Oct. 19, 1937. J. G. JACKSON 2,096,545

CIRCUIT BREAKER

Filed April 1, 1936 3 Sheets-Sheet 1

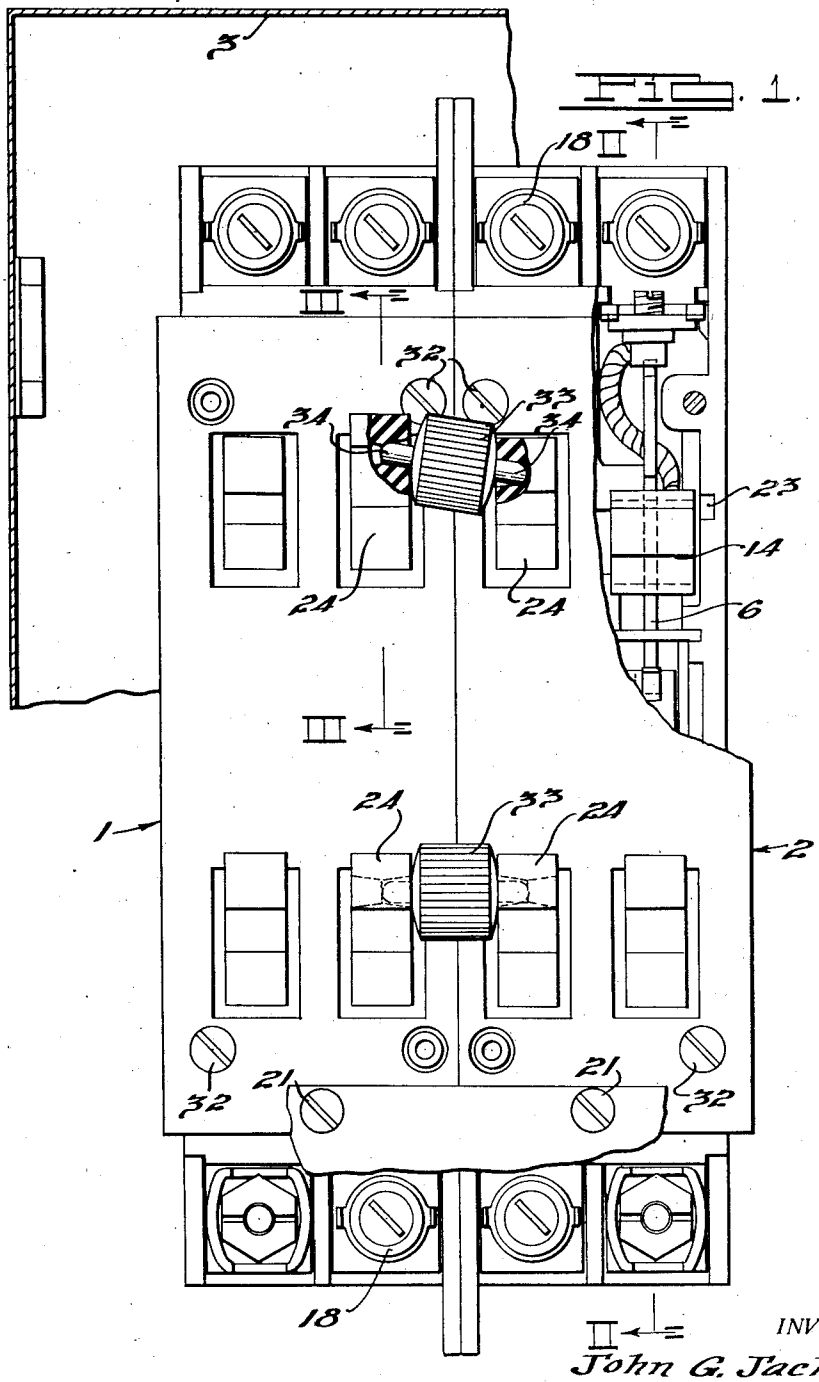


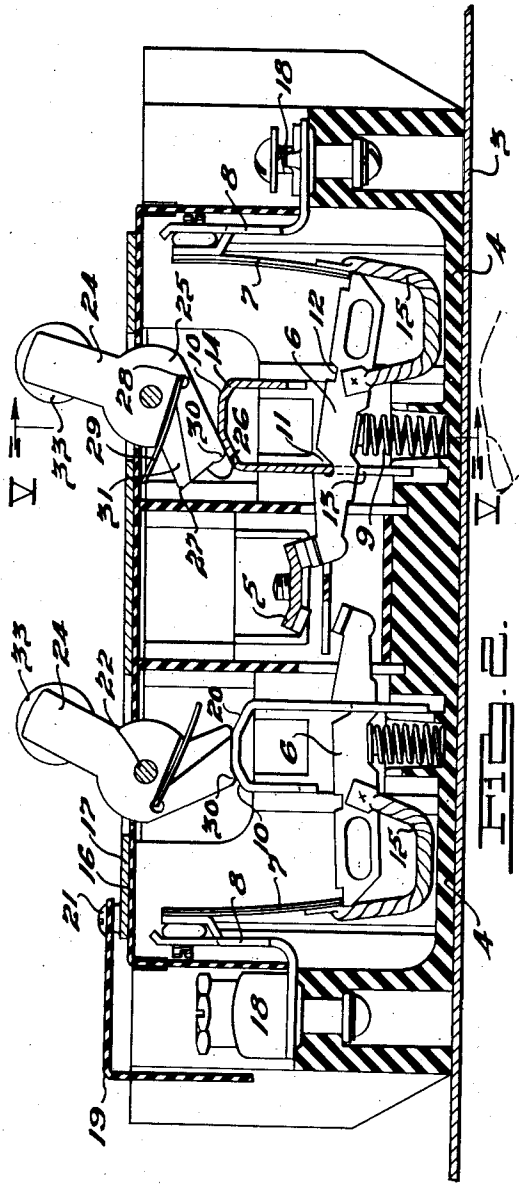
FIG. 1.

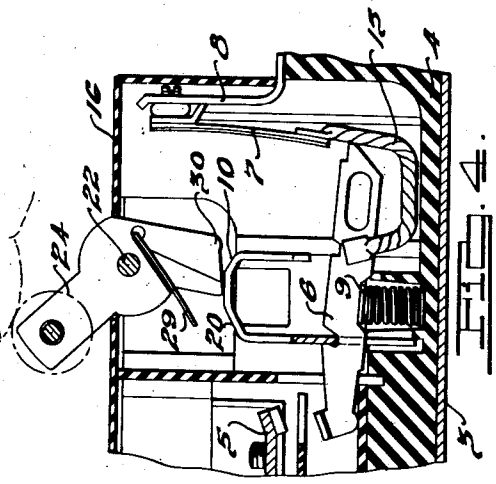
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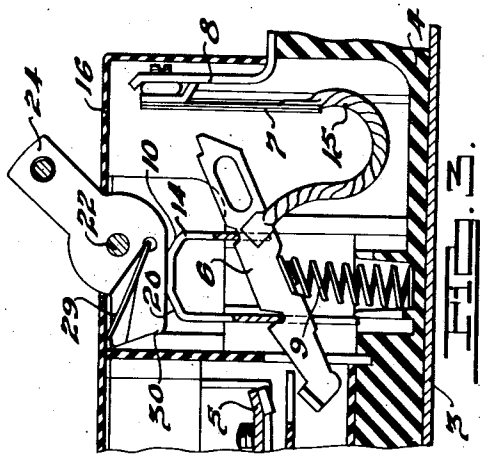
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CIRCUIT BREAKER

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CIRCUIT BREAKER

Filed April 1, 1936 3 Sheets-Sheet 3

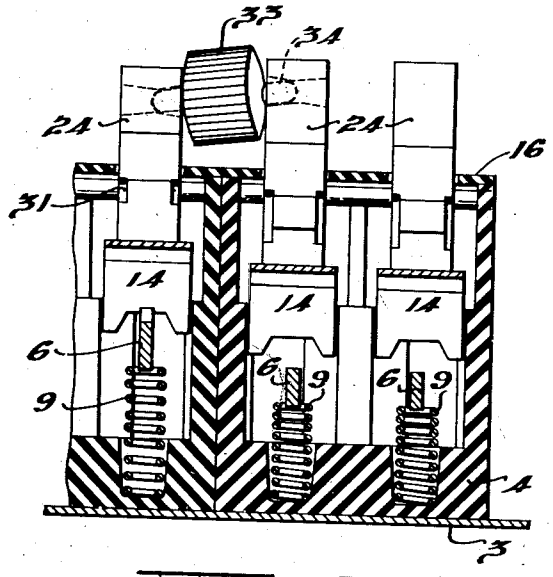


FIG. 5.

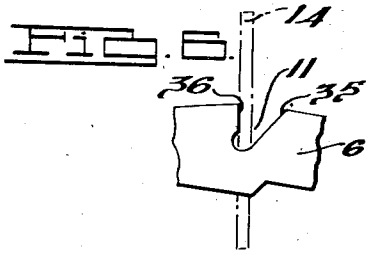


FIG. 6.

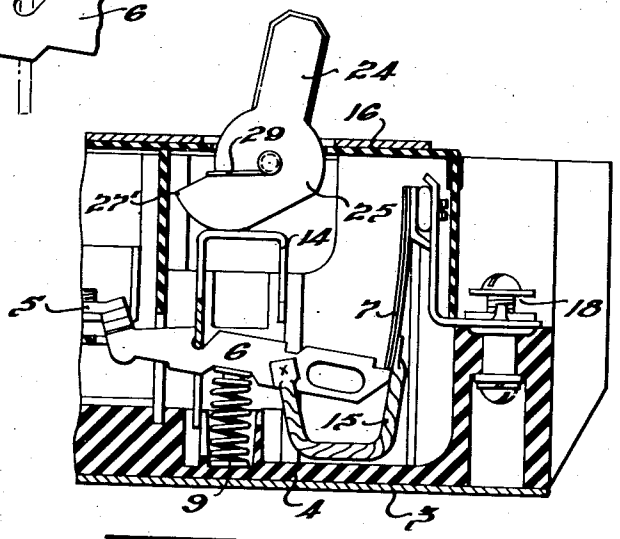


FIG. 7.

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CIRCUIT BREAKER

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Application April 1, 1936, Serial No. 72,035

10 Claims. (Cl. 200—116)

This invention relates to devices for making and breaking electrical circuits and more particularly to circuit breakers automatically operable in response to a current overload.

One object of this invention is to provide an improved operating handle and mechanism actuated thereby for an electric circuit breaker.

Another object of the invention is to provide a pivoted circuit breaker operating handle having a cam surface moving an element rectilinearly and having stable and unstable portions for maintaining or permitting movement of the element.

Another object of the invention is to provide an improved form of guiding and stopping means for a releasable contact bar.

Another object of the invention is to provide an improved pivotal support for a contact bar which shall insure the proper relation of parts when in circuit closed position.

Other objects and features of the invention will be readily apparent to those skilled in the art from the following specification and appended drawings illustrating certain preferred embodiments of the invention in which:

Figure 1 is a front elevational view of a circuit breaker assembly according to the present invention with certain parts broken away to show internal parts.

Figure 2 is a longitudinal sectional view taken on the line II—II of Figure 1.

Figure 3 is a fragmentary sectional view taken on the line III—III of Figure 1.

Figure 4 is a view similar to Figure 3 showing the parts in another position.

Figure 5 is a fragmentary transverse sectional view taken on the line V—V of Figure 1.

Figure 6 is an enlarged view of a constructional detail.

Figure 7 is a fragmentary sectional view similar to Figures 3 and 4 showing a modified form of operating handle.

The circuit breaker as herein illustrated and described embodies the main structural and operating features of that described in applicant's copending application, Serial No. 36,247, filed August 15, 1935, entitled Circuit breakers, and the present invention constitutes an improvement or a further development of the invention disclosed therein.

As shown, the circuit breaker assembly comprises two units 1 and 2 mounted in juxtaposed relation within an enclosing box 3 having an openable cover, not shown, which may be hingedly or otherwise mounted on the box. These units may be of identical construction and, as shown, each comprises an enclosure having a cup-shaped insulating base 4 within which is generally centrally disposed a contact plate 5 carrying contact surfaces at its corners. Cooperating with these contact surfaces are four individual floating contact bars 6 carrying contact surfaces at one end cooperating with the stationary contact surfaces and latched at the other end by bimetallic members 7 adjustably supported on connectors 8 leading to the exterior of the circuit breaker enclosure. Compression springs 9 bias the bars 6 against the stationary contact surfaces and the bimetallic latches 7. The top edges of the bars 6 are provided with pairs of notches 11 and 12 and are received within slots 13 in rectilinearly movable members 14 generally U-shaped in cross section. The longer legs of the elements 14 engage within the notches 11 at the top of the slots 13. Flexible leads 15 interconnect the free ends of the bimetallic latches 7 and intermediate points on the bars 6. The elements 14 and the bars 6 are provided with suitable guiding surfaces, as more fully explained in the aforementioned copending application.

The contact plate 5 may be disposed on a barrier wall dividing the lower portion of the base into two parts and the arc chamber adjacent the cooperating contact surfaces may be provided with suitable fibre barriers and openings but these features form no part of the present invention and constitute the invention described and claimed in a copending application, Serial No. 77,519, filed May 2, 1936.

A fibre sheet 16 is disposed over the top of the base and a cover 17 preferably of steel is riveted or otherwise sealably secured to the base to prevent access to the circuit breaker parts from the exterior. Terminal connectors 18 are provided on ledges at the opposite ends of the exterior of the breaker and over the line terminals may be disposed a fibre shield 19 attached to the cover by a pair of screws 21.

Pivotally supported as by means of shafts 22 within recesses 23 in the side walls of the base 1 are operating handles 24 having interior operating portions 25. These interior portions bear against the top surfaces of the rectilinearly movable elements 14 and constitute cam surfaces which upon rotation move the elements rectilinearly. The operating portions 25 are provided with flat surfaces 26 and projections 30 which form stable supports for the elements 14 in a depressed position corresponding to the manual

"off" position of the circuit breaker mechanism, and with tips 27 for causing a further movement of the elements 14 to reset the breaker mechanism after an automatic operation as will be more fully described hereinafter. The top corners of the elements 14 are beveled as at 10 and 20 to cooperate with the projections 30. The projections 30 bear against the bevels 10 in the manual "off" position and this provides a yielding resistance to the initial movement of the operating handles toward "on" position. The bevels 20 provide clearance for the projections to properly position the handles in the "on" position. The portions 25 of the operating handles are provided with openings 28 into which project the ends of springs 29 serving to bias the handles against the members 14. The interior portions 25 of the handles may be provided with cutout portions 31 to provide for free movement of the springs with relation to the operating portion of the handles.

The units are mounted in juxtaposed relation within the box 3 by means of studs 32 and when the studs on either unit are removed that unit may be readily moved sidewise. With the units mounted in this manner the immediately juxtaposed handles on the separate units may be joined together for common movement to certain positions by means of a large manually engageable portion 33 disposed between the handles and having reduced end portions or pins 34 disposed within conical or otherwise elongated holes in the handles 24. It can readily be seen that once the units are in a juxtaposed position the manually engageable means 33 cannot be detached from the cooperating handles unless the studs 32 on one unit are released and this unit moved sidewise.

The operation of the parts shown in Figures 1 to 5, inclusive, will now be explained.

As seen in Figure 2, the circuit breaker mechanism at the right therein is in the normal "on" position. When the handle 24 is rotated to engage the flat surface 26 and projection 30 with the rectilinearly movable member 14 the parts will assume the positions substantially shown at the left in Figure 2, corresponding to manual "off" position, with the movable contact surface moved to a disengaged position against the bias of the spring 9. This position constitutes a stable position which the parts will retain until the operating handle is moved in reversed direction to permit the movable contact surface to move into engaged position under the bias of the spring 9. The spring 29 in the normal "on" position of the device shown at the right in Figure 2 biases the handle 24 into engagement with the element 14 and biases this element within the notch 11 in the bar 6. Upon the occurrence of an overload the bimetallic latch 7 will become heated and move to the position shown in Figure 3, thus unlatching the end of the bar 6 and permitting it to rotate into the position shown in Figure 3. Here the bar is rotated about its engagement with the element 14 and moves the contact surface to a disengaged position. The notch 12 is engaged by the shorter leg of the element 14 which serves to limit the rotative movement of the bar and by its engagement with the notch, serves to further insure the proper positioning of the bar with respect to the element 14. As the compression spring 9 is considerably stronger than the light handle spring 29, in the released position the element 14 will be forced upwardly from the position shown at the right in Figure 2 and will rotate the handle 24 into an indicating position beyond the "on" position as shown in Figure 3.

To reset the mechanism after an automatic operation, the handle is rotated beyond the normal "off" position into that shown in Figure 4, whereupon the tip 27 on the operating portion 25 of the handle engages the element 14 and forces it into the position shown. In this rotation of the handle the contact end of the bar 6 engages the bottom of the arc chamber and causes the bar to rotate about its engagement with the member 14 into the position shown. When the handle is released from the position in Figure 4, the parts will assume the position of normal "off" as shown at the left in Figure 2. To again close the circuit through the breaker the handle is rotated to the normal "on" position whereupon the parts will assume the position shown at the right in Figure 2.

So far, the operation of the individual breaker mechanisms in the breaker unit have been described. Where the immediately juxtaposed handles are joined together by the engageable portion 33, their movement to manual "on", manual "off" and reset positions will be substantially common and will take place by the proper manipulation of the element 33. However, due to the enlarged openings in the handles 24 which receive the pins 34, provision is made for a limited independent movement of the handles so that they may independently indicate their tripped position. The joined handles shown at the bottom of Figure 1 are both in the "off" position. The joined handles in the upper part of Figure 1 and in Figure 5 are in different positions and that shown at the left indicates the tripped position of the breaker of which it forms a part, while that at the right is still in the normal "on" position. By this means it is possible to know which of the breakers has been automatically operated even though the handles are together for substantially common movement.

One detailed feature of the present invention resides in the means for insuring proper setting and calibration of the breakers. This means is more clearly illustrated in the enlarged detail shown in Figure 6 which illustrates the engagement of the element 14 with the notch 11 in the bar 6. It is seen that the notch is provided with an open side 35 permitting free rotation of the bar with respect to the element 14 in the released direction and with a projecting surface 36 engageable with the element 14 to restrict relative movement between the bar and element in the opposite direction. As the bar 6 moves into "on" position, the projecting surface 36 will engage element 14 and move it as far to the right as its guiding means will permit, or if the overlap between the bimetallic latch and the end of the bar has been too great, it will move the end of the bar with respect to the bimetallic latch after the play in the element 14 has been taken up. This insures the proper overlap of the bimetal 7 with the end of the bar and/or the proper positioning of the element 14 at the bimetal side of its guiding means so that as the bimetal 7 warps it will not have to absorb this play before moving with respect to the end of the bar.

In Figure 7 is shown a slightly modified form of operating handle in which the manual "off" and reset positions are the same. In this handle, when the tip 27' engages the element 14 a stable condition is produced and in this position the contact bar 6 and the other parts have assumed the resetting position shown in Figure 4. In this form of handle it is necessary to disengage the latching

end of the bar from the bimetallic latch each time the contacts are moved to manual "off" position and as this may disturb the calibration of the breaker, the handle illustrated in Figures 1 to 5, inclusive, is preferred. The joining together of the handles shown in Figure 7 may be the same as that shown in Figures 1 to 5, inclusive.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In an automatic electric circuit breaker, stationary and movable contacts, an element movable rectilinearly to move the movable contact, a pivoted manual operating member, said member including a cam surface engaging said element to move it rectilinearly in response to rotary movement of the member to engage and disengage said contacts, and automatic means for separating said contacts, rotary movement of said member causing said element to move rectilinearly to reset said automatic means after an automatic separation.

2. In an automatic electric circuit breaker, stationary and movable contacts, means biasing said contacts together, a pivoted operating handle, a cam surface movable with said handle, an element movable rectilinearly against said biasing means to move the movable contact to a separated position, said cam surface engaging said element and transforming rotary movement of the handle into rectilinear movement of the element, said cam surface including a stable supporting portion for maintaining the movable contact in the separated position, and means for effecting automatic separation of said contacts in response to a current overload, said cam surface including an unstable portion beyond said stable position for causing further movement of said element to effect resetting of the breaker mechanism after an automatic separation.

3. In an automatic electric circuit breaker, a stationary contact, a movable contact bar carrying a contact surface adjacent one end adapted to cooperate with said contact, current responsive latching means for the opposite end of the bar, biasing means intermediate the ends of the bar, a movable element engaging the bar interjacent the biasing means and said one end of the bar, a pivoted operating handle carrying a cam surface adapted to engage and move said element, said cam surface including a stable portion maintaining the contact surface in a separated position while the bar is engaged by the latching means, said surface including a portion beyond said stable portion for causing further movement of the element to move said opposite end of the bar beyond said latching means into a resetting position.

4. In an automatic electric circuit breaker, a stationary contact, a movable contact bar carrying a contact surface adjacent one end adapted to cooperate with said contact, current responsive latching means for the opposite end of the bar, biasing means intermediate the ends of the bar, a movable element engaging the bar interjacent the biasing means and said one end of the bar, a pivoted operating handle carrying a cam surface adapted to engage and move said element, means biasing said surface against said element and said element against said bar, said cam surface including a stable portion maintaining the contact surface in a separated position while the bar is engaged by the latching means, said surface including a portion beyond said stable portion for causing further movement of the element to move said opposite end of the bar beyond said latching means into a resetting position.

5. In an automatic electric circuit breaker, a stationary contact, a movable contact bar carrying a contact surface adjacent one end adapted to cooperate with said contact, current responsive latching means for the opposite end of the bar, biasing means intermediate the ends of the bar, a movable element engaging the bar interjacent the biasing means and said one end of the bar, a pivoted operating handle carrying a cam surface adapted to engage and move said element, means biasing said surface against said element and said element against said bar, said cam surface including a stable portion maintaining the contact surface in a separated position while the bar is engaged by the latching means, said surface including a portion beyond said stable portion for causing further movement of the element to move said opposite end of the bar beyond said latching means into a resetting position, said first mentioned biasing means causing a small movement of said element in its contact engaging direction when the bar is released upon a current overload to rotate the handle against its biasing means to a position beyond the normal contacts engaged position to indicate the automatic contacts separated condition of the breaker.

6. In an automatic electric circuit breaker, stationary and movable contacts, means biasing said contacts together, means for effecting automatic separation of said contacts in response to overload, an element movable rectilinearly against said biasing means to effect separation of said contacts and to reset the mechanism after an automatic separation, a pivoted operating handle carrying a cam surface engaging said element, the contacts separated and resetting positions of said element being the same and corresponding to a stable position of the cam surface to maintain the contacts separated.

7. In an automatic electric circuit breaker, a stationary contact, a contact bar carrying a contact surface at one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said bar, means interjacent the ends of the bar biasing it against said contact and latching means, means pivotally engaging said bar interjacent the biasing means and contact surface, and a limiting stop engaging said bar between the pivot and the latching end and limiting its rotative movement when released.

8. In an automatic electric circuit breaker, a stationary contact, a contact bar carrying a contact surface at one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said bar, means interjacent the ends of the bar biasing it against said contact and latching means, a notch in said bar interjacent the biasing means and contact surface, a rectilinearly movable element received in said notch to move and guide said bar, a second notch in said bar interjacent the first notch and the latching end of the bar, and means on said element receiving said second notch when the bar is released by the latching means to limit

the rotation of the bar and assist in its proper positioning.

9. In an automatic electric circuit breaker, a stationary contact, a contact bar carrying a contact surface at one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said bar, means interjacent the ends of the bar biasing it against said contact and latching means, a notch in said bar interjacent the biasing means and contact surface, a rectilinearly movable element received in said notch to move and guide said bar, said notch having an open side to permit free rotation of the bar in the automatic opening direction, and an interfering surface on the opposite side limiting free rotation of the bar in the opposite direction with respect to said element, said element being movable to rotate the bar into resetting position, movement of said bar to closed circuit position after reset causing said surface to engage the element and insure the proper positioning of the bar with respect to the latching means.

10. In an automatic electric circuit breaker, a stationary contact, a contact bar carrying a contact surface at one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said bar, biasing means interjacent the ends of the bar, means pivotally engaging said bar interjacent the biasing means and contact surface, said bar being freely rotatable with respect to said engaging means when released by said latching means, and means limiting the extreme position of rotation of the bar with respect to said engaging means in the opposite direction to ensure the proper positioning of the bar with respect to said engaging means and said latching means.

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