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2,015,598

CIRCUIT BREAKER

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Fig. 1.

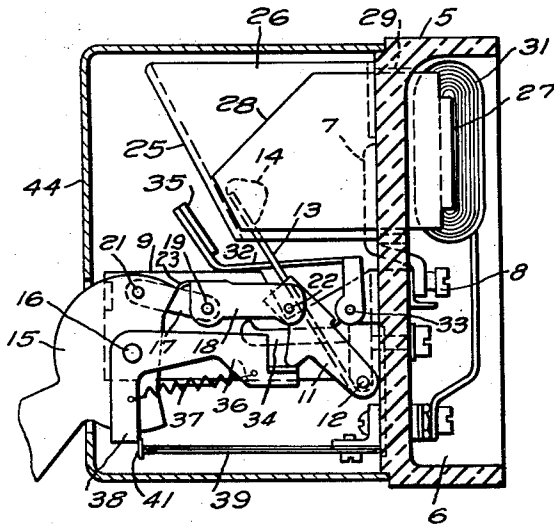


Fig. 2.

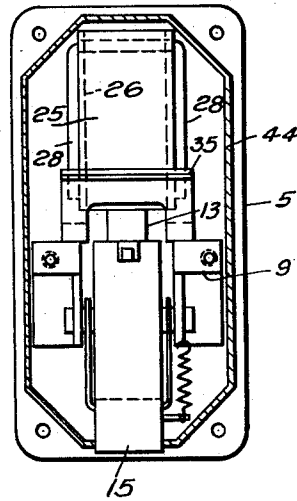


Fig. 3.

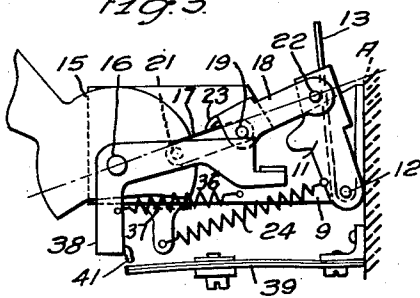


Fig. 4.

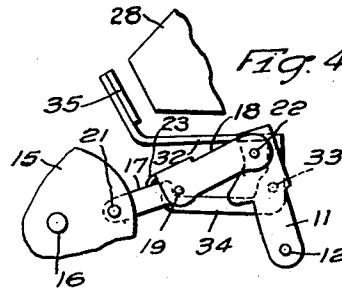
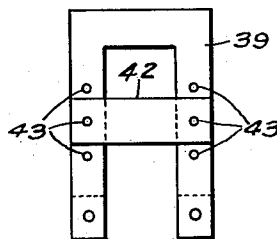


Fig. 5.



WITNESSES.

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CIRCUIT BREAKER

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pany, a corporation of Pennsylvania

Application March 18, 1931, Serial No. 523,495
In Germany March 18, 1930

7 Claims. (Cl. 200—88)

My invention relates to circuit breakers and particularly to circuit breakers used for controlling lighting circuits for residences, apartments, etc., and for controlling small motors.

5 An object of my invention is to provide a circuit breaker that shall be trip-free of the operating handle and which shall be released to open position by an electro-magnet which shall also serve as a blowout magnet.

10 Another object of my invention is to provide a circuit breaker having the above-noted characteristics, wherein the circuit breaker will be tripped to open position, under overload conditions by a current-responsive thermally-actuated latch device.

15 A further object of my invention is to provide a circuit breaker wherein the blowout magnet winding shall be mounted beneath the supporting base of the circuit breaker and wherein the pole pieces of the magnet shall extend through the base and be disposed substantially parallel to the side walls of the arc chute and wherein an armature for tripping the circuit breaker shall be disposed adjacent to the ends of the pole pieces in a flux path parallel with that of the flux path between the pole pieces that constitutes the blowout field.

20 A still further object of my invention is to provide a compact and relatively inexpensive circuit breaker that may be readily assembled and be rugged in construction.

30 These and other objects that will be made apparent throughout the further description of my invention are obtained by means of the circuit breaker hereinafter described, and illustrated in the accompanying drawing, wherein

35 Figure 1 is a side elevational view, partially in section, of a circuit breaker embodying the features of my invention;

40 Fig. 2 is an end elevational view of the circuit breaker shown in Fig. 1, the cover being shown in section;

45 Fig. 3 is an elevational view of a fragment of the circuit breaker shown in Fig. 1, the contact-operating parts being shown in their closed positions;

50 Fig. 4 is an elevational view of a fragment of the circuit breaker illustrating the operative position of the electromagnet trip member and the contact-operating parts when the circuit breaker is in closed position, and

55 Fig. 5 is an elevational view of a bimetal thermal element.

Referring to the drawing, the circuit breaker comprises an insulating base 5, having a recess 6 in its underside, and which supports, on its outer face, a stationary contact plate 7 having its ter-

minal extending, through the base, into the recess 6, where it is provided with a conductor-terminal screw 8 which serves to secure a conductor (not shown) to the contact terminal.

A sheet-metal supporting frame 9 is mounted 5 on the outer face of the base which serves to support the operating mechanism of the circuit breaker.

The circuit-breaker-operating mechanism comprises a contact arm 11 that is pivotally 10 mounted on the frame 9 for rotative movement about a pivot shaft 12. The arm is provided with a flexible contact strap 13 which carries, at its free end, a movable contact 14 that is adapted to engage the stationary contact 7 when the switch 15 arm is moved to the closed position, indicated in Fig. 3.

A switch arm 11 is moved to open and to closed position by means of an insulating operating handle 15 that is pivotally mounted upon the frame 9 20 for rotation about the pivot shaft 16. The handle is connected to the contact arm 11 by means of a pair of toggle links 17 and 18 that are joined by a knee pivot 19 and are pivotally connected to the operating handle 15 and the switch arm 11 by 25 means of pivot shafts 21 and 22, respectively.

As indicated in Fig. 3, the toggle links 17 and 18 are in their "made" position wherein the knee pivot 19 lies beneath a center line A through the pivot shafts 16 and 22, the relative movement of 30 the links in one direction being limited by a stop 23 carried on the link 18 which engages the link 17. Upward movement of the knee pivot 19 of the toggle past the center line A causes the collapse of the toggle and permits the spring 24 that 35 is connected to the frame 9 and to the contact arm 11 to move the switch arm to open position with a snap action.

When the switch is in the open position, the toggle links occupy the position shown in Fig. 1 40 where they are again in the "made" position and will cause the switch arm to be moved to closed position when the operating handle is moved in a clockwise direction.

An insulating arc chute 25, having spaced side 45 walls 26 disposed on opposite sides of the contact 7, is provided for surrounding the contacts 7 and 14 to constitute an arc chamber in which the arc, drawn between the contacts 7 and 14 upon separation, is temporarily confined, the arc being 50 moved through the chute by an electromagnet field produced by an electromagnet to be hereinafter described.

The blowout magnet comprises an iron mem- 55 ber 27 of U-shape, made of sheet iron and having

a pair of pole pieces 28 that extend through an opening 29 in the base 5 and are disposed exteriorly of the arc chute and in parallel relation to the side walls thereof. The winding 31 of the blowout magnet surrounds the central portion of the core member 27 and is disposed in the recess 6 of the base 5 where it is protected by the insulating base, from exposure to the arc drawn between the contacts. The flux lines passing from one pole piece to the other cross the path of the arc drawn between the contacts 7 and 14 and serves to move it upwardly out of the chute and extinguish it in a well known manner.

In order to render the circuit breaker responsive to severe overload and short-circuit conditions, a trip arm 32 of U-shape is provided that is pivoted for rotation about a shaft 33 mounted on the frame 9. The trip arm 32 is provided with an extension 34 that extends beneath the knee pivot 19, and the free end of the trip arm 32 is provided with an iron armature 35 that is disposed exteriorly of the chute 25 and adjacent to the outer ends of the pole pieces 28 of the blowout magnet. The magnet winding 31 is connected in series with the contacts 7 and 14 and, consequently, a sudden current surge, such as is produced by a severe overload or short-circuit condition, attracts the armature 35 toward the ends of the pole pieces. This movement causes the arm 34 on the trip arm 32 to strike the knee pivot 19 and move it upwardly across the center line A and thereby trip the switch arm to open position. By reason of the fact that the armature is connected in parallel with the blowout flux path, considerable attractive force is exerted by the pole pieces, and it has been found that a very small armature is required. The armature, therefore, while shunting the flux path, does not materially reduce the strength of the blowout field because of its relatively small cross-sectional area. Therefore, the arrangement is particularly advantageous and does not materially affect the ability of the blowout magnet to move and extinguish the arc.

In order to cause the circuit breaker to trip open under relatively small overloads after a predetermined duration thereof, I have provided a second trip arm 36 that is mounted for rotative movement about the pivot shaft 16 and is normally biased toward the knee pivot 19 by means of a spring 37 that is connected between a latch arm 38 on the trip arm 36, and the frame 9, as indicated in Figs. 1 and 3. The trip arm 36 is normally restrained by a bimetal element 39 of U-shape, as indicated in Fig. 5, which normally engages a latch 41 on the free end of the latch arm 38. The bimetal element 39 is also connected in series with the contacts 7 and 8 and is so proportioned that an overload which endures for a predetermined time will cause it to be deflected sufficiently to release the latch 41 and permit the spring 37 to move the trip arm 36 in the counterclockwise direction with a snap action. The arm strikes the underside of the knee pivot 19 and causes the collapse of the toggle. The bimetal element is provided with a conductive bridging strap 42 that is adjustably attached to the bimetal element by screws 43, and by shifting the position of the bridging strap, the calibration of the bimetal element may be altered to cause opening movement of the circuit breaker at predetermined current values.

In order to prevent tampering with the circuit-breaker parts, a cover 44 is provided to enclose all of the mechanism mounted on the outer

face of the insulating base 5, the operating handle extending through a slot in the cover for rendering it accessible exteriorly thereof.

From the foregoing description, it is apparent that I have provided a simple and inexpensive form of circuit breaker that is responsive to severe overload and short-circuit-current conditions and is also responsive to relatively small overloads which endure for a predetermined time.

While I have illustrated only one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim as my invention:

1. A circuit breaker comprising an insulating base having a recess in its underside, a contact member disposed on the outer side of the base, an arc chute having side walls disposed at opposite sides of the contact member, a movable contact member movable within the arc chute and engaging the first contact member, and a blowout magnet of U-shape having its pole pieces extending through the base and substantially parallel with the said side walls and having its winding disposed in the said recess, and an armature movable to a position bridging across the end portions of said U-shaped blowout magnet to trip the breaker.

2. A circuit breaker comprising an insulating base having a recess in its underside, a contact member disposed on the outer side of the base, an arc chute having side walls disposed at opposite sides of the contact member, a movable contact member movable within the arc chute and engaging the first contact member, a blowout magnet of U-shape having its pole pieces extending through the base and substantially parallel with the said side walls and having its winding disposed in the said recess, and an armature co-operating with the pole pieces for tripping the circuit breaker.

3. In a circuit interrupter, an arc chute, a pair of separable contacts for drawing an arc in said arc chute, biasing means for moving one of said contacts to separated position, a magnetic blowout for the arc drawn between said contacts including pole pieces of magnetic material having substantially all of the end portions thereof extending along opposite sides of the arc chute with an air gap therebetween traversed by the magnetic flux whereby substantially all of the flux in the space between the pole pieces extends across the arc chute for moving the arc, and a movable armature magnetically in parallel with the magnetic flux path across said air gap, said armature when moved initiating movement of said contact to separated position by said biasing means.

4. In a circuit interrupter, a movable contact for opening and closing the circuit, a blowout magnet for the arc drawn by said movable contact including a coil having a core of magnetic material extending therethrough and a pair of pole pieces rigid with said core and having only one pair of end portions, said pair of end portions extending to opposite sides of the path of movement of said movable contact and having a gap traversed by the magnetic flux set up by said coil for moving the arc, and an armature of magnetic material movable by the magnetic flux set up by said coil and positioned magnetically in parallel with the magnetic flux path across said gap between said pole pieces, said armature when moved causing said movable contact to open the circuit.

5 5. In a circuit interrupter, means for drawing
an arc, means of magnetic material energized by
the current flow through the circuit interrupter
for providing a magnetic blowout field transverse
10 to the axis of said arc, and means for initiating
the drawing of said arc upon the occurrence of
predetermined conditions, said means including
an armature of magnetic material positioned
15 magnetically in parallel with at least that portion
of the magnetic field which is transverse to the
axis of the arc, and thermally responsive means
for also initiating the drawing of said arc, said
thermally responsive means being operable with-
out movement of said armature toward said
means of magnetic material.

15 6. In a circuit interrupter, a movable contact
for opening and closing the circuit, a blowout
magnet for the arc drawn by said movable con-
tact including means providing a magnetic cir-
cuit having only a single air gap therein, said
20 magnetic means being positioned with said mov-
able contact in said air gap, and a movable arma-
ture of magnetic material positioned magnetically
in parallel with the magnetic flux path across
25 said air gap, said armature when moved by the

magnetic flux causing opening of said movable
contact.

7. In a circuit interrupter, an arc chute, a pair
of separable contacts for drawing an arc in said
arc chute, biasing means for moving one of said
5 contacts to separated position, a magnetic blow-
out for the arc drawn between said contacts in-
cluding pole pieces of magnetic material having
substantially the whole end portions thereof ex-
tending along opposite sides of the arc chute with
10 an air gap therebetween traversed by the mag-
netic flux whereby substantially all of the flux
in the space between the pole pieces extends
across the arc chute for moving the arc, and a
movable armature magnetically in parallel with
15 the magnetic flux path across said air gap, said
armature when moved initiating movement of
said contact to separated position by said biasing
means, and a thermal element responsive to elec-
trical conditions in the circuit for also initiating
20 movement of said contact to separated position
by said biasing means, said thermal element being
operable without movement of said armature to-
ward said pole pieces.

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