Nov. 17, 1942. J. G. JACKSON 2,302,551

CIRCUIT BREAKER

Filed Aug. 16, 1939 3 Sheets-Sheet 1

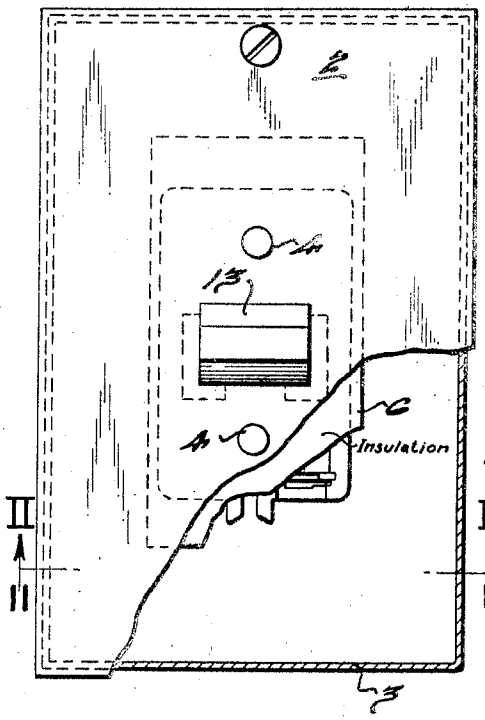


FIG. 1.

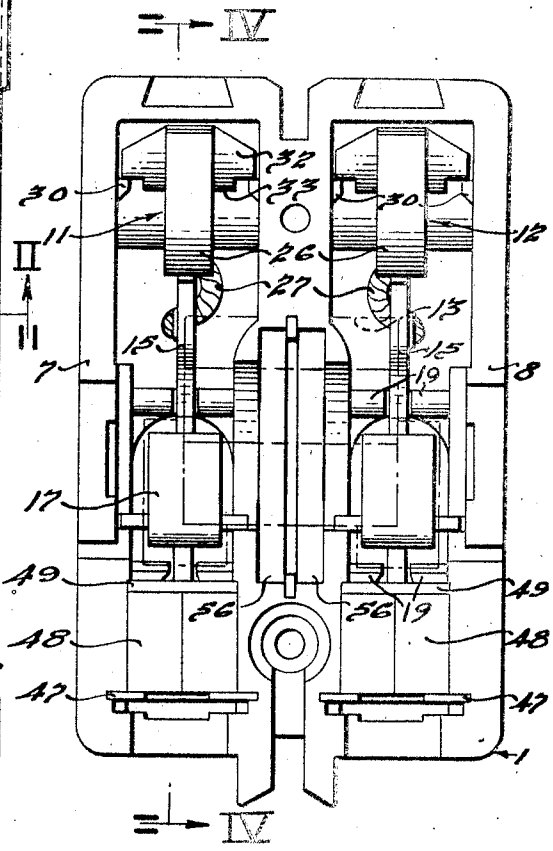


FIG. 3.

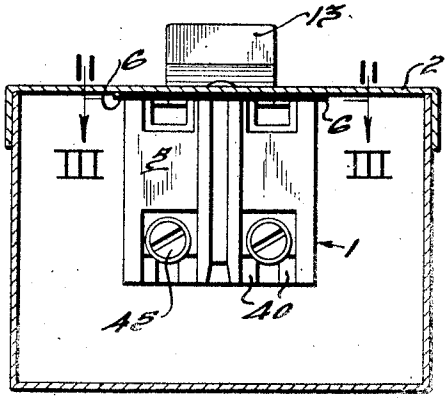


FIG. 2.

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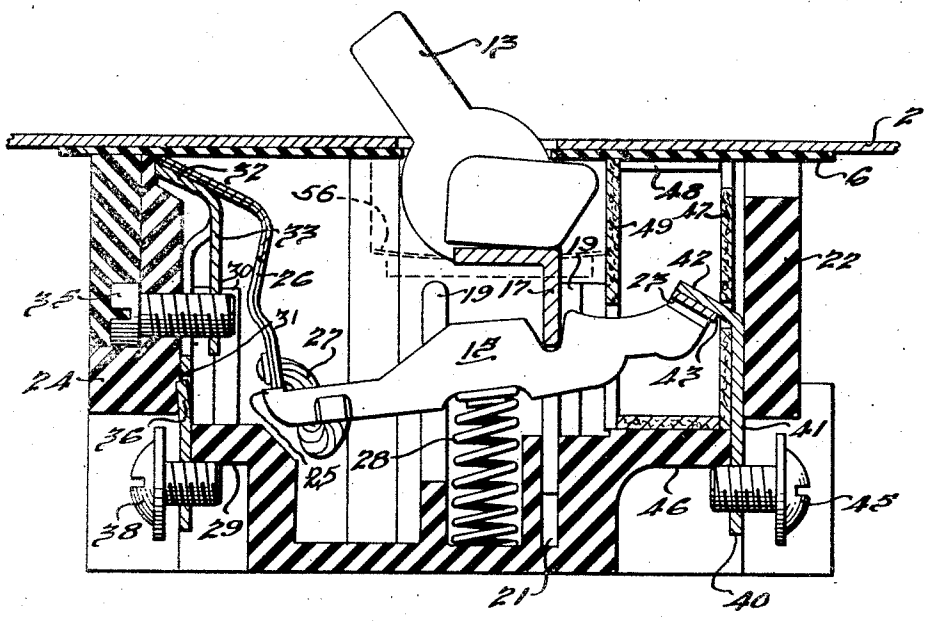


Fig. 4.

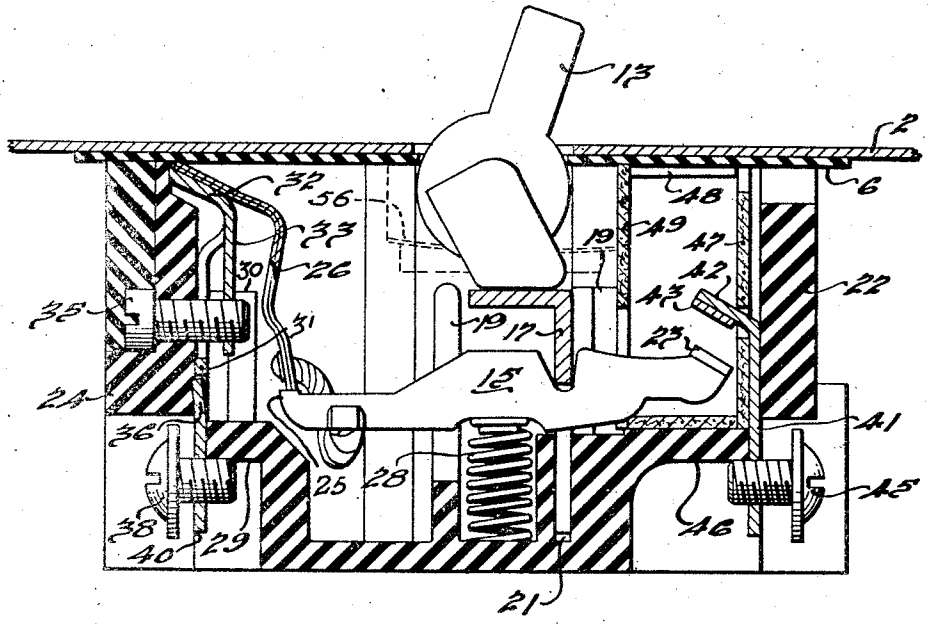


Fig. 5.

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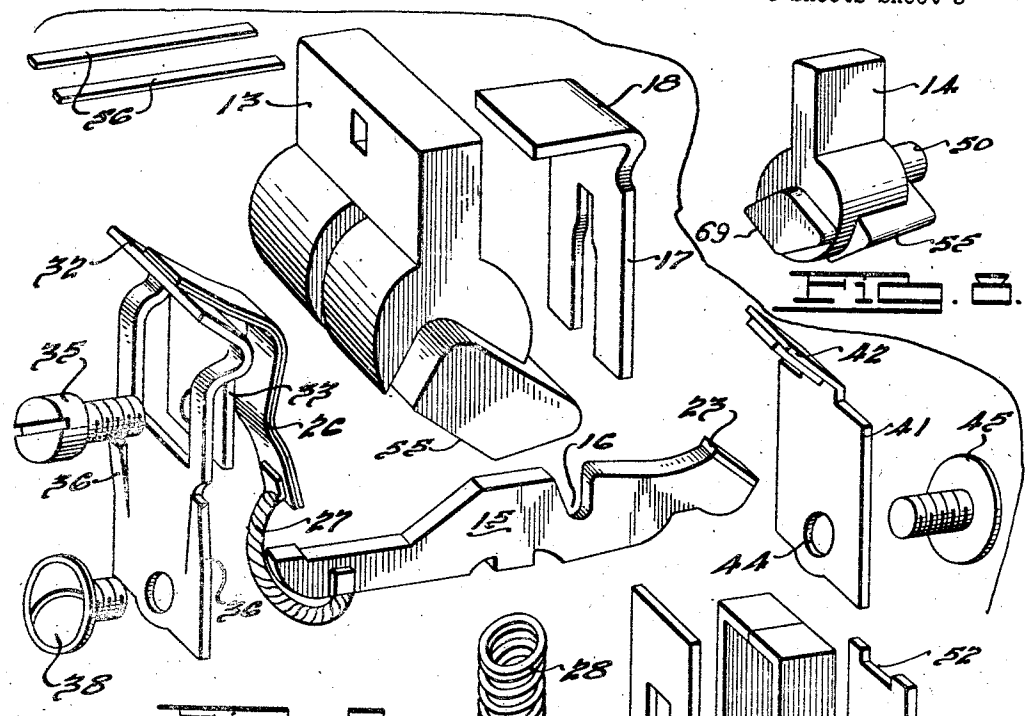


FIG. 8.

FIG. 7.

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UNITED STATES PATENT OFFICE

2,302,551

CIRCUIT BREAKER

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Application August 16, 1939, Serial No. 290,409

16 Claims. (Cl. 200—116)

This invention relates to apparatus for making and breaking electric circuits and more particularly to electric circuit breakers automatically operable to break the circuit in response to a current overload.

An object of the present invention is to provide an improved automatic circuit breaker having a novel manner of retaining the circuit breaker mechanism within its enclosure.

Another object of the present invention is to provide an automatic electric circuit breaker of extreme simplicity of construction and assembly, having a minimum of parts and great economies of manufacture.

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 with the cover parts broken away.

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

Figure 3 is a front elevational sectional view taken on the line III—III of Figure 2 showing the circuit breaker mechanisms with the handle removed.

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

Figure 5 is a view similar to Figure 4 showing the parts in manual "off" position.

Figure 6 is an exploded view in perspective of the internal parts of the circuit breaker.

Figure 7 is a perspective view of the circuit breaker enclosure.

Figure 8 is a perspective view of an operating handle for a single circuit breaker mechanism.

In the assembly, illustrated in the drawings, there is shown a circuit breaker unit 1 secured to the cover 2 of a metallic enclosing box 3 as by sealing rivets 4. The mounting of the circuit breaker unit 1 upon the interior face of the cover 2 provides a means for effectively sealing the breaker unit and preventing any outside tampering therewith.

The circuit breaker unit 1 embodies a generally cup-shaped base 5 having an insulating cover 6 disposed between it and the cover 2 with said insulating cover 6 being secured to said base by the same rivets 4 which secure the unit to the cover.

Within the base 5 and disposed in separate compartments formed by side walls 7 and 8 and a central barrier wall 9 are the individual circuit breaker mechanisms 11 and 12. The barrier wall 9 is provided with openings therein for the passage therethrough of the rivets 4 which mount the unit on the cover 2. The individual circuit breaker mechanisms may be operated as a unit through a common operating handle 13 or they may be operated individually as by a pair of operating handles 14, one of which is shown in perspective in Figure 8.

The individual mechanisms 11 and 12 for the breaker are identical and a detailed description will be made of breaker 11. The individual mechanism 11 embodies a floating contact bar 15 having a notch 16 in its upper edge receiving the top edge of a cooperating slot in a leg 17 of a rectilinearly movable element 18, L-shaped in cross-section. The base 5 is provided with a plurality of upstanding walls 19 provided with slots therein receiving and guiding the floating bar 15. The element 18 is guided for rectilinear movement at right angles to the back of the base by means of slots 21 provided in the central wall 9, the side wall 7, and at the bottom of the base. The contact bar 15 is provided at its end adjacent end wall 22 of the base 5 with a contact surface 23 and at its opposite end adjacent end wall 24 with a latching surface 25 adapted to cooperate with a bimetallic element 26 having its free end connected to a midpoint on the bar by means of a flexible lead 27. A compression spring 28 is disposed between the bottom edge of the contact bar 15 and the back of the base 5 and acts to bias the bar to supply contact pressure and for rotation to automatic tripped position when released.

Disposed against end wall 24 and rectilinearly guided into place by ribs or projections 30 on side wall 7 and central wall 9 and by a portion 29 on the back wall of the base, is a conducting piece 31 having its upper extremity bent as at 32 to which is rigidly secured as by welding the bimetallic element 26. Directly beneath this point of attachment is the pressed out portion 33 having a threaded opening therein receiving an adjusting stud 35 passing through an opening in end wall 24. Rotation of the stud 35 to distort the conducting piece 31 and thereby move the bimetallic element 26 provides a means for adjusting the latching end of the bimetallic element. Pressed out portions 36 are disposed upon the lower half of the conducting piece 31 and through their resiliency serve to prevent transverse play or movement of the piece by exerting their bias against the back wall 24 and ribs 30 when the piece 31 is placed therebetween. The

lower end of the conducting piece 31 is also provided with a threaded opening therethrough to receive a terminal stud 38. The downward movement of the piece 31 is limited by the engagement of the lower extremity of said piece 31 with ledge portions 40 on said base. The adjusting stud 35 extending through the wall 24 and the terminal stud 38 cooperating with the under surface of the portion 29 serve to maintain the conducting piece 31 in its assembled position and to prevent the removal of the conducting piece 31 from the block.

In abutting relation with the end wall 22 and guided into place by slots 39 provided in barrier wall 9 and side wall 7 is a conducting piece 41. The upper end of said conducting piece 41 is bent as at 42 and carries a contact face 43 thereon. A threaded opening 44 is provided at the lower extremity of conducting piece 41 within which a terminal stud 45 is receivable. The downward movement of the piece 41 is limited through the engagement of the lower extremity of said piece with ledges 40 provided upon the base 5. The terminal stud 45 cooperates with a surface 46 provided by a notch in the back and end walls of the base to securely hold the conducting piece 41 in its interior assembled position. An arc chamber comprising fiber sheets 47, 48 and 49 is disposed about the contacts 23 and 43. Fiber sheet 47 is received within the same guide slots 39 as is conducting piece 41 and has an opening 51 provided generally centrally thereof through which the bent portion 42 carrying contact piece 43 extends. The upper extremity of the fiber sheet is cut away as at 52 to provide a means of escape for the arc gases formed within the arc chamber. End wall 22 is likewise cut away at a point opposite the cutaway portion 52 of the fiber sheet 47 thereby furnishing a vent to the exterior of the unit. Fiber sheet 48 is bent into a rectangular shape and is disposed about the contacts 23 and 43. The third sheet 49 lies between the edges of rectangular shaped sheet 48 and a pair of walls 19 and is provided with a slot 53 within which the contact bar 15 is movable. The upper edges of the side walls 7 and 8 are cut away as shown to provide vents 60 to carry off any arc gases escaping from the arc chamber into the interior of the cup shaped block 5.

It is evident from the above detailed description that a complete and simplified circuit breaker is provided having a minimum of parts and that a novel and unique method of securing a circuit breaker assembly within its enclosure has been disclosed. The entire assembly is securely held in position by the cooperation of terminal studs 38 and 45, carried by conducting pieces 31 and 41, with the abutment portions 29 and 46. The adjusting screw 35 is also adapted to maintain the conducting element 31 in place. By assigning this plurality of functions to these said parts, terminal studs 38 and 45 and adjusting screw 35 an economical but yet very efficient structure has been evolved.

The cup shaped base 5 is adapted to support either an operating handle 13 for actuation of the individual mechanism as a unit or individual operating handles 14 for actuation individually. When an operating handle of the type 13 is used, it is supported by and pivoted upon the barrier wall 9, said barrier wall being provided with a cutaway portion into which the body of the handle is placed. When an individual operating handle 14 is utilized, it is supported and pivoted upon barrier wall 9 and, through a trunnion 50, on ledge 54 provided upon the side walls. The interior portions of the handles are provided with cam surfaces 55 adapted to cooperate with the tops of members 17 to effect movement thereof to actuate the breaker mechanism. Relatively light flat leaf springs 56 are carried upon ledges 70 provided upon the barrier wall 9 and the operating handles are provided with flat surfaces disposed over and in contact with the leaf springs to provide a definite "on" position of the handles. This surface is shown at 69 in the single handle of Figure 8 and similar surfaces are disposed on the double handle shown in the other figures. The flat springs 56 cooperate with the surfaces as at 69 to maintain the handle against the members 17, and the members 17 within the slots in the bars 15. As will be explained hereinafter, upon the occurrence of an automatic opening of the breaker, the member 17 will be moved upwardly and will rotate the handle in a counterclockwise direction a short distance to give an indicating automatic trip position.

The circuit breaker mechanisms shown in Figure 4 is in the "on" position with the stationary and movable contacts engaged. To move the parts to the manual "off" position, the handle is rotated clockwise to the position shown in Figure 5 whereupon the parts will assume the positions shown in Figure 5. The cam surface 55 transforms the rotary movement of the handle into rectilinear movement of the element 17 whereupon the bar 15 is moved toward the back of the base, pivoting about the engagement of its latching surface with the bimetallic element 26. The position assumed upon the engagement of the camming surface 55 with the member 17 constitutes a stable one which the parts will maintain. When the parts are in the "on" position, if a current overload should occur, the corresponding bimetal will flex or bend due to the heat generated therein and the free end of the bimetal will move out of engagement with the latching end of the bar 15. This permits the bar to rotate under the action of its biasing spring 25 until limited by the engagement of the bottom of the contact end of the bar with the back of base 5. As the operating spring 28 is many times stronger than the handle biasing spring 56, release of the bar causes an upward movement of the member 17 which rotates the handles a small amount in a counter-clockwise direction to indicate the automatic trip.

To reset the breaker mechanism after an automatic operation, the handle is rotated in a clockwise direction beyond the "off" position of Figure 5. In this movement the cam surface 55 forces the member 17 downwardly carrying the contact bar 15, engaged by notch 16 of said member 17, in the same direction to bring the back of said bar into engagement with the back of base 5. The contact bar 15 thereupon rotates about its engagement with member 17 with the back of the contact bar sliding along the back of base 5 until the latching surface of the bar 15 is carried beyond and beneath the latching end of bimetallic element 26. To place the parts again in the "on" position, the handle is rotated in the opposite direction whereupon the latching end of the bar engages the bimetal if it has in the meantime cooled sufficiently to resume its normal position, and the movable contact surface on the bar will engage with the stationary contact surface on the conducting piece 41.

While certain preferred embodiments of the invention have been specifically disclosed, it is un-

derstood 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, an insulating base, a stationary contact, a conducting element mounting said stationary contact, a sliding connection between the base and said conducting element limiting relative movement between the base and element to a straight line rectilinear movement, a terminal stud threaded into said conducting element and cooperating with an abutment on the base to prevent said straight line rectilinear movement whereby the conducting element and the contact supported thereon are rigidly positioned on the base, a movable contact cooperating with said stationary contact, manual means for effecting movement of said movable contact, and current responsive means mounted on said base for effecting automatic movement of the movable contact to separated position upon the occurrence of current overload.

2. In an automatic electric circuit breaker, an insulating base, a stationary contact, a conducting element mounting said stationary contact, guide surfaces on said base for receiving said conducting element and guiding it for movement relative to the base in a path at substantially right angles to the back of the base, means limiting the interior position of said conducting element, said stationary contact being disposed in front of the back of the base when said conducting element is in its interior position, a terminal stud threaded into said conducting element and accessible for manipulation from the end of the base, the interior portion of said terminal stud engaging an abutment surface on the base for restraining said conducting element against sliding movement in an exterior direction whereby said stationary contact is rigidly mounted on the base, a movable contact cooperating with said stationary contact, manual means for effecting movement of said movable contact, and current responsive means mounted on said base for effecting automatic movement of the movable contact to separated position upon the occurrence of current overload.

3. In an automatic electric circuit breaker, a relatively cup-shaped base, guide surfaces in opposite side walls of said cup for the reception of a conducting connector, said guide surfaces and connector interlocking to limit movement between the connector and base to a straight line forward direction, means limiting the interior position of the connector, one end of said connector being disposed within the cup and the other end being disposed at the exterior thereof when said connector is in its interior position, a stationary contact mounted on the interior end of the connector, means maintaining said connector in its interior position with the exterior end of said connector serving as a terminal means for the reception of a circuit conductor, a movable contact within the cup, and current responsive means within the cup for effecting automatic movement of the movable contact to separated position upon the occurrence of a current overload through the circuit breaker.

4. In an automatic electric circuit breaker, a relatively cup-shaped base, guide surfaces in opposite side walls of said cup for the reception of a conducting connector, said guide surfaces and connector interlocking to limit movement between the connector and base to a straight line forward direction, means limiting the interior position of the connector, one end of said connector being disposed within the cup and the other end being disposed at the exterior thereof when said connector is in its interior position, a stationary contact mounted on the interior end of the connector, the exterior end of said connector having a terminal surface facing and accessible from an end of said base and receiving a terminal stud manipulable from the end of the base and having its interior end cooperable with an abutment surface on the base for maintaining the connector in its interior position, a movable contact within the cup, and current responsive means within the cup for effecting automatic movement of the movable contact to separated position upon the occurrence of a current overload through the circuit breaker.

5. In an automatic electric circuit breaker, an insulating base, a stationary contact, a conducting element mounting said stationary contact, a sliding connection between the base and said conducting element limiting relative movement between the base and element to a straight line rectilinear movement, a terminal stud threaded into said conducting element and cooperating with an abutment on the base to prevent said straight line rectilinear movement whereby the conducting element and the contact supported thereon are rigidly positioned on the base, a movable contact cooperating with said stationary contact, manual means for effecting movement of said movable contact, and current responsive means mounted on said base for effecting automatic movement of the movable contact to separated position upon the occurrence of current overload, a liner of arc resistant material providing an arc chamber for the cooperating contacts, said liner including a portion having an opening through which the contact carrying end of the conducting element extends, and cover means for said breaker cooperating with at least said portion of said liner to further prevent movement of the conducting element relative to the base.

6. In an automatic electric circuit breaker, a relatively cup-shaped base, guide surfaces in opposite side walls of said cup for the reception of a conducting connector, said guide surfaces and connector interlocking to limit movement between the connector and base to a straight line forward direction, means limiting the interior position of the connector, one end of said connector being disposed within the cup and the other end being disposed at the exterior thereof when said connector is in its interior position, a stationary contact mounted on the interior end of the connector, means maintaining said connector in its interior position with the exterior end of said connector serving as a terminal means for the reception of a circuit conductor, a movable contact within the cup, and current responsive means within the cup for effecting automatic movement of the movable contact to separated position upon the occurrence of a current overload through the circuit breaker, a liner of arc resistant material for the space adjacent the cooperating contacts, said liner including a portion having an opening through which the interior end of the connector extends, at least said portion extending to the top of the base and being engaged by the circuit breaker cover to further prevent forward movement of the connector.

7. In an automatic electric circuit breaker, an insulating base, cooperating contacts and means for effecting manual and automatic movement thereof, said means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of a current overload therethrough, said element being adjustably mounted upon a conducting connector, said connector having a sliding, interlocking engagement with the base limiting movement thereof relative to the base to a single direction for assembly therewith, and means engaging with said connector and the base for preventing said movement, whereby the bimetallic element will be rigidly mounted on the base.

8. In an automatic electric circuit breaker a cup-shaped insulating base, cooperating contacts and means for effecting manual and automatic movement thereof mounted within said base, said means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of the current overload pressure, a conducting connector upon which said bimetallic element is mounted, guide surfaces in opposite side walls of the cup receiving said connector and limiting movement thereof relative to the base to a straight line rectilinear movement, and means engaging with said connector and the base for preventing such movement whereby the bimetallic element will be readily mounted on the base.

9. In an automatic electric circuit breaker, an insulating base, cooperating contacts and means for effecting manual and automatic movement thereof, and means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of a current overload therethrough, said element being adjustably mounted upon a conducting connector, said connector having a sliding, interlocking engagement with the base limiting movement thereof relative to the base to a single direction for assembly therewith, a portion of said connector remote from said bimetallic element having a terminal stud threaded therein, said stud engaging with an abutment on the base to prevent such movement and to rigidly mount the connector and the element supported thereon on the base.

10. In an automatic electric circuit breaker, an insulating base, cooperating contacts and means for effecting manual and automatic movement thereof, said means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of a current overload therethrough, a conducting connector mounting said bimetallic element, interlocking surfaces on said conductor and base limiting relative movement therebetween to a straight line rectilinear movement, an adjusting screw for varying the current calibration of said bimetallic element, and means on said base interlocking with said adjusting screw to prevent relative movement between the connector and base whereby the bimetallic element will be rigidly mounted on the base.

11. In an automatic electric circuit breaker, an insulating base, cooperating contacts and means for effecting manual and automatic movement thereof, said means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of a current overload therethrough, a conducting connector upon which said bimetallic element is adjustably mounted, guide surfaces on said base interlocking with said connector to limit relative movement therebetween to a straight line rectilinear movement, portions on said connector extending beyond the normal plane thereof and resiliently engageable with said guide surfaces to insure against play between said connector and guide surfaces which might occur from manufacturing clearances, the resilient force of said portions being greater than the force being exerted on said connector by the bimetallic element, and means engaging with said connector and the base for preventing relative movement therebetween whereupon the bimetallic element will be rigidly mounted on the base.

12. In an automatic electric circuit breaker, an insulating base, cooperating contacts and means for effecting manual and automatic movement thereof, said means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of a current overload therethrough, a conducting connector adjustably mounting said bimetallic element, guide surfaces on said base interlocking with said connector and limiting relative movement between the connector and the base to a straight line rectilinear movement, said connector having pressed out portions thereof cooperating with said guide surfaces to resiliently take up any play which might exist between the parts due to manufacturing clearances, the resilient strength of said pressed out portions being greater than any force which may be exerted on the connector through the flex of the bimetallic element, and means engaging with the connector in the base to prevent movement therebetween whereby the bimetallic element will be rigidly mounted on the base.

13. In an automatic electric circuit breaker, an insulating base, cooperating contacts and means for effecting manual and automatic movement thereof, said means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of a current overload therethrough, a conducting connector having a cutout tab on the connecting end of which a bimetallic element is mounted, adjustment means for bending said tab relative to the main body of the connector to effect calibration of the bimetallic element, guide surfaces on said base interlocking with the connector to limit relative movement between the connector and the base to a straight line rectilinear movement, said adjustment means cooperating with a part on the base to prevent such movement whereby the bimetallic element will be rigidly and adjustably mounted on the base.

14. In an automatic electric circuit breaker, an insulating base, cooperating contacts and means for effecting manual and automatic movement thereof, said means including a current responsive bimetallic element connected in series circuit with the contacts and adapted to flex upon the occurrence of a current overload therethrough, a conducting connector having a cutout tab on the connecting end of which a bimetallic element is mounted, adjustment means for bending said tab relative to the main body of the connector to effect calibration of the bimetallic element, guide surfaces on said base interlocking with the connector to limit relative movement between the connector and the base to a straight

line rectilinear movement, said adjustment means cooperating with a part on the base to prevent such movement whereby the bimetallic element will be rigidly and adjustably mounted on the base, and additional resilient pressed out portions on said connector cooperating with the guide surfaces to absorb any play which might otherwise exist between the connector and the base due to manufacturing clearances.

15. In an automatic electric circuit breaker, an insulating base, a pair of conducting elements interlocked with surfaces on the base to limit relative movement between the conducting elements and the base to a straight line rectilinear movement, means engaging said elements and the base to prevent such movement whereby the conducting elements are rigidly mounted on the base, a stationary contact mounted on one of said conducting elements and a current traversed bimetallic element mounted on the other conducting element, a movable contact cooperating with said stationary contact and connected in series circuit with said bimetallic element, and means for effecting automatic movement of the movable contact to separated position upon the flexing of said bimetallic element upon the occurrence of current overload.

16. In an automatic electric circuit breaker, an insulating base, a pair of conducting connectors interlocked with guide surfaces on said base limiting movement between the connectors and the base to a straight line rectilinear movement, each of said connectors having an accessible terminal portion at one end thereof, the opposite ends of said connectors carrying respectively a stationary contact and a current responsive bimetallic element, a movable contact cooperating with said stationary contact, means on said base for effecting automatic movement of the movable contact to separated position upon the flexing of said bimetallic element, and means cooperating with said accessible terminal portions and with the base for preventing relative movement between connectors and the base whereby the connectors and the parts supported thereon are rigidly mounted upon the base.

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