Feb. 3, 1953 W. A. THOMAS 2,627,563

ELECTRIC CIRCUIT BREAKER

Filed Aug. 16, 1950 2 SHEETS—SHEET 1

Fig. 2.

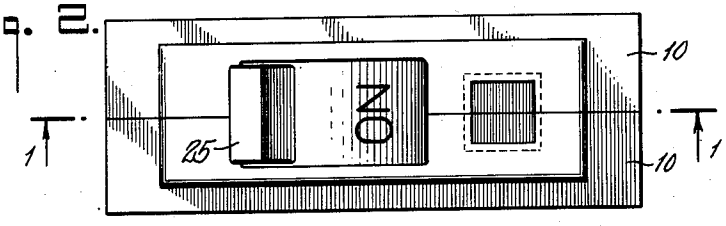


Fig. 1.

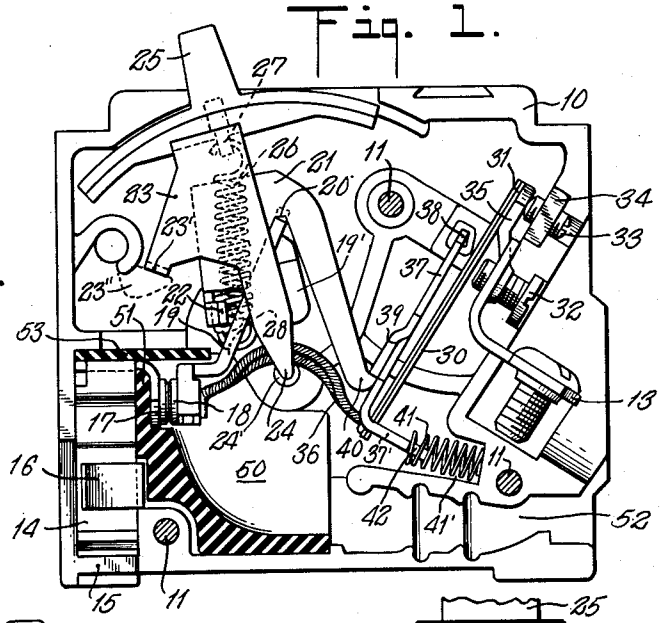


Fig. 3.

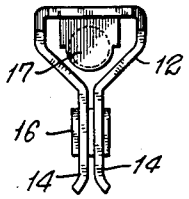


Fig. 4.

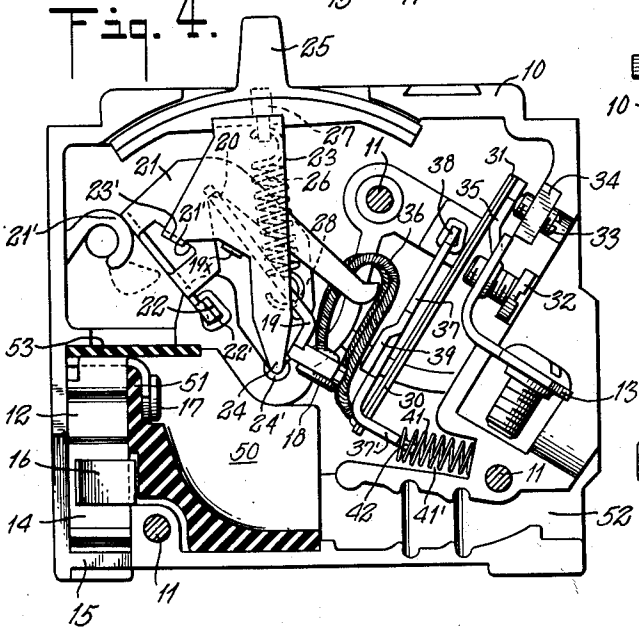
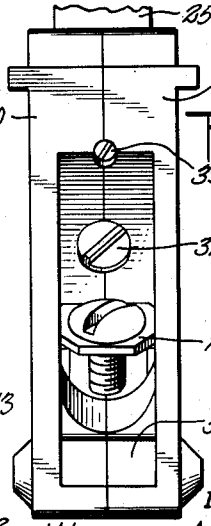


Fig. 5.



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Fig. 6.

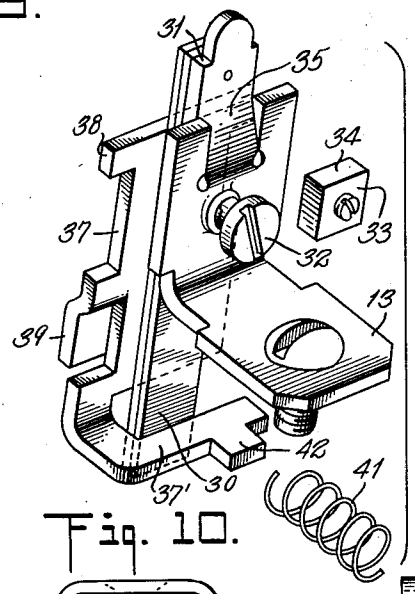


Fig. 7.

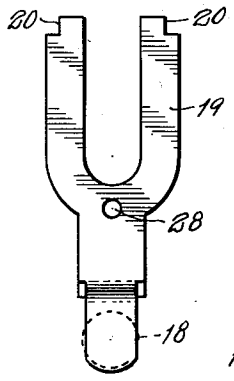


Fig. 8.

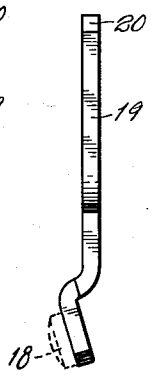


Fig. 9.

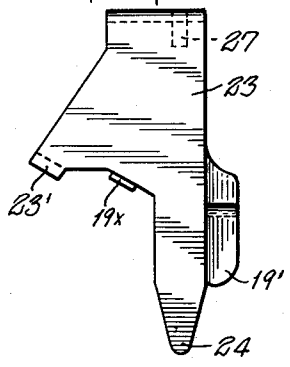


Fig. 10.

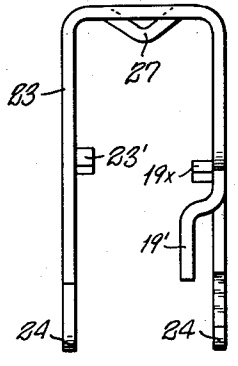


Fig. 11.

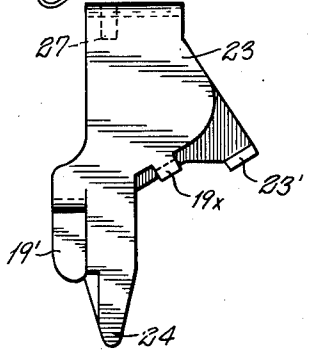


Fig. 12.

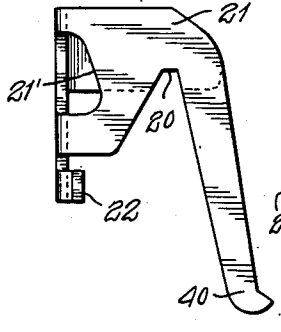


Fig. 13.

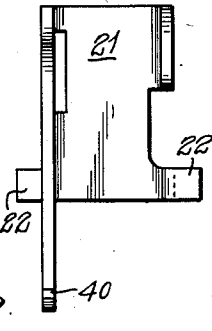
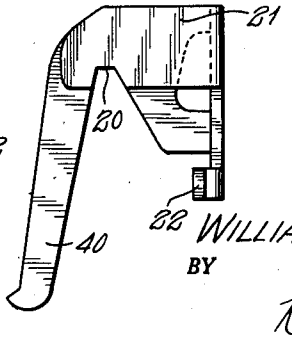


Fig. 14.



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UNITED STATES PATENT OFFICE

2,627,563

ELECTRIC CIRCUIT BREAKER

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Application August 16, 1950, Serial No. 179,692

3 Claims. (Cl. 200—88)

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My invention relates particularly to a breaker adapted for use in panel boards or like constructions.

The main object is to provide a simple and very compact breaker of the automatic type which can be operated to open or close a circuit manually and which can be reset manually after automatic breaking of a circuit. The automatic opening of the circuit will take place upon a continuous small overload or upon a sudden heavy overload such as a short circuit.

One object is to simplify the construction and increase the reliability and sensitivity of the automatic release.

Another object is to provide a compact breaker unit which can be readily mounted upon and removed from a panel or distribution board.

I have discovered many advantages can be obtained by entirely omitting the magnet yoke usually employed in such breakers and mounting a latching armature alongside a bimetal element and provide a coupling arrangement so that a release of the tripping mechanism occurs upon a prolonged slight overload or a sudden heavy overload in the circuit.

Accordingly the bimetal control element performs not only as the thermally bendable releasing element of the tripping mechanism in case of a small overload but also provides the magnetic field in case of a heavy overload for actuating a releasing armature. The latch for the tripping mechanism is carried by a member which also serves as the armature for the magnetic field of the bimetal element thus doing away with the U-shaped magnetic yoke usually carried by or embracing the bimetal element. The breaker can be readily calibrated by adjusting the position of the bimetal element.

In its preferred form, the circuit breaker is constructed to facilitate plugging into line terminal members of a panel board or cabinet.

I provide a conventional type of over-center toggle or snap mechanism controlled by a very simple thermal and magnetic release arranged for compactness and provided with a ventilated arc chute all embodied in an insulating housing.

Fig. 1 is a side view of the inside of a circuit breaker embodying my invention showing the parts in closed circuit position and showing an arc chute in cross-section.

Fig. 2 is a top plan view of the housing for the circuit breaker.

Fig. 3 is an edge view showing the line terminal.

Fig. 4 is a view similar to Fig. 1 showing the parts in the position they occupy when tripped automatically.

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Fig. 5 is a view of the right hand edge of the housing showing the load terminal.

Fig. 6 is an exploded perspective view showing the load terminal and the trip controlling parts.

Fig. 7 is a face view of the hinged or swinging switch member.

Fig. 8 is an edge view of the same.

Fig. 9 is a side view of the manually operable pivoted or hinged member.

Fig. 10 is an edge view of the same.

Fig. 11 is a view of the side opposite to that shown in Fig. 9.

Fig. 12 is a side view of the cradle or tripping member.

Fig. 13 is an edge view of the same.

Fig. 14 is a view of the side of the cradle opposite to that shown in Fig. 12.

The housing is formed of the two parts 10, 10, of insulating material secured together by rivets or screws 11, 11. Terminals 12 and 13 are mounted in opposite ends of the housing. Line terminal 12 has two spring jaws 14, 14 mounted in recesses between the parts of the housing. A passage 15 in the bottom of the housing leads to the space between these jaws so as to permit the circuit breaker to be applied to the projecting blade of a panel construction (not shown). These jaws may be reinforced by a supplemental spring clip 16. The upper end of the terminal 12 has a downwardly projecting lug 17 which carries the stationary contact of the switch mechanism. The movable switch contact 18 is carried by a lever 19 which is hinged at 20 in the cradle or tripping member 21. The latter has lugs 22 which are pivoted in bearings 22' in the side walls of the housing.

The manual actuating member 23 has two arms terminating in hinge members 24, 24 which are seated in bearings 24' in the opposite walls of the housing. The outer end of the member 23 is provided with a handle or finger piece 25. A spring 26 of the usual over-center action type is hooked at one end to a projection 27 in the actuating member and hooked at the other end to a lug 28 of the switching arm or lever 19. This spring serves to press the switch lever to the left (Fig. 1) in the closed circuit position when the lug 23' presses against the lug 23'' in the housing in the closed circuit position.

The bimetal thermally actuated strip member 30 is anchored at 31 to a part of the load terminal bracket 13 which is secured in place between the parts of the housing by a screw 32. A calibrating

screw 33 is adjustable in a nut 34 which is fixed between the parts of the housing. The end 35 of the terminal bracket 13 is integral with the part which is fixed by the screw 32 but is bendable by screw 33 for the purpose of calibration.

The movable tip of the bimetal strip is connected to the swinging switch member 19 by a flexible conductor 36. The latching of the tripping mechanism is effected by the member 37 which is loosely hinged at 38 in the inner walls of the housing near the stationary end of strip 30 and provided with an offset cam-like catch member 39 which interlocks with the arm 40 of the tripping member 21. The latch member 37 is normally biased into locking position by means of the spring 41 which is mounted in a recess 41' and engages a lug 42 on the end of hook 37' (Fig. 6). The latching member 37 is made of soft iron so as to act as an armature and be attracted by the magnetic field caused by the flow of a heavy current longitudinally of the bimetal strip and has a hook-like portion 37' which stands in the path of movement of the tip of the bimetal strip 30. When the bimetal strip is heated by an overload, it will move the armature member with it and disengage the catch 39 from the end of the tripping arm 40. When a heavy overload, such as a short circuit occurs, the armature is drawn toward the strip by the magnetic field created around the strip and this releases the catch 39 from the tripping arm.

The armature is mounted substantially parallel with the bimetal and close to it so as to cut across as many of the lines of force created by the current through the bimetal strip as is practical. The bimetal should be stiff enough so that it will provide the core of a substantially stationary field without any magnet yoke.

The manual operation to open the circuit is effected by the simple swinging of the fingerpiece 25 and lever 23 from the position of Fig. 1 to the right. This moves the outer end of the spring 26 over the center so as to snap the switching arm to the "off" position in the usual manner. As the lever 23 moves to the right the lug 19x will engage an edge of the switch arm 19 and start the opening movement in case the spring 26 has not already operated. The manual closing of the circuit is effected by simply moving the finger piece back to the position of Fig. 1.

The lug 19' serves as a stop for the switch lever in the open circuit position and when the closing movement of the actuator lever 23 is started, the lug 19' of the actuator 23 will engage the switch lever 19 and start it moving even if the spring 26 has not yet started to move it.

In case of an overload produced by a continuing small excess current, the latch member 37 is drawn counterclockwise as viewed in Fig. 1 by the bending or warping of the bimetal due to the heat until the tripping member or cradle 40 is released from the catch 39. The tension of the spring 26 is then applied to the cradle or tripping member to throw the same into the position of Fig. 4 thus opening the circuit with a snap action and leaving the operating parts in the mid position of Fig. 4.

When the bimetal has cooled sufficiently the switch member may be reset manually to the open circuit position by simply moving the lever 23 to the right as viewed in Fig. 4. The actuating lever has a lug 23' which engages a shoulder 21' on the member 21 and forces the tripping member to the open circuit position during which movement the tip of the cradle arm 40 engages the cam-like surface of the catch portion 39 and

brings the parts into the open circuit interlocking engagement. In resetting the tripping member 21, the lug 19x of lever 23 engages switch member 19 and cooperates in moving the cradle and the switch member to the open circuit latched position.

In case of a short circuit or a sudden heavy overload above the rated capacity of the breaker, the armature is suddenly attracted by the magnetic field created by the current passing through the bimetal strip and thus releases the tripping member and causes the circuit to be broken by the snap action mechanism. In this connection, it will be seen that no magnet yoke is required.

The omission of the usual magnet yoke not only results in a more sensitive and uniform action but also simplifies and lessens the cost of manufacture and assembly of parts.

By dispensing with the yoke, the bimetal element is free to warp uniformly throughout its length and the magnetic field existing between the bimetal and the face of the armature on short circuit is uniformly distributed over substantially the entire length of the cooperating parts.

By omitting the mass of metal usually employed for the core of the magnet, the bimetal strip is surrounded by air and will cool much quicker by radiation after an automatic tripping action and thus facilitate a much quicker resetting of the breaker for use.

By eliminating a magnet yoke and properly relating the bimetal and its armature I not only simplify and minimize the cost of construction but provide a more compact and reliable mechanism.

The arc chute 50 is formed of suitable high refractory material and has a shoulder portion 51 which is held in position between the line terminal 12 and its opposite lug 17.

The housing is ventilated by a passage 52 which extends from between the walls of the arc chute and discharges at the edge of the housing opposite the line terminal.

An insulating cap 53 overlies the line terminal and its contact and assists in holding the arc chute in place.

This provides a highly effective and reliable mechanism of a very compact form.

The terminal contact and arc chute structure and arrangement of the circuit breaker as herein shown and described are claimed in my copending application Serial Number 244,897 filed September 4, 1951.

I claim:

1. A circuit breaker comprising a housing, formed of insulating material, circuit terminals mounted in opposite ends of the housing, a stationary switch contact connected to one terminal in the housing, a bimetal element having one end connected to the other terminal in the housing and movable at the opposite end, a movable switch member for coacting with the stationary contact and connected by a flexible conductor to the opposite end of the bimetal element, an armature pivoted at one end and extending alongside of said bimetal element and having a hook at its other end embracing the movable end of the bimetal element, a spring biasing said armature hook against said element, said armature having a cam-like catch member, an actuating member hinged in said housing, a tripping cradle hinged in said housing and having an arm normally interlocked with said catch member, means for hinging said switch member in said tripping cradle, a spring connecting said actuating mem-

ber with said switch member, said actuating member having a lug coacting with the switch member to start a circuit opening movement and another lug coacting with the switch member to start a circuit closing movement of said switch member, said actuating member having another lug coacting with the tripping cradle for resetting the tripping arm into interlocking engagement with said armature catch.

2. A circuit breaker comprising a housing formed of insulating material, circuit terminals mounted in opposite ends of the housing, a stationary switch contact connected to one terminal in the housing, a bimetal element having one end connected to the other terminal in the housing and movable at the opposite end, a movable switch member for coacting with the stationary contact and connected by a flexible conductor to the movable end of the bimetal element, an armature pivoted alongside of said bimetal element and having a hook at its end embracing the movable end of the bimetal element, a spring biasing said armature hook toward said element, said armature having a cam-like catch member, an actuating member hinged in said housing, a tripping cradle hinged in said housing and having an arm normally interlocked with said catch member, means for hinging said switch member in said tripping cradle, a spring connecting said actuating member with said switch member, said actuating member having a lug coacting with the switch member to start a circuit opening movement and another lug coacting with the switch member to start a circuit closing movement of said switch member, said actuating member having another lug coacting with the tripping cradle for resetting the tripping arm into interlocking engagement with said armature catch.

3. In a circuit breaker, the combination of tripping mechanism including a tripping lever, a latch arm pivoted at one end and having a shoulder remote therefrom normally restraining the action of said tripping lever, said latch member being formed of magnetic material, a bimetallic thermostatic member supported at one end and extending substantially parallel with said latch member from a point adjacent its pivot to a point beyond said shoulder, the opposite end of said bimetallic member engaging said latch member to actuate said latch member and release said tripping lever upon a predetermined overload in the circuit through said bimetallic member, said bimetallic member being sufficiently stiff to act as a substantially stationary core, the magnetic flux of which upon passage of a predetermined sudden overload will retract said latch member from said tripping lever without requiring any supplementary magnetic yoke.

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