit position.

18. A circuit breaker comprising a switch operating member, supporting means adjacent each end of said member for supporting each end for pivotal movement and for transverse slidable movement, a pivoted handle provided with spaced apart operating surfaces, an intermediate transversely extending portion on said member between said operating surfaces, current-responsive means for securing a first end of said member against transverse movement, a tension spring having one end connected to said handle and its other end connected to said member at a point spaced from said current-responsive means so as to bias said first end for transverse movement and said member for movement about said current-responsive means to a first circuit position and bias said handle to an intermediate position with one of said operating surfaces against one side of said intermediate portion, said other operating surface engaging the other side of said intermediate portion when said handle is moved against the tension of said spring to a predetermined position thereby to move said member about said current-responsive means to a second circuit position, and a projection on said member cooperating with said other operating surface thereby to hold said handle in said predetermined position against its bias, said first end of said member when released by said current-responsive means being moved transversely by said spring thereby to release said projection from said handle whereupon said handle is moved by said spring to said intermediate position to return said member to said first circuit position, and said second operating surface cooperating with said intermediate portion upon continued movement of said handle thereby to return said first end of said member to a position to be secured by said current-responsive means.

19. An automatic circuit breaker comprising a support, a fixed contact mounted upon said support, a resiliently mounted movable contact, a floating lever slidably and pivotally mounted upon said support, said floating lever having a free end connected to said movable contact and a normally fixed end provided with a latching portion, a trip lever pivotally mounted upon said support and having a detent arranged to engage said latching portion, a latch lever pivotally mounted upon said support, said trip lever and latch lever being provided with interlocking means including a tongue and slot having corresponding contiguous portions of different widths, a spring connecting said trip lever with said latch lever and arranged to bias said latch lever to secure said trip lever in latching position and to bias said trip lever to disengage said detent from said latching portion, current responsive means for actuating said latch lever in opposition to said spring thereby to disengage a first portion of said tongue from a first portion of said slot and permit said spring to actuate said trip lever to release said floating lever, and means for rotating said normally fixed end of said floating lever about said free end thereby to cause said latching portion to engage said trip lever to rotate said trip lever in opposition to said spring to reset said trip lever and said latch lever.

WILLIAM LAWRENCE BUTLER.

CERTIFICATE OF CORRECTION.

Patent No. 2,300,202. October 27, 1942.

WILLIAM LAWRENCE BUTLER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 44, for "position; Fig. 5 is a view similar to Figs. 3 and 4" read --portion loosely attached to the floating lever 19--; page 4, second column, line 55, claim 4, for "moutned" read --mounted--; page 5, second column, line 52, claim 10, after "lever" and before "said" insert a comma; page 6, second column, line 53, claim 15, after "member" and before "a" insert a comma; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of December, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

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