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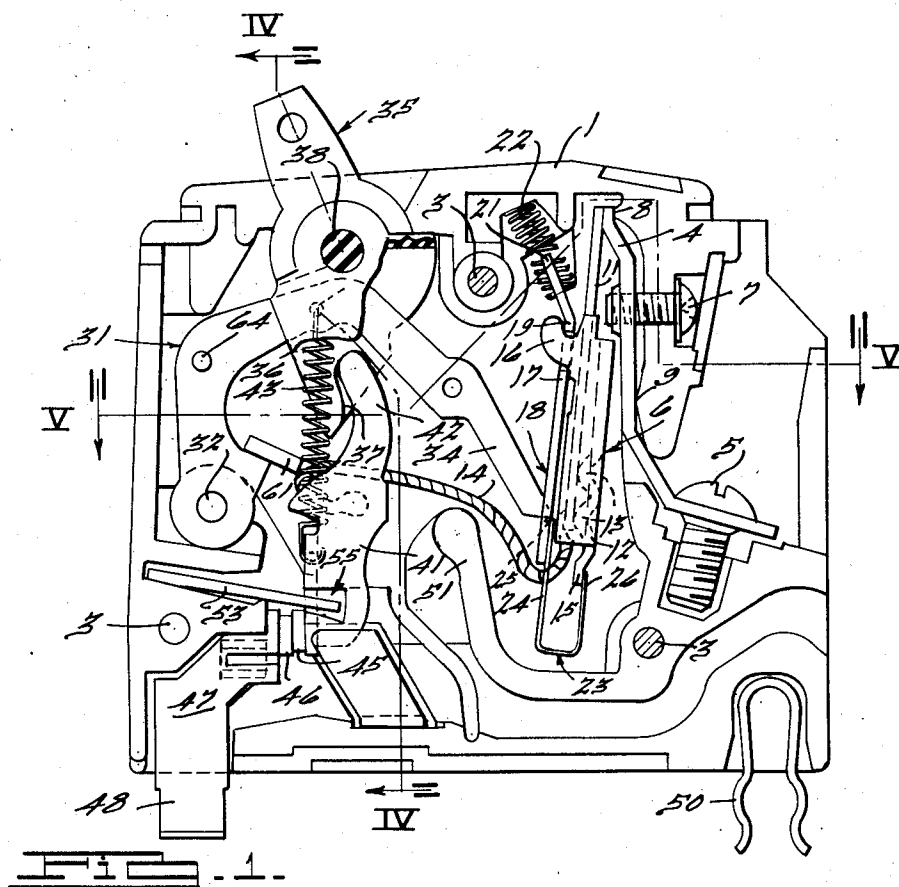
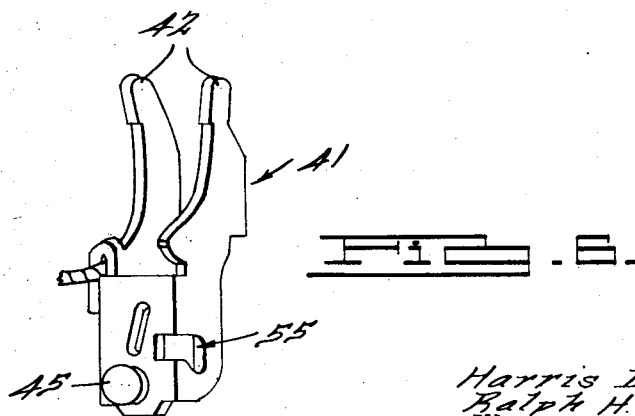
H. I. STANBACK ET AL

2,902,560

CIRCUIT BREAKER

Filed May 18, 1955

3 Sheets-Sheet 1



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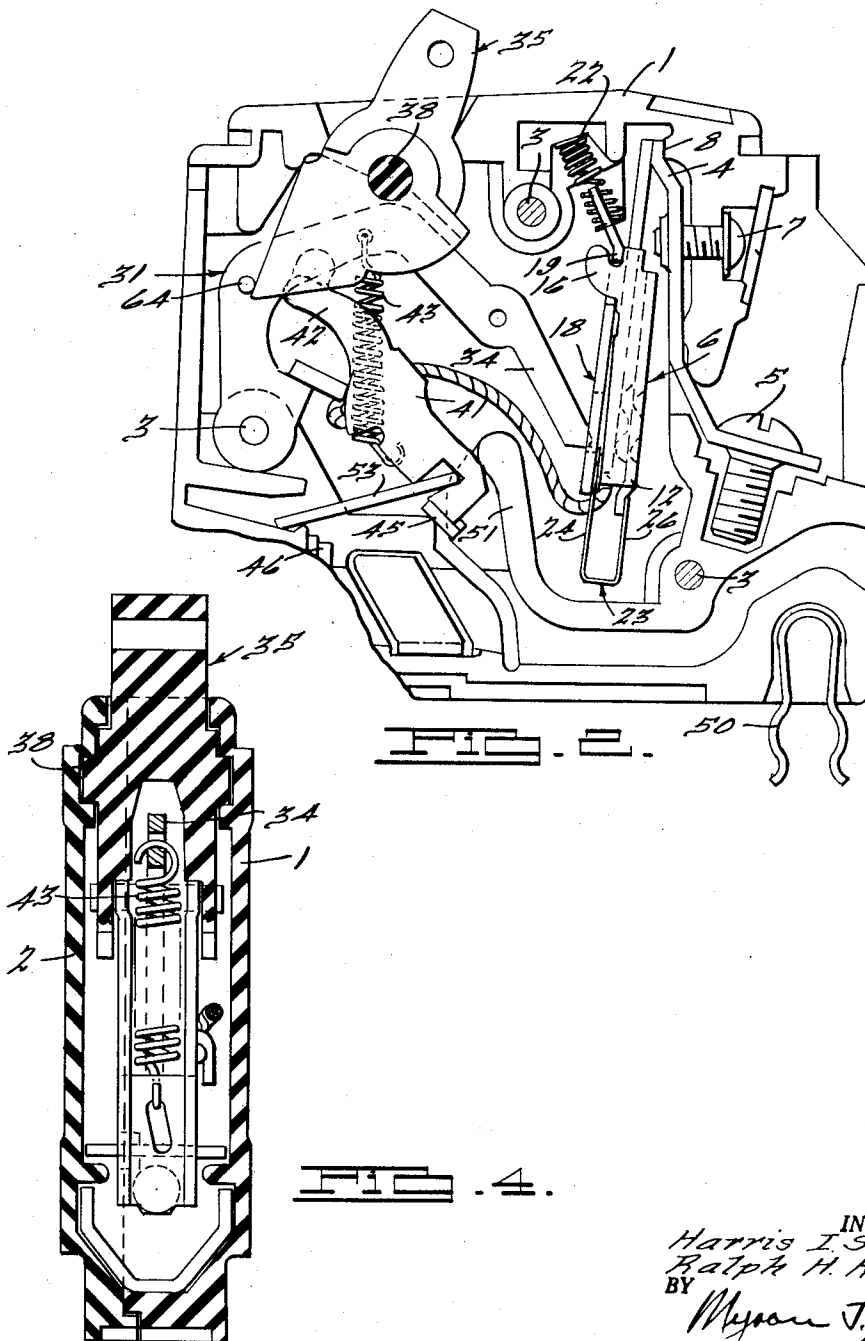
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CIRCUIT BREAKER

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3 Sheets-Sheet 2



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CIRCUIT BREAKER

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3 Sheets-Sheet 3

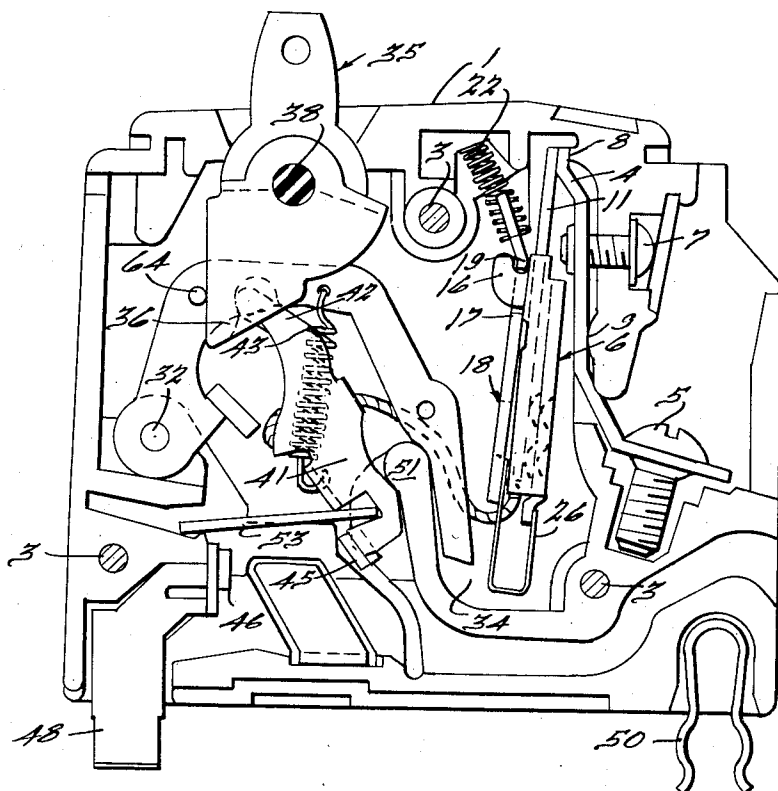


FIG. 3.

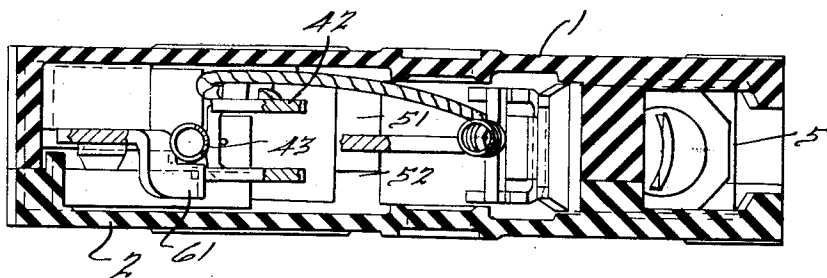


FIG. 5.

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2,902,560

CIRCUIT BREAKER

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Application May 18, 1955, Serial No. 509,135

11 Claims. (Cl. 200—88)

This invention relates to apparatus for making and breaking electrical circuits, and particularly to circuit breakers automatically operable in response to current overloads.

An object of the present invention is to provide an improved circuit breaker of the quick-make and quick-break type which is of simple and economical construction.

A further object of the present invention is to provide an improved circuit breaker having positive contact opening means to insure opening of the circuit through the circuit breaker in the event the contacts become partially welded during circuit overload.

A further object of the present invention is to provide a novel arc chamber within the circuit breaker.

A further object of the present invention is to provide a combination terminal contact jaw supporting the stationary contact within the circuit breaker.

A further object of the present invention is to provide a case and cover of insulating material providing for the support of spring clip jaw devices utilized in the support of the circuit breaker in a load center or panelboard device.

Further objects and features of the invention will be readily apparent to those skilled in the art from the following specifications and appended drawings illustrating a certain preferred embodiment of the invention in which:

Figure 1 is a side view of the circuit breaker with the side cover removed and showing the operating mechanism in the "on" position.

Figure 2 is a side view of the circuit breaker with the side cover removed and showing the operating mechanism of the circuit breaker in the "off" position.

Figure 3 is a side view of the circuit breaker with the side cover removed and showing the operating mechanism of the circuit breaker in the "tripped" position.

Figure 4 is a vertical sectional view of the circuit breaker taken along the lines IV—IV of Figure 1.

Figure 5 is a horizontal sectional view of the circuit breaker taken along the lines V—V of Figure 1.

Figure 6 is a perspective view of the movable contact carrier of the circuit breaker of the present invention.

The circuit breaker of the present invention comprises an open sided casing 1 of molded insulating material having molded recesses and barriers for the support of the circuit breaker mechanism and contacts therein. A cover 2 of molded insulating material providing complementary recesses and barriers closes the open side of the casing 1 and is mounted thereon by means of a plurality of rivets 3. Both the base and side cover are provided with top and bottom openings through which extend the operating and connecting members of the circuit breaker mechanism as will be described.

In one end of the insulating base 1 and supported by barriers established by portions of the base, is a conducting terminal strap 4 provided at its outside end with a terminal screw 5 and having secured thereto, at its inside end, the current responsive trip mechanism 6 of the circuit breaker. An adjustable screw 7 extends through

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a slot in the base 1 and threadedly engages the conducting strap 4 in the interior of the base 1 with the head thereof operating against the slotted portion of the base 1 to provide an adjustment for the calibration of the automatic circuit breaker.

The conducting strap 4 bears at one end against a nib 8 in the insulating base 1 and substantially at its mid point against a shoulder 9 on a portion of the insulating base so that rotation of the adjustment screw 7 operates to determine the angular position of the trip mechanism 6 within the interior of the base 1. The terminal end of the conducting strap 4 is suitably supported between support ribs molded in the base and cover as generally shown in Figure 1.

The current responsive trip mechanism 6 supported on the interior end of the conducting strap 4 constitutes a bimetallic member 11 attached by suitable means, such as welding, to the strap 4 at one end and having fixed thereto at its other end, by means such as welding, a magnetic yoke member 12 of generally U-shape construction. The magnetic yoke member is provided with a pair of vertically and laterally disposed nibs 13 at which the weld to the bimetal member is made and between which there is welded to the bimetal member 11 and yoke 12, at the same time, a braided conductor or pigtail 14. The magnetic yoke member is provided with an offset extension 15 centrally thereof and, at the uppermost ends thereof, the arms of the U-shape are formed into supporting pivot arms 16 disposed on the opposite side of the bimetal member 11 from that side on which the yoke member and bimetal are welded together.

A movable magnetic armature member 17 having a central cutout 18 is pivotally supported on the pivot arms 16 of the magnetic yoke 12 by outwardly extending shoulders 19 with the armature body formed so as to extend toward the bottom end of the circuit breaker substantially parallel to the magnetic yoke 12. The armature is also formed to provide an arm 21 extending beyond the bimetallic member 11 toward the upper end of the circuit breaker at an offset angle away from the bimetallic member 11.

A helical coil spring 22 engages the magnetic armature member 17 at the shoulders 19 and about the arm 21 at one end and, at its other end, operates against the insulating base member in a suitable recess provided therein. To the lower end of the armature member 17 there is secured a U-shaped ambient temperature responsive bimetal 23 having the upper portion of one end 24 thereof extending along the inner side of the magnetic armature member 17 and bent over at its extreme end at 25 to extend along the lower surface of the cutout 18 in the armature. The other leg 26 of the U-shaped bimetal 23 extends into cooperating relationship with the offset extension 15 at the lower end of the magnetic yoke member 12.

The operating mechanism of the circuit breaker constituting those parts which open and close the contacts of the circuit breaker to make and break the circuit through the device include a generally U-shaped cradle member 31 pivotally supported at one end on a hub 32, formed during the molding of the base 1, and cooperating at the extremity of the other leg 34 with the bent over portion 25 of the bimetal member 23 within the cutout 18 of the magnetic armature 17. A manual operator 35 having a handle portion at one end thereof extending outwardly of the circuit breaker insulating base 1 and a body portion extending inwardly into the central recess of the base 1 provides a pair of legs 36 surrounding the cradle member 31 substantially at the center thereof. Each of the legs 36 is provided with inward recesses 37 for support of a movable contact carrier as will be described. The manual operable handle 35 is provided with a central

trunnion 38 for cooperation with suitable bearing recesses in the base 1 and cover 2 for the pivotal support thereof.

Pivotal support to the manual operator 35 is a movable contact carrier 41 having a generally U-shaped cross section providing two upwardly extending legs 24 cooperating with the internal recesses 37 of the legs 36 of the operator. To the base of the U-shaped cross section of the movable contact member 41, a helical coil spring 43 is secured with the opposite end of the spring hooked to the cradle member 31 so that the tension of the spring maintains the legs 42 spring biased into engagement with the recess 37 in the manual operator 35. A contact 45 is secured at the lower most extremity of the movable contact member 41 and at the opposite end of the base of the U-shaped cross section thereof from the side defining the legs 42. Movable contact 45 cooperates with a stationary contact 46 secured to the base of a U-shaped spring jaw clip 47 having the lower end 48 thereof extending beyond the base of the circuit breaker. The flexible conductor or pigtail 14 secured at one end, as has been described, to the bimetallic member 11 is also secured, by means such as welding at its other end, to the movable contact member 41 so that when the movable contact 45 engages stationary contact 46 a circuit is complete from the spring jaw 48 through the circuit breaker current responsive overload mechanism to the terminal 5. The movable contact carrier 41 is provided with a flexible extending tab 49 integral therewith and adapted to be returned back on the body of the member and about the flexible conductor 14 so as to substantially completely eliminate movement of the conductor at the point of the weld. It should be noted that the conductor is looped to enter upon and engage the movable contact carrier from the far side thereof and is clamped in position by the bent over tab 49 so that substantially all of the flexing of the flexible conductor takes place at the free side of the tab at a point removed from the weld to the contact carrier.

An arcing chamber is established in the circuit breaker at the area therein where the movable contact and stationary contacts are separated. This arcing chamber is established by the bottom and sides of the base 1 and cover 2 adjacent to the contact area and barriers 51 in the base 1 and 52 in the cover 2 at one end and the stationary contact carrier 47 at the other end. The upper extremity of the chamber is established by a movable barrier 53 of insulating material having a hooklike extension 54 at the internal part thereof designed to engage the movable contact carrier 41 so as to move therewith. The movable contact carrier is provided with a cutout slot 55 at one side of the body portion thereof through which the hook 54 of the barrier extends to connect the barrier to the contact carrier. It can now be seen that the barrier 53 when moved with the contact carrier 41 in its travel to open circuit position substantially encloses the area wherein the contacts are separated so as to restrict any arc which may be generated with contact separation away from the operating components of the circuit breaker. Also disposed within the area defined as an arc chamber is a U-shaped arc suppressor 56 with the legs thereof generally embracing the direction of travel of the stationary contact in its movement toward open circuit position and operative to draw an arc into the bight of the suppressor. Arc gas escaped paths are provided below the internal portion of the stationary contact carrier 47 and along the base of the circuit breaker toward the end containing terminal 5 to allow generated arc gases to blow out of the arc chamber rather than into the areas of the circuit breaker containing the operating mechanism.

A positive opening means is provided for the circuit breaker to insure that the contacts will be opened when required even if the contacts are stuck by partial welding. To accomplish this purpose, a bent-over integral heel-like extension 61 is provided on the cradle member 31 and an integral shoulder 62 is provided centrally of the

body portion of the movable contact carrier 41. In manual circuit breaker opening and closing, as can be seen in the drawings and as will be explained hereinafter, these surfaces 61 and 62 do not engage each other, but on tripping movement of the cradle 31 as spring 43 is moved through its overcenter action, the heel 61 will engage shoulder 62 in a hammering fashion to drive the contacts 45 and 46 apart before spring 43 passes through overcenter to initiate opening of the breaker and continued opening movement of the contacts is effected by spring 43.

Resetting means are provided for the circuit breaker to return the mechanism to operating conditions after an overload has occurred. Referring to Figure 3 wherein the circuit breaker is shown in tripped position, it is apparent that the latched end 34 of the cradle 31 must be returned to its latched position on the latch 25 in the cutout 18 of the armature 17. To accomplish this movement, a pin 64 is provided on the cradle 31 in cooperative relationship with one of the integral legs 36 of the manual operator 35. Figure 3 showing the circuit breaker in the tripped position shows the pin 64 adjacent to the leg 36 so that in movement of the handle to the position shown in Figure 2 the cradle will be rotated about its pivot on hub 32 to carry the end of leg 34 into relatched position on the armature 17 due to the cooperation of pin 64 with the legs 36 of the manual operator 35.

The circuit breaker of the present invention is designed to be mounted in a panelboard, load center or other current distribution device through the cooperation of spring jaw clips at the base as is more fully described in a pending application of Harris I. Stanback and Ralph H. Kingdon, Serial No. 483,048, filed January 20, 1955, assigned to this same assignee. The spring jaw clips constitute the previously described terminal jaw 47 at one end of the circuit breaker and a second spring jaw 50 at the opposite end, both extending beyond the exterior of the circuit breaker. The axis of these spring jaw clips are rotated 90° with respect to each other so that jaw 50 may engage a continuous strip type mounting device and jaw 48 may engage an isolatable terminal within the associated panelboard, load center or other current distribution device. Both jaws are supported within the base and cover within suitable recesses and are maintained in place through cooperation with grooves and bosses, not specifically shown, and are securely held when the cover 2 is riveted in place to enclose the circuit breaker mechanism within the case 1.

The current responsive overload trip mechanism 6 operates to open the circuit breaker contacts in response to a sustained moderate overload and in response to an instantaneous extreme overload in the manner which now will be described.

The path of current through the circuit breaker is such that current flows through the current responsive bimetallic member 11 so that, upon sustained moderate overload, the bimetallic member 11 deflects about its fixed engagement with the conducting strap 4 so as to move the free end of the bimetallic member in a counterclockwise fashion with respect to its fixed end. Movement of the bimetallic member 11 carries with it the magnetic yoke member 12 moving the offset extension 15 and the bimetal 23 due to the cooperation with leg 26 of the U-shaped bimetal 23. The opposite end of the bimetal 23 is secured to the magnetic armature member 17 so that the armature is moved on sustained moderate overloads to move the latching surface 25 from its cooperating engagement with the leg 34 of the cradle member 31. Upon release of the cradle member 31 from the latching surface 25, the cradle 31 moves in a clockwise fashion about its pivot 32 to carry the end of the coil spring 43 attached to the cradle 31 at 44 to the other side of the pivotal engagement of the legs 42 within the recess 37 of the operating handle 35. Once the spring 43 has moved through this line of pivot, the bias of spring 43 and the camming action of heel 61 with shoulder 62

becomes operative to rotate movable contact member 41 in a counterclockwise fashion about its pivot in the recess 37 of the operating handle 35 to open the contacts 45 and 46 with a snap action. In the same manner and upon occurrence of an extreme overload, the flow of current through the bimetallic member 11 sets up a magnetic force in the magnetic yoke 12 which operates to attract armature 17 to instantaneously release cradle member 31 from its engagement with the latching surface 35, thereby causing the same movements of the spring 43 and movable contact carrier 41 to open the circuit of the contacts 45 and 46. It should be noted that the contacts 45 and 46 will be separated upon overload in the manner described regardless of whether the manual operator 35 is held in its On position or allowed to move with trip action making the circuit breaker trip-free in action.

Ambient temperature compensation is provided in the current responsive trip mechanism 6 of the circuit breaker through the construction of the U-shaped member 23 of bimetallic material so arranged that its leg 26 moves away from the leg 24 on high ambient condition and toward the leg 24 on low ambient condition. The movement of the ambient temperature responsive bimetal 23 permits the latching surface 25 to remain substantially in the same position at all ambient temperatures by letting the leg 26 move substantially the same distance as the free end of the current responsive bimetal 11 will move due to an increase or decrease in ambient temperature.

The construction of the U-shaped member 23 from bimetallic material provides an additional feature in the trip mechanism 6 of the circuit breaker in that the end of the leg 24 bent over and cooperating with the cutout portion 18 of the magnetic armature 17 to form the latch surface 25 provides at the latch surface an extremely smooth and hard latching surface for the leg 34 of the cradle 31. In this manner, an additional manufacturing step of hardening and machining the latch surface in the magnetic armature 17 is eliminated and a uniform latching surface is provided in all circuit breakers as manufactured.

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 automatic electric circuit breaker having an open side molded insulating case with recesses and barriers for support of the mechanism constituting said circuit breaker, a complementary cover of insulating material for closing said case, current responsive mechanism supported within said case in said recesses and between said barriers, a generally U-shaped cradle member pivotally supported at one end on said case and cooperating at its other end with said current responsive mechanism, a manual operator pivotally supported within and extending beyond said case and cover, bifurcated interior portions of said operator surrounding said cradle generally centrally thereof, interior notches in said interior portions, a movable contact carrier having a U-shaped transverse cross-section and a U-shaped longitudinal configuration, said U-shaped configuration being formed by the bight of said U-shaped cross-section and extensions projecting longitudinally from the legs of said U-shaped cross-section, said legs being parallel to the central axis of said U, bearing surfaces at the peripheral ends of said extensions, said bearing surfaces cooperating with said notches in said interior portions for pivotally supporting said contact carrier in said operator, resilient means operating between said cradle and contact carrier to bias the contact carrier into said operator, said cradle into said current responsive mechanism and said contact carrier

for rotation about its pivotal support, a flexible conductor fixed at one end to said current responsive mechanism and at its other end to said contact carrier, a nib extending from said contact carrier return bent on said contact carrier and so as to enclose said flexible conductor for reducing movement of said conductor at its engagement with said contact carrier, a contact fixed to said contact carrier at the exterior of the bight of said U shape cross-section and at the end of said carrier opposite to the pivoted end, and a stationary contact supported within said case and cover in cooperating alignment with said movable contact.

2. An automatic electric circuit breaker having an open side molded insulating case with recesses and barriers for support of the mechanism constituting said circuit breaker, a complementary cover of insulating material for closing said case, current responsive mechanism supported within said case in said recesses and between said barriers, a generally U-shaped cradle member pivotally supported at one end on said case and cooperating at its other end with said current responsive mechanism, a manual operator pivotally supported within and extending beyond said case and cover, bifurcated interior portions of said operator surrounding said cradle generally centrally thereof, interior notches in said interior portions, a movable contact carrier having a U-shaped transverse cross-section and a U-shaped longitudinal configuration, said U-shaped configuration being formed by the bight of said U-shaped cross-section and extensions projecting longitudinally from the legs of said U-shaped cross-section, said legs being parallel to the central axis of said U, bearing surfaces at the peripheral ends of said extensions, said bearing surfaces cooperating with said notches in said interior portions for pivotally supporting said contact carrier in said operator, resilient means operating between said cradle and said contact carrier to bias said contact carrier into said operator, said cradle into said current responsive mechanism and said contact carrier for rotation about its pivotal support, a contact fixed to said contact carrier at the exterior of the bight of said U-shaped cross-section and at the end of said carrier opposite to said pivoted end, a stationary contact supported within said case and cover in cooperating alignment with said movable contact, a slot in said case and cover adjacent to said movable and stationary contacts, and means movable in said slots with movement of said contact carrier to contacts opened position parallel to the relative movement of said contacts to separate the area of said case and cover wherein said contacts are separated from the remainder of said case and cover, said slots being formed so that said movable means travels in an arcuate path to be at all times in close proximity to said movable contact and said stationary contact as said movable contact moves in an arcuate path about the pivot of said contact carrier in said manual operator.

3. An automatic electric breaker having an open side molded insulating case with recesses and barriers for the support of the mechanism constituting said circuit breaker, a complementary cover of insulating material for closing said case, current responsive mechanism supported within said case in said recesses and between said barriers, a generally U-shaped cradle member pivotally supported at one end on said case and cooperating at its other end with said current responsive mechanism, a manual operator pivotally supported within and extending beyond said case and cover, bifurcated interior portions of said operator surrounding said cradle generally centrally thereof, interior notches in said interior portions, a movable contact carrier having a U-shaped transverse cross-section and a U-shaped longitudinal configuration, said U-shaped configuration being formed by the bight of said U-shaped cross-section and extensions projecting longitudinally from the legs of said U-shaped cross-section, said legs being parallel to the central axis of said

U, bearing surfaces at the peripheral ends of said extensions, said bearing surfaces cooperating with said notches in said interior portions for pivotally supporting said contact carrier in said operator, resilient means operating between said cradle and said contact carrier to bias said contact carrier into said operator, said cradle into said current responsive mechanism, and said contact carrier for rotation about its pivotal support, a contact fixed to said contact carrier at the exterior at the bight of said U-shaped cross-section and at the end of said carrier opposite to said pivoted end, a stationary contact supported within said case and cover in cooperative alignment with said movable contact, complementary slots in said case and cover adjacent to said movable and stationary contacts, a barrier plate of insulating material slidable in said slots, said barrier plate being movable with said contact carrier parallel to the relative movement of said contacts to separate said contacts from the remainder of the said circuit breaker mechanism in circuit opening operation, said slots being formed so that said movable means travels in an arcuate path to be at all times in close proximity to said movable contact and said stationary contact as said movable contact moves in an arcuate path about the pivot of said contact carrier in said manual operator.

4. In an automatic electric circuit breaker having an open side molded insulating case with recesses and barriers for support of the mechanism constituting said circuit breaker, a complementary cover of insulating material for closing said case, current responsive mechanism supported within said case in said recesses and between said barriers, a generally U-shaped cradle member pivotally supported at one end on said case and cooperating at its other end with said current responsive mechanism, a manual operator pivotally supported within and extending beyond the case and cover, bifurcated interior portions of said operator surrounding said cradle generally centrally thereof, interior notches in said interior portions, a movable contact carrier having a U-shaped transverse cross-section and a U-shaped longitudinal configuration, said U-shaped configuration being formed by the bight of said U-shaped cross-section and extensions projecting longitudinally from the legs of said U-shaped cross-section, said legs being parallel to the central axis of said U, bearing surfaces at the peripheral ends of said extensions, said bearing surfaces cooperating with said notches in said interior portions for pivotally supporting said contact carrier in said operator, resilient means operating between said cradle and said contact carrier to bias said contact carrier into said operator, said cradle into said current responsive mechanism and said contact carrier for rotation about its pivotal support, a contact fixed to said contact carrier at the exterior of the bight of said U-shaped cross-section and at the end of said carrier opposite to said pivoted end, and a stationary contact supported within said case and cover in cooperating alignment with said movable contact, complementary slots in said case and cover adjacent to said movable and stationary contacts, a barrier plate of insulating material slidable in said slots, said barrier plate being provided with a hook portion and said contact carrier being provided with a cutout area, said hook portion engaging said contact carrier at said cutout area for movement of said barrier plate with said contact carrier, said barrier plate being moved in contacts opening movement parallel to the direction of relative movement of said contacts to separate said contacts from the remainder of circuit breaker mechanism.

5. An automatic electric circuit breaker having an open side molded insulating case with recesses and barriers for support of the mechanism constituting said circuit breaker, a complementary cover of insulating material for closing said case, current responsive mechanism supported within said case in said recesses and between said barriers, a generally U-shaped cradle mem-

ber pivotally supported at one end on said case and cooperating at its other end with said current responsive mechanism, a manual operator pivotally supported within and extending beyond said case and cover, bifurcated interior portions of said operator surrounding said cradle generally centrally thereof, interior notches in said interior portions, a movable contact carrier having a U-shaped transverse cross section and a U-shaped longitudinal configuration, said U-shaped configuration being formed by the bight of said U-shaped cross-section and extensions projecting longitudinally from the legs of said U-shaped cross-section, said legs being parallel to the central axis of said U, bearing surfaces at the peripheral ends of said extensions, said bearing surfaces cooperating with said notches in said interior portions for pivotally supporting said contact carrier in said operator, resilient means operating between said cradle and said contact carrier to bias said contact carrier into said operator, said cradle into said current responsive mechanism, and said contact carrier for rotation about its pivotal support, a movable contact fixed to said contact carrier at the exterior of the bight of said U-shaped cross-section and at the end said contact carrier opposite to the pivoted end, an integral generally U-shaped stationary contact carrier and terminal jaw having the bight of said U within said case and cover and the legs of said U extending beyond said case and cover at the base thereof, a contact fixed to said stationary contact carrier at the exterior surface of the bight thereof for cooperation with said movable contact, said stationary contact carrier and terminal jaw engaging barriers of said case and cover and having an extension thereof projecting beyond said case and cover to the exterior thereof, and a spring jaw clip supported by said recesses and barriers in said case and cover and extending exteriorly of the base of said circuit breaker, said clip being disposed from said terminal jaw extension and having its axis normal to the axis of said terminal jaw extension.

6. In an automatic electric circuit breaker having an open side molded insulating case with recesses and barriers for the support of the mechanism constituting said circuit breaker, a complimentary cover of insulating material for closing said case, current responsive mechanism supported within said case in said recesses and between said barriers, a generally U-shaped cradle member pivotally supported at one end on said case and cooperating at its other end with said current responsive mechanism, a manual operator pivotally supported within and extending beyond said case and cover, bifurcated interior portions of said operator surrounding said cradle generally centrally thereof, interior notches in said interior portions, a movable contact carrier including a pair of legs pivotally supported in said interior notches of said operator, a contact fixed to a first surface of said contact carrier, said first surface being perpendicular to the plane of movement of said contact carrier, a pair of second surfaces on said legs being wide compared to the thickness of the legs and having said wide surfaces parallel to the plane of movement of said contact carrier, resilient means operating between said cradle and said contact carrier to bias said contact carrier into said operator, said cradle into said current responsive mechanism and said contact carrier for rotation about its pivotal support, a stationary contact supported within said case and cover in cooperating alignment with said contact fixed to said movable contact carrier, complimentary slots in said case and cover adjacent to said movable and stationary contacts, a barrier plate of insulating material slidable in said slots, said barrier plate being provided with a hooked portion, portions of said first surface and one of said legs of said contact carrier being cut out to define a slot therein, said hooked portion engaging said contact carrier at said slot for effecting movement of said barrier plate with said contact carrier, said barrier plate being moved with said contact carrier to travel in an arcuate path to be at all times in close proximity to said movable contact and said

stationary contact as said contact carrier moves in an arcuate path about its pivot in said manual operator.

7. In an automatic electric circuit breaker having an insulating enclosure and a manual operator pivotally supported within said enclosure, a movable contact carrier having a U-shaped transverse cross-section including a bight portion and spaced leg portions and having a U-shaped longitudinal configuration defined by spaced extensions of equal length projecting longitudinally from said leg portions, respectively, each extension having a width in the direction of said leg portions materially greater than its thickness in the direction of said bight portion, arcuate bearing surfaces on the outer end faces of said extensions, respectively, generated about an axis intersecting both of said extensions, said arcuate bearing surfaces having a diameter materially greater than the thickness of said plate, and means urging said bearing surfaces into engagement with said manual operator for rockable motion of said contact carrier directly upon said manual operator at said bearing surfaces upon pivotal movement of said operator.

8. An automatic electric circuit breaker having an insulating enclosure, a current responsive mechanism operatively supported within said enclosure, a releasable member pivotally supported within said enclosure and releasable by said current responsive mechanism upon operation thereof, a manual operator pivotally supported within said enclosure, a movable contact carrier having a movable contact thereon and having an end portion pivotally supported on said manual operator and movable thereby, a fixed contact supported by said enclosure and normally engaging said movable contact, a cam on said releasable member, a cam surface on said contact carrier intermediate of said end portion and said movable contact adjacent to and directed toward said cam, means operative upon initial rotation of said manual operator in one direction for effecting rotation of said contact carrier about said fixed contact as a pivot in a direction to engage said cam surface with said cam, and, upon further rotation of said manual operator in said one direction, said cam providing a fulcrum about which said contact carrier pivots to forcibly separate said contacts.

9. An automatic electric circuit breaker having an insulating enclosure, a current responsive mechanism operatively supported within said enclosure, a releasable member pivotally supported within said enclosure and releasable by said current responsive mechanism, a manual operator pivotally supported within said enclosure, a movable contact carrier pivotally supported by said operator, a cam on said releasable member, and a cam surface on said contact carrier, said cam surface being positioned so that said cam engages said cam surface upon release of said releasable member thereby to move said contact carrier about its pivotal support, and said cam surface having a contour such that, throughout engagement between said cam and said cam surface, said cam surface is disposed substantially normal to the path of movement of said cam.

10. A circuit breaker comprising a stationary contact and movable contact separable therefrom, operating means comprising a manual operating lever, a movable contact carrier, a spring operably related with said contact carrier for actuating said contact carrier to the open

and closed positions of said contacts upon operation of said manual operating lever, a pivoted trip member releasable to effect automatic opening movement of said contact carrier, current responsive means for releasing said trip member, and a projection fixedly positioned on said pivoted trip member to move with the trip member at all times, said projection engaging said contact carrier to initiate opening movement of said contact carrier upon release of said trip member, said contact carrier being formed to provide a clearance space thereon preventing engagement of said contact carrier with said projection upon manual movement of said contact carrier when said contacts separate under the actuation of said spring, and said contact carrier being also so formed to permit engagement thereof with said projection upon manual movement of said operating lever when the force of said spring is insufficient to separate said contacts.

11. A circuit breaker comprising a stationary and a movable contact, a movable contact carrier carrying said movable contact and movable to an open position and to a closed position of said contacts selectively, a spring, a normally latched trip member releasable to cause said spring to effect automatic movement of said contact carrier from said closed to said open position of said contacts, means to release said trip member, a fixed projection on said trip member positioned to engage said contact carrier upon release of said trip member thereby to initiate said automatic movement of said carrier, a manual operating lever manually movable to an open position and to a closed position selectively and, with said contacts closed, operative upon movement from said closed position to said open position to cause said spring to move said carrier toward said projection and then away from said projection to said open position of said contacts, said contact carrier and projection being so shaped and positioned that, upon said movement of said carrier toward said projection, engagement between said carrier and said projection is prevented if said contacts open under action of said spring alone, and said contact carrier and projection being further so shaped and positioned that upon said movement of said carrier toward said projection with said contacts welded said carrier engages said projection for forcing said carrier toward said open position.

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