Oct. 19, 1937. J. G. JACKSON 2,096,546

CIRCUIT BREAKER

Original Filed Aug. 15, 1935 2 Sheets-Sheet 1

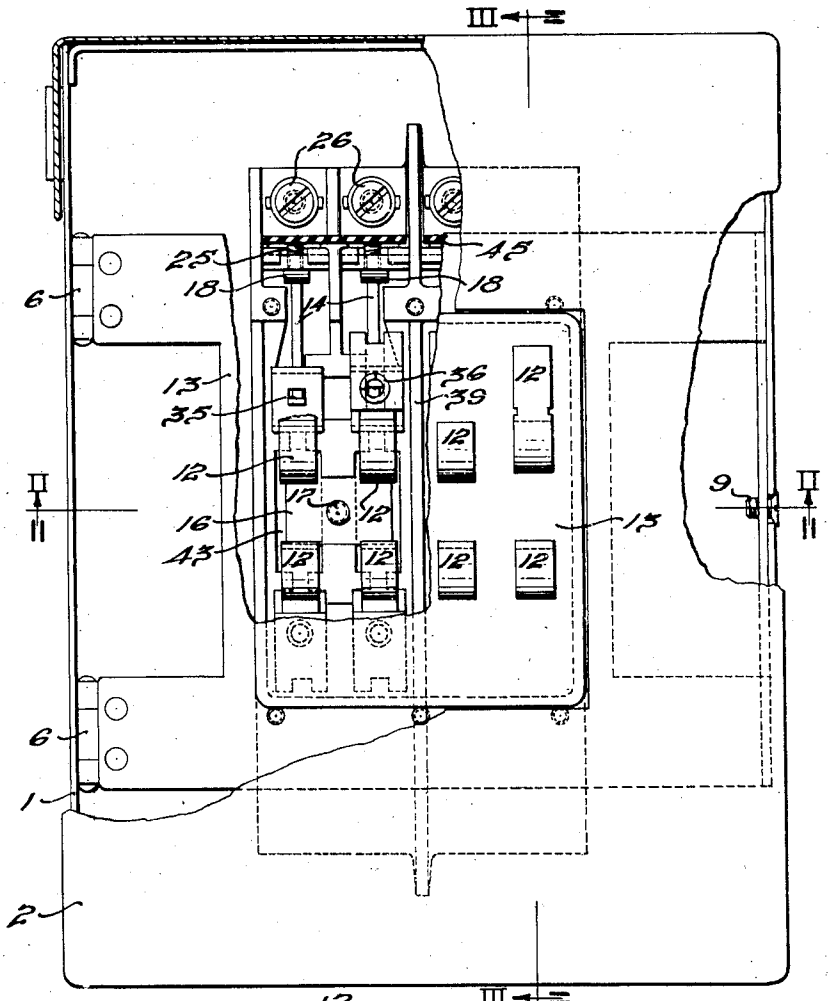


FIG. 1.

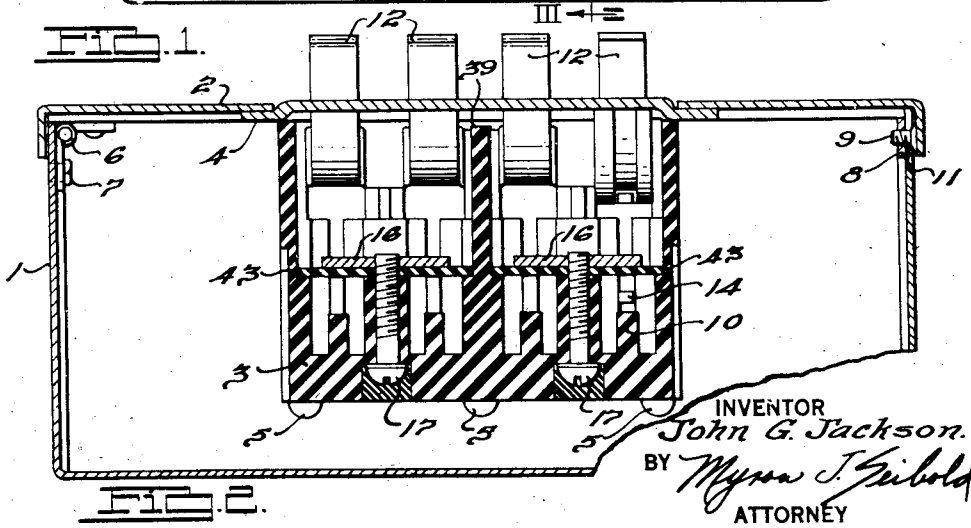


FIG. 2.

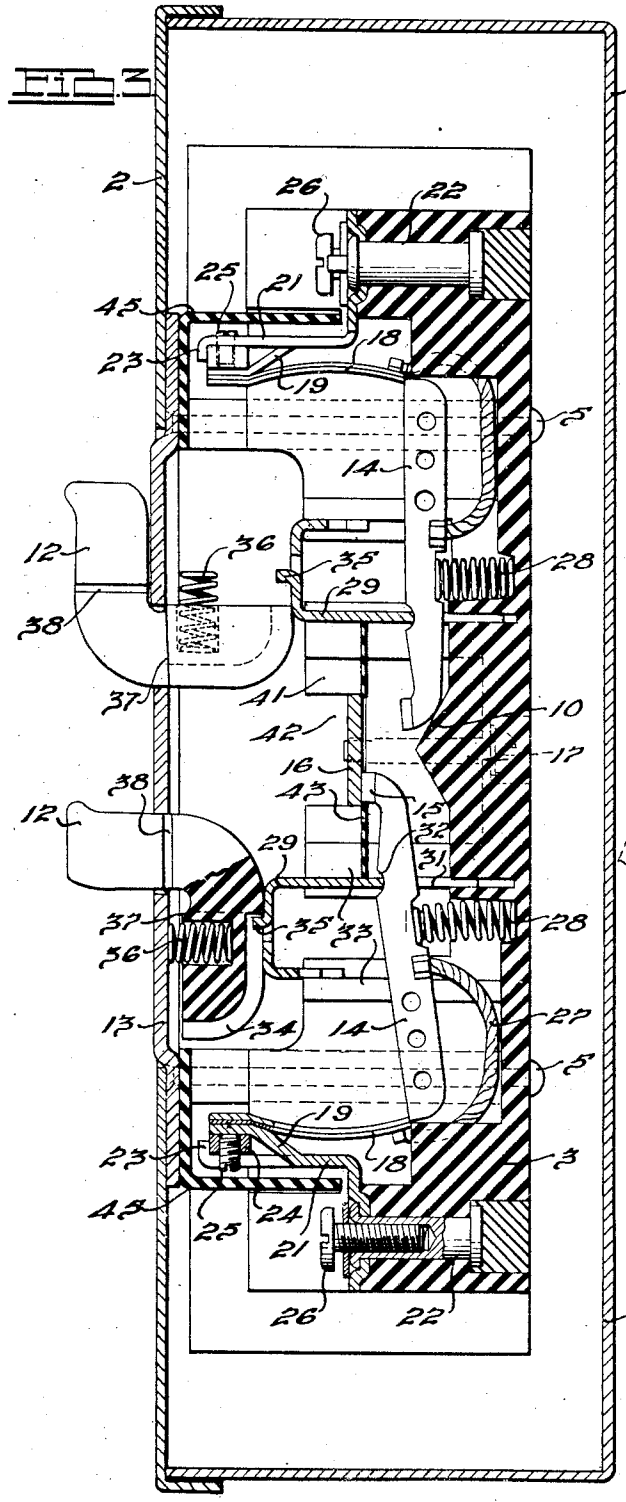
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Fig. 3



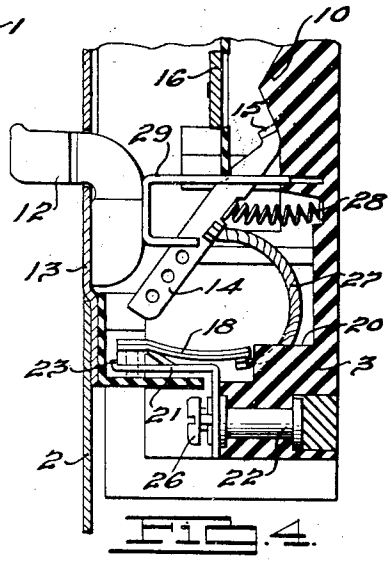


Fig. 4.

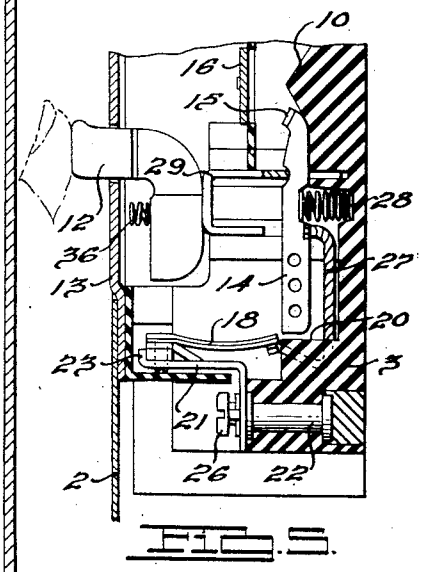


Fig. 5.

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CIRCUIT BREAKER

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Original application August 15, 1935, Serial No. 36,247. Divided and this application June 25, 1936, Serial No. 87,212

26 Claims. (Cl. 200—116)

This invention relates to devices for making and breaking electrical circuits and has for its object the provision of an improved automatic electric circuit breaker.

Another object of the present invention is to provide an economical automatic electric circuit breaker having a minimum of parts.

Another object of the present invention is to provide an automatic electric circuit breaker having a floating contact bar carrying a contact surface adjacent one end and cooperating with the stationary contact and having a current responsive latching means for the opposite end of the member, with biasing means holding said member against the latch and stationary contact and biasing the member for rotation about the pivotal axis when released by the latching means, together with the manual means for moving the axis to move the contact surface for manual operation.

Another object of the present invention is to provide an electric circuit breaker having a switch arm latched to a bimetallic element, with a flexible shunt connecting the arm and the element and with means for increasing the resistance of the path directly from the element to the arm.

Another object of the present invention is to provide an improved enclosure mounting for an electric circuit breaker.

Other objects and features of this 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 according to the present invention with both the exterior cover and the cover of the circuit breaker proper broken away to show internal parts.

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

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

Figure 4 is a fragmentary sectional view showing the breaker mechanism in the automatic tripped position.

Figure 5 is a fragmentary sectional view showing the breaker mechanism in the resetting position.

This application is a division of application Serial No. 36,247, filed August 15, 1935, for Circuit breakers.

The circuit breaker illustrated in the drawings comprises an outside enclosing box 1 having a cover 2 hingedly mounted thereon. Within this box is disposed a sealable multi-circuit circuit breaker comprised of an insulating base 3 and a metal cover 4. The cover 4 is adapted to be sealably attached to the base 3 by means of rivets 5. The cover 4 extends across the width of the box and to one side there is riveted or otherwise attached a hinge 6 which is bolted to the side walls of the box as at 7. The opposite side of the metal cover 4 is provided with a flange 8 carrying a bolt 9 adapted to be received within a slot 11 in the box wall to secure the cover 4 and breaker mechanisms within the box 1. The cover 4 is provided with a plurality of openings through which extend the push button handles 12 for operating the breaker mechanisms. The box cover 2 is provided with a generally central opening which closely receives a slightly raised portion 13 in the cover 4 so that the operating push button handles 12 extend to the box exterior. The hinged mounting of the metal cover 4 permits the circuit breaker to be swung to the exterior of the box to facilitate pulling in and connecting of the circuit wires. To then secure the circuit breaker within the box interior it is swung back to its interior position with the bolt 9 received within the slot 11 whereupon tightening of the bolt 9 will secure the circuit breaker in position.

The individual circuit breaker mechanisms comprise a movable contact bar 14 carrying a contact tip 15 adapted to engage with a common stationary contact 16 which is rigidly secured to the base by means of a bolt 17. The free end of the contact bar 14 is normally latched in the position shown at the bottom of Figure 2 by the bimetallic current responsive member 18. The bimetallic strip 18 is rigidly welded or otherwise secured to an arm 19 centrally punched or otherwise spaced from the main part of a connector 21 which is rigidly secured to the base by means of rivet 22. The side arms thus formed at the end of the connector 21 are bent over as at 23 and within the space formed between the connector 21, the bent-over portions 23 and the arm 19 is disposed a block 24 through which is threaded a stud 25 bearing against the free end of arm 19 and thus serving as an adjusting or calibrating means for the bimetallic strip. Within the rivet 22 is threaded a stud 26 forming the terminal for the breaker. A flexible lead 27 connects the free end of bimetallic strip 18 with the contact bar 14 adjacent to a pivot point thereof to be hereinafter described. The portion of the bar 14 between the lead 27 and the bimetal 18 is provided with holes or otherwise reduced in cross-

section to increase its resistance and lessen the current passing directly from the bimetal to the bar through their latching engagement.

A compression spring 28 is provided between the base 3 and the contact bar 14 and acts to bias the bar away from the main body of the base. This spring is located closer to the contact tip 15 than to the latching end of the bar to provide a high contact pressure without unduly increasing the pressure between the bar and the bimetallic latching member.

For operating the contact bar 14 there is provided a generally U-shaped member 29 having legs of different lengths. The longer leg of the member 29 is provided with a slot 31 in which the contact bar is disposed. The upper portion of the bar within this slot is provided with a notch 32 engaging the end of the slot and serving to restrain the bar from longitudinal movement as well as to provide a pivot point for movement of the bar to automatic trip and reset positions. The short leg of the U-shaped member is also slotted to receive the contact bar in over-load position as more particularly shown in Figure 4.

The base 3 is provided with a plurality of upstanding walls 33 provided with slots receiving the bar 14 and with suitable projections for holding and guiding the member 29 in its reciprocal movement.

In front of the operating member 29 is provided an L-shaped push button handle 12 having its leg extending through the cover 4. The base of the handle 12 is provided with a groove 34 mounted over a projection 35 on the closed end of the member 29. A small compression spring 36 is disposed within the handle base and bears against the under side of cover 5 in position to normally maintain the upper side of the base a definite distance from the cover. The ends of the base of the L are provided with smooth curves to facilitate rotation of the push button handle about an axis at right angles to its direction of straight line motion. The leg and the adjacent curved portion of the L-shaped handle are of a size to fit snugly within the opening in the cover 4. The remaining portion of the base as at 37 is enlarged and in the rotated position of the handle forms flanges bearing against the edges of the opening. A colored ring 38 may be placed on the outwardly projecting leg of the handle for a purpose to be hereinafter described.

The operation of this single circuit breaker mechanism will now be described in detail.

The mechanism shown at the bottom of Figure 3 is in the normal closed operating position. In the circuit breaker at the top of Figure 3 the handle 12 has been rotated 90 degrees so that the end of the base of the handle now bears upon the closed end of the member 29 with the enlarged portion 37 forced against the under side of cover 4 by spring 28. This in effect forms a simple toggle and the parts are maintained in this position. As the length of the base of the handle from enlargement of portion 37 to the end is greater than the distance between member 29 and cover 4 in the normal operating position, the member 29 has been moved toward the base moving the contact bar 14 by engagement of the end of slot 31 with notch 32 in the bar. In this movement the bar pivots about its engagement with the bi-metallic member 18 and assumes the position shown in the upper circuit breaker in Figure 3 which is the manual "off" position. In again closing the circuit through the breaker it is only necessary to flip the handle back 90° to the position shown in the lower circuit breaker in Figure 3 whereupon the contact bar 14 is moved upwardly to the position therein shown under action of the compression spring 28. When an overload is passed through the circuit breaker it becomes heated and is deflected away from the contact bar 14 thus releasing the end thereof and permitting this end to move away from the main body of the base 3. This movement of the contact bar 14 is caused by the compression spring 28 and the bar 14 moves about the engagement of the notch 32 with the top of the slot 31 into the position shown in Figure 4. The upward movement of the contact bar is restrained only by its engagement with member 29 which presses against the base of the push button handle 12. As the spring 36 is relatively weak as compared with the spring 28, the base of the handle will be moved against the under side of the cover 4 and the overload tripped condition of the breaker will be indicated by the extended position of the arm of the handle which brings the colored ring 38 into view above the cover. To reset the breaker mechanism it is necessary only to press inwardly upon the push button handle 12. In the extreme inward movement of the handle, the parts assume the reset position shown in Figure 5 with the end of the contact bar again in a position to have its upward movement restrained by the bimetallic member 18 and with the contact tip separated from the stationary contact 16. When the handle is released it will be moved outwardly to the position of the lower breaker in Figure 3 under action of spring 28 and the movable contact 15 will be engaged with the stationary contact. By this method of resetting it is obviously impossible to prevent the automatic tripping of the breaker by holding the operating handle as the contacts are not engaged to close the circuit until the operating handle moves to its normal operating position. If the push button handle is pushed inwardly and held there the contacts simply remain separated as shown in Figure 4. If the operating handle should be held in its nonindicating position as shown in the lower portion of Figure 3 the contacts will separate to the same extent although the now free end of the contact bar will not move to its full upward position until the handle is released. However, the contact carrying end of the bar will still move against the main body of the base and separate the contacts.

The connection of the flexible lead 27 to an intermediate point on the bar 14 serves two functions as it not only lessens the movement of the lead but also by by-passing a length of the bar places its resistance in the circuit through the latching engagement. This resistance may be increased, as shown, by reducing the cross section of the bar or may be increased in any other manner as by the interposition of insulation or a highly resistant material.

Guides or stops 10 and 20 are provided at the ends of the bar 14. These limit and guide the longitudinal movement of the bar. The limiting stop 10 also provides a positive pivot point for the bar in its movement to reset position. The stop 20 also prevents the bar moving with the bimetal where there is play at the notch 32.

In the multi-circuit form of circuit breaker illustrated, a plurality of circuit breaker mechanisms are mounted upon base 3. In the specific example herein disclosed the base is provided with a generally central dividing wall 39 which divides the mechanism into two duplicate and

electrically separate parts each of which may be regarded as a multi-circuit circuit breaker.

Describing now the multi-circuit circuit breaker shown at one side of the dividing wall 39, there is provided a central wall 41 having a cutout portion 42 in which is maintained a stationary contact plate 16. The bolt 17 projects upwardly through the central portion of the wall 41 and rigidly secures the contact plate to the base. The opening through which the bolt 17 projects may then be waxed to provide insulation. Between the contact 16 and the supporting portion of the wall 41 is disposed an insulating strip 43 having cutout portions through which the movable contacts project to engage the contact 16. The insulating strip 43 projects beyond the contact 16 on both sides of the wall 41 to the member 29 and in combination with the walls of the base forms an arc chamber. This arrangement permits the discharge of gas from the rupturing of a single breaker into the space occupied by the multiple group of breakers thus rendering less necessary any important discharge vent to the outer air. The central wall 41 may be integral with certain of the walls 33 and in this construction the walls 33 may be considered to form projections upon the side walls of the base and the wall 41 rather than as unitary walls slotted to receive the member 14. The ends of the breaker are provided with fibre shields 45 extending between the base 3 and the cover 4 and sealable therewith by rivet 5.

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 circuit breaker, a stationary contact, a movable contact bar having a contact surface at one end thereof, a current responsive element adapted to engage the opposite end of said bar, biasing means for said bar, a reciprocable member having a slot therein receiving said bar between said biasing means and said contact surface, said bar having a notch engaging the end of the slot to prevent longitudinal movement of the bar and to provide a pivot for automatic trip and reset movements.

2. In an automatic electric circuit breaker, a relatively stationary contact, a movable member having a contact surface at one point adapted to cooperate with said contact, current responsive latching means for another point on said member, means biasing said member against said contact and latching means, a pivotal axis for said member, said axis and biasing means being relatively positioned to provide for rotation of said member about said axis under the influence of said biasing means when released by said latching means to move the contact surface to a position separated from said stationary contact, and manual means for moving said axis against said biasing means to move the contact surface to a separated position.

3. In an automatic electric circuit breaker, a relatively stationary contact, a movable member having a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, a pivotal axis for said member interjacent the biasing means and contact surface, and manual means for moving said axis against said biasing means to move the contact surface to a separated position.

4. In an automatic electric circuit breaker, a relatively stationary contact, a movable member having a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, a pivotal axis for said member interjacent the biasing means and contact surface, and manual means for moving said axis against said biasing means after an automatic movement of the contact surface to reengage said latching means with said member.

5. In an automatic electric circuit breaker, a relatively stationary contact, a movable member having a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, a pivotal axis for said member interjacent the biasing means and contact surface, manual means for moving said axis, and a stop engaging adjacent to said one end of the member as said axis is moved after an automatic movement of the contact surface, said member thereafter pivoting about said axis in response to further movement of the axis to relatch said opposite end of the member.

6. In an automatic electric circuit breaker, a relatively stationary contact, an elongated floating member carrying a contact surface adjacent to one end adapted to cooperate with said contact, a bimetallic strip having relatively fixed and free ends, a conductor connected to the fixed end of said strip, a flexible lead interconnecting the free end of said strip and said member, a fixed biasing means for said member, the opposite end of said member engaging said strip, and an axis for said member located between said biasing means and said contact surface and about which said member rotates when released by said strip.

7. In an automatic electric circuit breaker, a relatively stationary contact, an elongated member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member; a compression spring having one end abutting against a relatively fixed part and its other end biasing said member toward said contact and latching means, and means for limiting the movement of an intermediate part of said member whereby the member will be rotated when released by said latching means to move the contact surface to a separated position.

8. In an automatic electric circuit breaker, a base, a relatively stationary contact supported in spaced relation to the main body of the base, a bimetallic strip having relatively fixed and free ends and disposed with its free end directed toward but spaced from the main body of the base, an elongated floating member carrying a contact surface adjacent one end disposed between said contact and the main body of the base, the opposite end of said member having a latching surface engaging the free end of said strip, a flexible lead connecting the free end of the strip to said member, a cover for said base, an operating handle projecting through said cover, and means interconnecting said handle and member for moving

said contact surface toward the main body of the base in response to movement of said handle.

9. In an automatic electric circuit breaker, a base, a relatively stationary contact supported in spaced relation to the main body of the base, a bimetallic strip having relatively fixed and free ends and disposed with its free end directed toward but spaced from the main body of the base, an elongated floating member carrying a contact surface adjacent one end disposed between said contact and the main body of the base, the opposite end of said member having a latching surface engaging the free end of said strip, a flexible lead connecting the free end of the strip to said member, means biasing said member away from the main body of the base, and means limiting the movement of an intermediate portion of said member away from the base, said means engaging said member between said biasing means and the contact surface.

10. In an automatic electric circuit breaker, a base, a relatively stationary contact supported in spaced relation to the main body of the base, a bimetallic strip having relatively fixed and free ends and disposed with its free end directed toward but spaced from the main body of the base, an elongated floating member carrying a contact surface adjacent one end disposed between said contact and the main body of the base, the opposite end of said member having a latching surface engaging the free end of said strip, a flexible lead connecting the free end of the strip to said member, means biasing said member against said strip and contact, and a movable pivotal axis for said member between said biasing means and said contact surface.

11. In an automatic electric circuit breaker, a base, a relatively stationary contact supported in spaced relation to the main body of the base, a bimetallic strip having relatively fixed and free ends and disposed with its free end directed toward but spaced from the main body of the base, an elongated floating member carrying a contact surface adjacent one end disposed between said contact and the main body of the base, the opposite end of said member having a latching surface engaging the free end of said strip, a flexible lead connecting the free end of the strip to said member, means biasing said member away from the main body of the base, and means limiting the movement of an intermediate portion of said member away from the base, said limiting means pivotally engaging said member between said biasing means and the contact surface.

12. In an automatic electric circuit breaker, a base, a relatively stationary contact supported in spaced relation to the main body of the base, a bimetallic strip having relatively fixed and free ends and disposed with its free end directed toward but spaced from the main body of the base, an elongated floating member carrying a contact surface adjacent one end disposed between said contact and the main body of the base, the opposite end of said member having a latching surface engaging the free end of said strip, a flexible lead connecting the free end of the strip to said member, means biasing said member against said strip and contact, and a movable pivotal axis for said member between said biasing means and said contact surface, and manual means for moving said pivotal axis against said biasing means to move the contact surface to a disengaged position.

13. In an automatic electric circuit breaker, a base, a relatively stationary contact supported in spaced relation to the main body of the base, a bimetallic strip having relatively fixed and free ends and disposed with its free end directed toward but spaced from the main body of the base, an elongated floating member carrying a contact surface adjacent one end disposed between said contact and the main body of the base, the opposite end of said member having a latching surface engaging the free end of said strip, a flexible lead connecting the free end of the strip to said member, means biasing said member against said strip and contact, and a movable pivotal axis for said member between said biasing means and said contact surface, said member rotating about said axis when released by said strip, and manual means for rotating said member in a reverse direction about said axis to relatch the member with the strip.

14. In an automatic electric circuit breaker, a stationary contact facing in one direction, a current responsive latching surface facing in the same direction, an elongated floating member carrying a contact at one end adapted to cooperate with said stationary contact and a latching surface at its opposite end adapted to cooperate with said first mentioned latching surface, means intermediate the ends of said member constantly biasing said member in the reverse direction, and means pivotally engaging said member between said biasing means and contact surface and limiting the movement of said member in said reverse direction whereby when said latching surfaces are disengaged the member will rotate about its engagement with said means to move the contact surface to a disengaged position.

15. In an automatic electric circuit breaker, a relatively stationary contact, a member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, a rectilinearly movable element pivotally engaging said member, and operating means for controlling the movement of said element.

16. In an automatic electric circuit breaker, a relatively stationary contact, a member carrying a contact surface adjacent to one end adapted to cooperate with said contact, a bimetallic element, a latching surface controlled by said element and adapted to be engaged by a latching surface adjacent to the opposite end of said member, a flexible lead interconnecting said element and member, means biasing said member against said contact and latching surface, a movable element pivotally engaging said member, and a manual operator for controlling the movement of said element, said member rotating about its pivotal engagement with said element under the influence of said biasing means when released by said latching surface.

17. In an automatic electric circuit breaker, a relatively stationary contact, an elongated, floating member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, a movable element pivotally engaging said member, guide means for limiting said element to rectilinear movement, and an operating means for moving said element to move the member and the contact surface carried thereby to an open circuit position.

18. In an automatic electric circuit breaker, a relatively stationary contact, an elongated

floating member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, a notch in said member between said biasing means and contact surface and an element engaging said notch for moving said member and serving as a pivot for rotary movement of said member by said biasing means when released by said latching means.

19. In an automatic electric circuit breaker, a relatively stationary contact, an elongated floating member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, a relatively strong biasing means urging said member against said contact and latching means, a notch in said member between said biasing means and contact surface, an element engaging in said notch and serving as a pivot for automatic rotation of said member, a relatively weak biasing means urging said element into said notch, said element having a relatively small movement under the action of said first biasing means when the member is released to cause exterior indication of the tripped condition.

20. In an automatic electric circuit breaker, a relatively stationary contact, an elongated floating member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, an element pivotally engaging said member, means guiding said element for rectilinear movement, and a rotary handle operatively connected to transmit rectilinear movement to said element.

21. In an automatic electric circuit breaker, a relatively stationary contact, an elongated floating member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, an element pivotally engaging said member, means guiding said element for rectilinear movement, and a rotary handle having a cam surface thereon engaging said element and transforming rotary movement of the handle to rectilinear movement of the element.

22. In an automatic electric circuit breaker, a relatively stationary contact, an elongated floating member carrying a contact surface adjacent to one end adapted to cooperate with said contact, current responsive latching means for the opposite end of said member, means biasing said member against said contact and latching means, an operating handle adapted to rotate about a transverse axis, and means interconnecting said handle and member for moving the member in response to movement of the handle, said member rotating about its engagement with said interconnecting means under the force exerted by said biasing means when released by said latching means.

23. In an automatic electric circuit breaker, separable contacts, a member having a rotary movement to separate said contacts, means for automatically separating said contacts in response to overload, rectilinearly movable means for moving said member, and an operating handle having a cam surface engageable with said last mentioned means to transform rotary movement of the handle to rectilinear movement of the means.

24. In an automatic circuit breaker, a stationary contact, a movable contact bar having a contact surface at one end thereof, a current responsive element adapted to restrain the opposite end of said bar, biasing means for said bar, a flexible lead interconnecting said element and an intermediate point on the bar, and means for increasing the resistance of the bar between said point and said element.

25. In an automatic circuit breaker, a stationary contact, a movable contact bar having a contact surface at one end thereof, a current responsive element adapted to engage the opposite end of said bar, biasing means for said bar, and a flexible lead interconnecting said element and an intermediate point on the bar, the portion of the bar between said point and element being reduced in cross-section to increase its resistance.

26. In an automatic circuit breaker, a base, a stationary contact spaced from the main body of the base, a movable contact bar having a contact surface on one end thereof, a current responsive bimetallic element adapted to restrain the opposite end of said bar, a flexible lead interconnecting said element and bar, means biasing said bar against said contact and element, means about which said bar pivots when released by said element, the contact end of said bar moving toward the main body of the base when released, and limiting stops at either end of said bar to ensure its proper positioning, the stop adjacent the contact end of the bar constituting an effective pivot point for rotation of the bar into reset position.

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