Jan. 16, 1940. J. G. JACKSON ET AL 2,187,606

CIRCUIT BREAKER

Original Filed Oct. 31, 1935 3 Sheets-Sheet 1

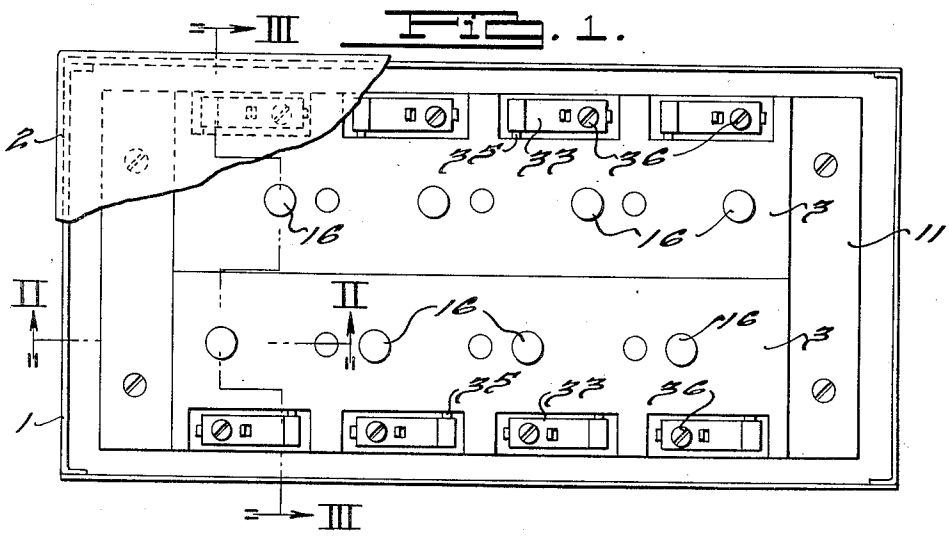

FIG. 1.

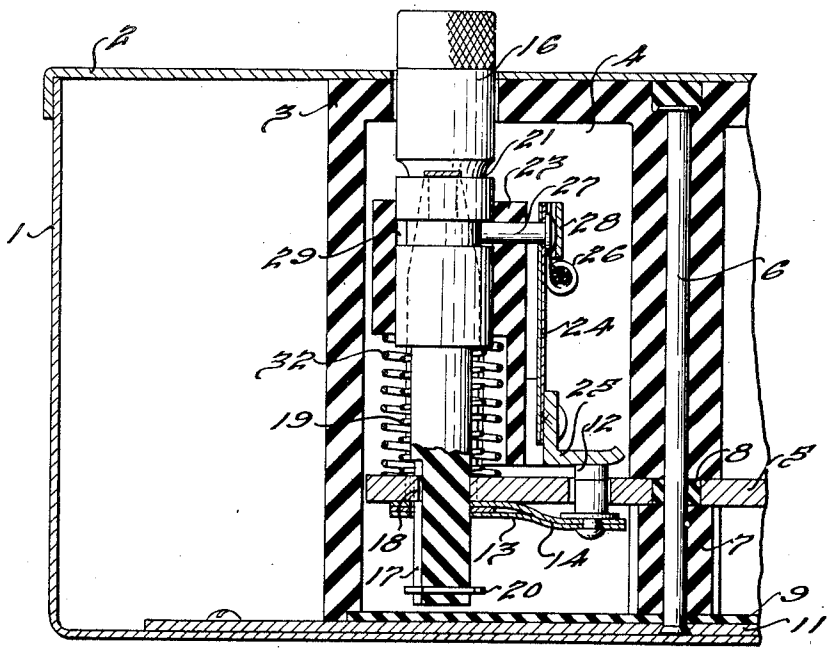

FIG. 2.

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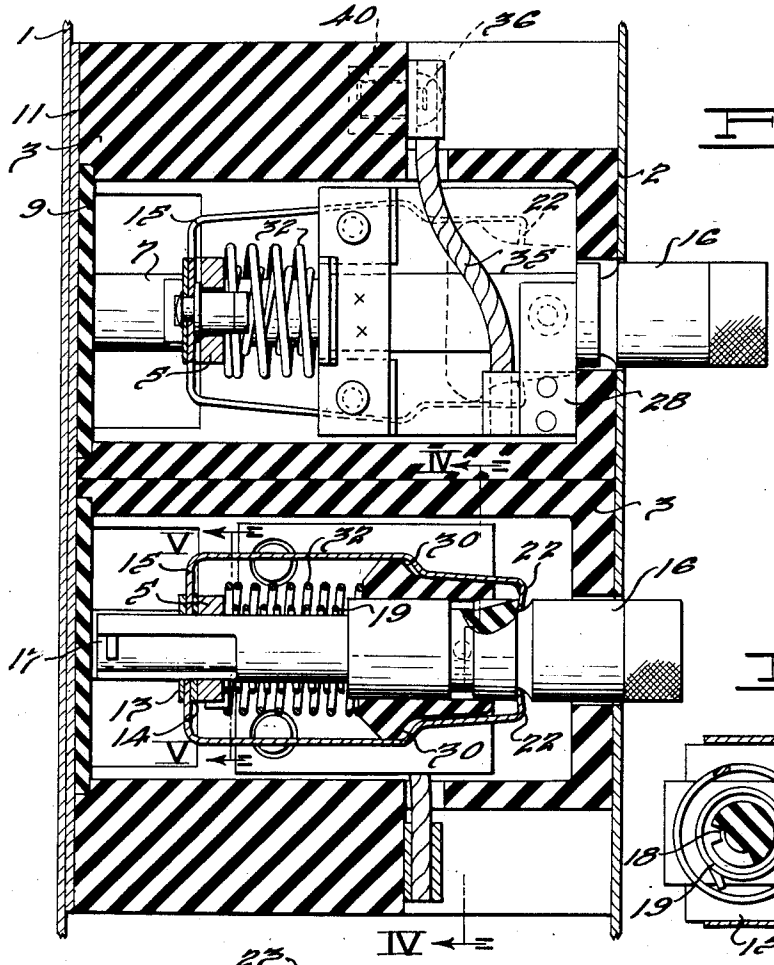

Fig. 3.

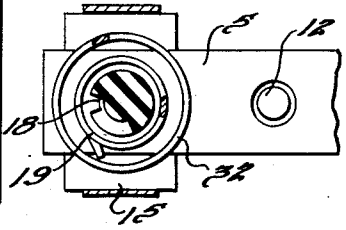

Fig. 5.

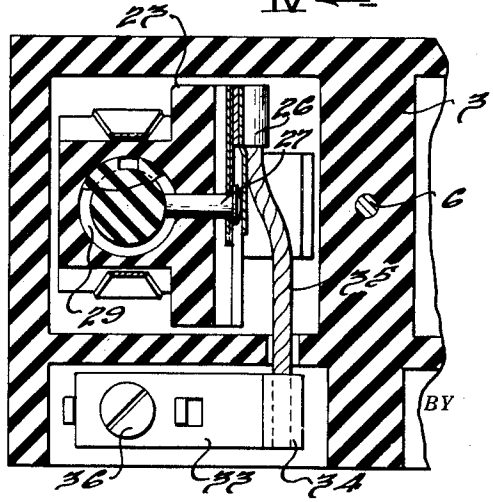

Fig. 4.

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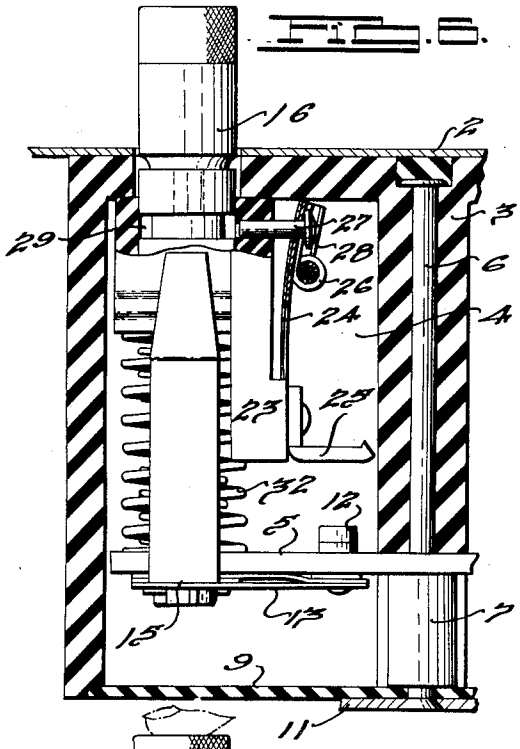
CIRCUIT BREAKER

Original Filed Oct. 31, 1935 3 Sheets-Sheet 3

FIG. 6.



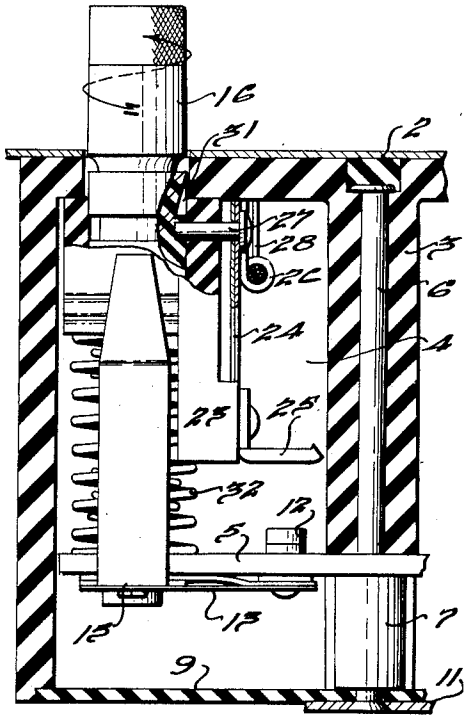


FIG. 7.

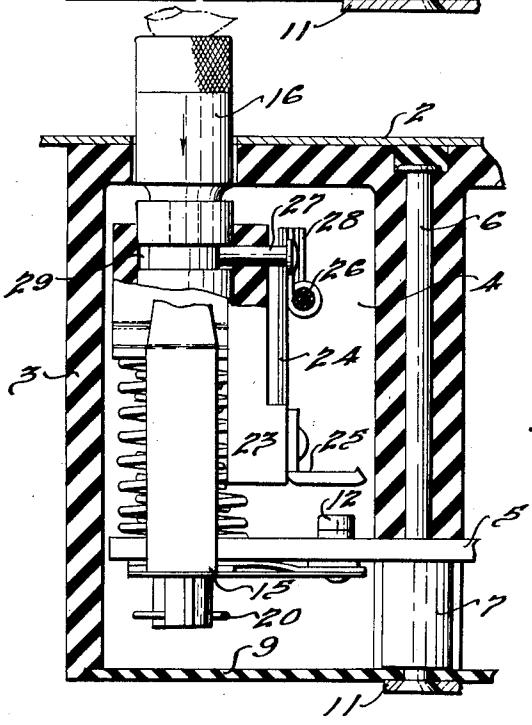


FIG. 8.

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Patented Jan. 16, 1940 2,187,606

UNITED STATES PATENT OFFICE

2,187,606

CIRCUIT BREAKER

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Original application October 31, 1935, Serial No. 47,524, now Patent No. 2,156,760, dated April 5, 1939. Divided and this application November 23, 1938, Serial No. 241,938

15 Claims. (Cl. 200—116)

This invention relates to automatic electric circuit breakers and has for its object the provision of an improved simple, economical and reliable automatic electric circuit breaker mechanism. This application is a division of application, Serial Number 47,524, filed October 31, 1935, for Circuit breakers, now Patent Number 2,156,760, dated April 5, 1939.

Another object of this invention is to provide an improved form of automatically and manually trippable circuit breaker mechanism.

Another object of the invention is to provide an automatic electric circuit breaker having a current responsive element and movable contact supported for rectilinear movement upon an insulating member with the movable contact maintained in its engaged position through the manual operator in cooperation with the current responsive member.

Another object of the invention is to provide automatic electric circuit breakers as described in the preceding object in which release of the reciprocable insulating element by the current responsive means will also effect movement of the operating member into reset position.

Another object of the invention is to provide a circuit breaker with either or both of the preceding objects in which the maintaining of the movable contact in engaged position is positive and in which the stationary contact is resiliently mounted to maintain adequate contact pressure.

Another object of the invention is to provide an electric circuit breaker with any or all of the preceding objects in which a current traversed bimetallic element and movable contact are rigidly connected together for common movement bodily to effect the switching operation and in which a flexible lead interconnects the free end of the bimetal and an exterior terminal of the circuit breaker.

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

Figure 1 is a top plan view of a combined circuit breaker apparatus using a plurality of individual breaker mechanisms according to the present invention.

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

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

Figure 4 is a sectional view taken on the line IV—IV of Figure 3.

Figure 5 is a detail sectional view taken on the line V—V of Figure 3.

Figure 6 is a view similar to Figure 2 showing the parts in automatic trip position.

Figure 7 is a view similar to Figure 2 showing the parts in manual trip position.

Figure 8 is a view similar to Figure 2 showing the parts in resetting position.

The circuit breaker apparatus as illustrated and which embodies a circuit breaker according to the present invention comprises an outer sheet metal enclosing box 1 having an openable cover 2 hingedly or otherwise mounted thereon. Within this outer box is mounted one or more sealable circuit breaker units. In the specific embodiment illustrated there are shown two circuit breaker units sealably and supportedly mounted upon a single plate which mounts them within the enclosing box. It is readily understood that any number of these units may be mounted upon a single sealing and supporting plate or that each unit may have an individual sealing and supporting plate permitting separate manipulation of each separate unit. The outer box may be equipped with the usual knockouts, cover latch and similar features as is conventional in the art.

Each circuit breaker embodies a base 3 having a plurality of individual compartments 4. In each of these compartments is disposed an individual circuit breaker mechanism. Extending across the base in common with the individual compartments and mechanisms is a bus 5 secured to the base by means of the sealing rivet 6.

The dividing walls between the compartments are cut away to receive the bus 5 and a spacer 7 serves to rigidly mount the bus against the wall. The bus is provided with an enlarged opening receiving an insulating spacer 8 serving to insulate the rivet 6. At the back of the base is disposed an insulating fibre plate 9 which is in turn backed up by the supporting and mounting plate 11. The rivet 6 extends through to the back of the plate 11 and hence mounts the parts together in sealable relationship.

The opening in the dividing walls between the compartments is preferably enlarged to permit the gases generated by the rupture of an arc between any pair of contacts to be discharged within the entire circuit breaker interior and thus render less necessary any vent to the outer air. These walls dividing the interiors into compartments are not at all essential and may be entirely omitted if desired.

The stationary contact 12 of each mechanism

is conductingly and resiliently supported upon the bus 5 by means of a resilient arm 13. A woven conducting strip 14 may be used to interconnect the contact and bus to lower the resistance. Also supported on the bus is the base of a U-shaped latch 15. The ends of the strips 13 and 14 and the base 15 of the latch may be welded, riveted, or otherwise rigidly secured to the bus 5.

These elements at their points of connection are provided with an opening receiving the interior ends of a push button 16 in slidable and rotatable relation. The portion of the push button within this opening is provided with a peripheral groove 17 cooperating with a tongue 18 on the bus to limit the rotary movement of the push button. A compression spring 19 disposed intermediate the bus 5 and the push button 16 is stressed to bias the push button outwardly and to rotate it in a counterclockwise direction to engage the tongue 18 with one side of the peripheral groove 17. A pin 20 is provided at the lower end of the push button to limit its outward movement.

The push button is provided with a latching groove 21 adapted to be engaged by the ends 22 of the latch 15 to hold the push button inwardly against the bias of spring 19. Slidably mounted upon push button 16 is an insulating member 23 having a bimetallic strip 24 and movable contact 25 rigidly mounted thereon. The free end of the bimetal carries a conductor lug 26 and a latch pin 27. The latch pin 27 is loosely maintained in position at the end of the bimetal by holding strip 28 rigidly mounted thereon. The latch pin 27 extends through an opening in the member 23 and is received in a peripheral groove 29 in the push button 16. The pin 27 thus serves to latch the member 23 to the push button and provide for a common movement thereof as a unit.

An inclined notch 31 leads to the groove 29 at one point on the periphery of the push button and enables pin 27 to slide therein to release the latching engagement. A compression spring 32 biases member 23 away from the bus 5. The member 23 is provided with surfaces 30 adapted to engage and separate the latch arms 22 when the member 23 moves upwardly under the bias of the spring 32.

A conducting strip 33 is disposed on a shelf on the outside of each chamber and has a conductor lug 34 on one end thereof. A flexible lead 35 interconnects the conductor lugs 26 and 34. The conductor 33 is rigidly mounted on the base by riveting connection with a metallic insert 40 mounted in the base. This insert is interiorly threaded to receive the terminal stud 36.

The operation of an individual circuit breaker mechanism according to the present invention will now be described. The parts as shown in Figure 2 and at the bottom in Figure 3 are in their normal "on" position. Upon the occurrence of an overload the bimetallic strip 24 will warp clockwise pulling the pin 27 out of the groove 29 and permitting the member 23 to move upwardly under the bias of the compression spring 32, thus carrying the movable contact 25 away from the stationary contact 12 in its upward movement. The surfaces 30 on the member 23 engage the arms of the U-shaped latch 15, moving them apart, thus unlatching the push button 16 and permitting it to move upwardly under the bias of its spring 19. The upward movement of the push button is limited by the pin 20 of the lower end thereof.

With the member 23 and the push button 16 both in their upward positions, the latch pin 27 will be again received within the groove 29 as soon as the bimetallic strip 24 is cool. The positions of the parts in the automatic trip position is shown in Figure 6 and at the top in Figure 3. To reset the circuit breaker, the push button is pressed inwardly as shown in Figure 8 until the latch arms 22 engage the latching groove 21 on the push button, whereupon the contacts will be held in their engaged position. The resilient mounting of the contact 12 by means of strip 13 is to insure adequate pressure between the cooperating contacts.

To manually trip the breaker, the push button 16 is rotated clockwise until the inclined notch 31 is brought over the pin 27, whereupon the member 23 is again free to move upwardly, separating, as it moves, the latch arms 22. The spring 19 then moves the push button outwardly and rotates it back to its original position whereupon the pin 27 and the groove 29 are again in latching engagement. The limits of rotation of the push button are determined by the engagement of the tongue 18 with the groove 17.

With the breaker as herein illustrated, it is seen that the stationary contacts are electrically connected together by means of the bus 5. In feeding through this breaker, one of the mechanisms will constitute a main circuit breaker through which the current will be led in to the bus 5. The remaining circuit breaker mechanisms will constitute branch circuit breakers leading to separate circuits. This places a main and load breaker in series with any short circuit which may occur. In some instances it may be desirable to extend the bus 5 to the exterior of the breaker for connection to the main. The various features of this group of individual circuit breaker apparatus is claimed in the aforesaid parent application and forms no part of the invention of this divisional application.

While the latch 15, the operating springs and the push button have all been shown as mounted upon and cooperating with the bus 5, it is obvious that these parts may be carried by any supporting surface and that they have been here shown as cooperating with the bus for the purposes of simplicity, particularly in the embodiment illustrated.

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. An electric circuit breaker comprising a stationary contact, an operating push button, a member carried by said push button and movable relative thereto, a movable contact carried by said member and cooperating with said stationary contact, a current responsive latch normally latching said member to said push button, a mechanical latch for holding said push button in its contact engaged position, and separate biasing means for said push button and member providing for individual movement thereof when released by said current responsive latch.

2. An electric circuit breaker comprising a stationary contract, an operating push button, a member carried by said push button and movable

relative thereto, a movable contact carried by said member and cooperating with said stationary contact, a current responsive latch normally latching said member to said push button, a mechanical latch for holding said push button in its contact engaged position, and separate biasing means for said push button and member providing for individual movement thereof when released by said current responsive latch, movement of said member when released by said current responsive latch releasing said mechanical latch whereby said push button is moved by its biasing means into relatching relation with said member.

3. An electric circuit breaker comprising a stationary contact, an operating push button, a member carried by said push button and movable relative thereto, a movable contact carried by said member, a current responsive latch normally latching said member to said push button, a mechanical latch for holding said push button in its contact engaged position, a stop providing for limited rotary movement of said push button, means biasing said member outwardly from said stationary contact, means biasing said push button outwardly and against said stop, rotary movement of said push button releasing said first mentioned latch whereupon said first biasing means moves said member to separate said contacts.

4. An electric circuit breaker comprising a stationary contact, an operating push button, a member carried by said push button and movable relative thereto, a movable contact carried by said member, a current responsive latch normally latching said member to said push button, a mechanical latch for holding said push button in its contact engaged position, a stop providing for limited rotary movement of said push button, means biasing said member outwardly from said stationary contact, means biasing said push button outwardly and against said stop, rotary movement of said push button releasing said first mentioned latch whereupon said first biasing means moves said member to separate said contacts, movement of said member releasing said mechanical latch whereby said second biasing means moves said push button outwardly and rotates it into relatching relation with said member.

5. An electric circuit breaker comprising a conductor, a stationary contact mounted on said conductor, a reciprocable member, a movable contact carried by said member, at least one of said contacts having a resilient mounting, an operating push button, means latching said member to said push button for common movement therewith, means for releasing said latched engagement upon manual rotation of said push button, current responsive means for releasing said latched engagement in response to overload, separate biasing means for said push button and member, and means for latching said push button in its interior position, whereby when said latched engagement is released said member is independently movable to separate said contacts.

6. An electric circuit breaker comprising a conductor, a stationary contact mounted on said conductor, a reciprocable member, a movable contact carried by said member, at least one of said contacts having a resilient mounting, an operating push button, means latching said member to said push button for common movement therewith, means for releasing said latched engagement upon manual rotation of said push button, current responsive means for releasing said latched engagement in response to overload, separate biasing means for said push button and member, and means for latching said push button in its interior position, whereby when said latched engagement is released said member is independently movable to separate said contacts, said member engaging and releasing said last mentioned latching means whereby said push button is moved into relatching relation with said member under the action of its biasing means.

7. An electric circuit breaker comprising a resiliently mounted stationary contact, an insulating support, a movable contact upon said insulating support, said support being mounted for straight line reciprocatory movement to effect engagement and disengagement of the movable contact with the stationary contact, said movable contact in its extreme "on" position effecting movement of the stationary contact against its resilient bias to produce an adequate contact pressure, a manual operator, a current traversed bimetallic element mounted on said insulating support and bodily movable therewith, spring means biasing said insulating support to contacts disengaged position, and means under the control of said bimetallic element for effecting movement of said insulating support through said manual operator, said operator having a stable on position wherein it holds the insulating support in contacts-engaged position through said last mentioned means, flexing of said bimetallic element upon current overload effecting movement of the movable contact to separated position and movement of the operator to its normal off or reset position, whereupon a single movement only of the operator is required to again effect engagement of the contact.

8. An electric circuit breaker comprising a resiliently mounted stationary contact, an insulating support, a movable contact upon said insulating support, said support being mounted for straight line reciprocatory movement to effect engagement and disengagement of the movable contact with the stationary contact, said movable contact in its extreme "on" position effecting movement of the stationary contact against its resilient bias to produce an adequate contact pressure, a manual operator, a current traversed bimetallic element mounted on said insulating support and bodily movable therewith, spring means biasing said insulating support to contacts disengaged position, means under the control of said bimetallic element for effecting movement of said insulating support through said manual operator, said operator having a stable "on" position wherein it holds the insulating support in contacts-engaged position through said last mentioned means, said last mentioned means being ineffective to control the position of the insulating support through the manual operator when the bimetallic element is sufficiently deflected by an excess current through the circuit breaker, flexing of said bimetallic element upon current overload effecting movement of the movable contact to separated position and movement of the operator to its normal off or reset position, whereupon a single movement only of the operator is required to again effect engagement of the contact.

9. An electric circuit breaker comprising a resiliently mounted stationary contact, an insulating support, a movable contact upon said insulating support, said support being mounted for straight line reciprocatory movement to effect

engagement and disengagement of the movable contact with the stationary contact, said movable contact in its extreme "on" position effecting movement of the stationary contact against its resilient bias to produce an adequate contact pressure, a manual operator, a current traversed bimetallic element mounted on said insulating support and bodily movable therewith, spring means biasing said insulating support to contacts-disengaged position, means under the control of said bimetallic element for effecting movement of said insulating support through said manual operator, said operator having a stable "on" position wherein it holds the insulating support in contacts-engaged position through said last mentioned means, said last mentioned means being ineffective to control the position of the insulating support through the manual operator when the bimetallic element is sufficiently deflected by the excess current through the circuit breaker, release of said insulating support by the deflection of said bimetal effecting movement of the support to contacts separated position under its biasing means, an independent spring bias for said manual operator, release of said insulating support also effecting release of the manual operator and its movement to reset or normal "off" position under its own spring bias.

10. An automatic electric circuit breaker comprising a relatively stationary contact having a support including a leaf spring against the bias of which the stationary contact is adapted to have limited movement, an insulating support mounted for straight line reciprocatory movement toward and away from said stationary contact, a movable contact mounted on said insulating support and adapted to be moved into butt engagement with said stationary contact in one extreme position of movement of the insulating support, a bimetallic element mounted on said insulating support and rigidly connected to said movable contact, a manual operator, means controlled by said bimetallic element for effecting rectilinear movement of said insulating support in response to movement of said manual operator, said operator having a stable on position for holding said contacts engaged, and means biasing said insulating support to contacts separated position, deflection of said bimetallic member upon the passage of a current overload effecting movement of said insulating support to contacts-separated position under the action of the spring bias independent of a maintained position of the manual operator, said manual operator automatically moving to its normal off or reset position when not manually maintained upon the occurrence of a current overload separation of the contacts.

11. An automatic electric circuit breaker comprising a relatively stationary contact having a support including a leaf spring against the bias of which the stationary contact is adapted to have limited movement, an insulating support mounted for straight line reciprocatory movement toward and away from said stationary contact, a movable contact mounted on said insulating support and adapted to be moved into butt engagement with said stationary contact in one extreme position of movement of the insulating support, a bimetallic element bodily movable with said insulating support and rigidly connected to said movable contact, a manual operator, means controlled by said bimetallic element for effecting rectilinear movement of said insulating support in response to movement of the manual operator, said operator having a stable "on" position for holding said contacts engaged, means biasing said insulating support to contacts-separated position, and independent biasing means for said manual operator for returning it to its reset position, deflection of said bimetallic member under the action of excess current resulting in movement of said insulating support to contacts-separated position under the action of its biasing means and concurrent movement of the manual operator into its "off" or reset position where it will again be operative to effect movement of the insulating support to contacts-engaged position when the bimetallic element has cooled sufficiently to make the connection between the manual operator and the insulating support effective.

12. An electric circuit breaker comprising an enclosure formed of insulating parts sealably joined together to prevent access to the interior thereof, stationary and movable contacts within said enclosure, said stationary contact having a resilient mounting against the bias of which it is adapted to have limited movement, a movable support having at least its main body portion formed of insulating material, a bimetallic element, said movable contact and bimetallic element being rigidly connected together and mounted on said support, means guiding the support for straight line reciprocatory movement of the movable contact into and out of engagement with the stationary contact, the movable contact in its extreme "on" position effecting movement of the stationary contact against its bias whereby an adequate contact pressure is maintained, a manual operator having portions at the interior and exterior of the enclosure and projecting through an opening in the top wall of the enclosure, and means whereby movement of said operator effects movement of said insulating support to engage the movable contact with the stationary contact, said last mentioned means including an element under the control of the bimetallic member whereby said contacts cannot remain engaged by manipulation of the manual operator upon occurrence of a current overload through the contacts and the bimetallic element.

13. An electric circuit breaker comprising an enclosure formed of insulating parts sealably joined together to prevent access to the interior thereof, a stationary contact within said enclosure, a movable support within said enclosure having at least its main body portion formed of insulating material and being guided for straight line reciprocatory movement, a movable contact mounted on said support for movement into and out of engagement with the stationary contact, a bimetallic element rigidly mounted on said insulating support in series circuit with said movable contact, a manual operator having portions at the exterior and interior of the enclosure and projecting through the opening in the top wall of the enclosure, the area of said opening being small compared to the area of said top wall, means under the control of said bimetallic element for effecting rectilinear movement of the support in response to movement of the manual operator, and a circuit terminal having at least a portion thereof disposed upon a forward facing surface of a ledge on an exterior wall of the enclosure, the said circuit terminal including means for securing a circuit wire thereto, and a continuous flexible lead interconnecting the free end of said bimetallic element and said circuit terminal.

14. An electric circuit breaker comprising an

enclosure formed of insulating parts sealably joined together to prevent access to the interior thereof, a stationary contact within said enclosure, a movable support within said enclosure having at least its main body portion formed of insulating material and being guided for straight line reciprocatory movement, a movable contact, a bimetallic strip, said movable contact and bimetallic strip being rigidly welded together adjacent to one end of said strip and being mounted on said support to move bodily therewith, a manual operator having portions at the exterior and interior of the enclosure and projecting through the opening in the top wall of the enclosure, means under the control of said bimetallic strip for effecting rectilinear movement of the support in response to movement of the manual operator, a circuit terminal having at least a portion thereof disposed upon a forward facing surface of a ledge on an exterior wall of the enclosure, the said circuit terminal including means for securing a circuit wire thereto, and a continuous flexible lead interconnecting the free end of the said bimetallic strip and said circuit terminal.

15. An electric circuit breaker comprising an enclosure formed of insulating parts sealably joined together to prevent access to the interior thereof, stationary and movable contacts within said enclosure, said stationary contact having a resilient mounting against the bias of which it is adapted to have limited movement, a movable support having at least its main body portion formed of insulating material, a bimetallic element, said movable contact and bimetallic element being rigidly connected together and mounted on said support, means guiding the support for straight line reciprocatory movement of the movable contact into and out of engagement with the stationary contact, the movable contact in its extreme "on" position effecting movement of the stationary contact against its bias whereby an adequate contact pressure is maintained, a manual operator having portions at the interior and exterior of the enclosure and projecting through an opening in the top wall of the enclosure, and means whereby movement of said operator effects movement of said insulating support to engage the movable contact with the stationary contact, said last mentioned means including an element under the control of the bimetallic member whereby said contacts cannot remain engaged by manipulation of the manual operator upon occurrence of a current overload through the contacts in the bimetallic element, said operator having a stable position for holding the movable contact in its engaged position, means biasing said insulating support to contacts separated position, a circuit terminal mounted upon a forward facing surface of a ledge on an exterior wall of the enclosure and there having means for the attachment of a circuit wire, and a continuous flexible lead interconnecting the free end of the bimetallic element and the circuit terminal element.

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