June 17, 1947. F. G. VON HOORN 2,422,508

CIRCUIT BREAKER

Filed June 25, 1943

Fig. 1.

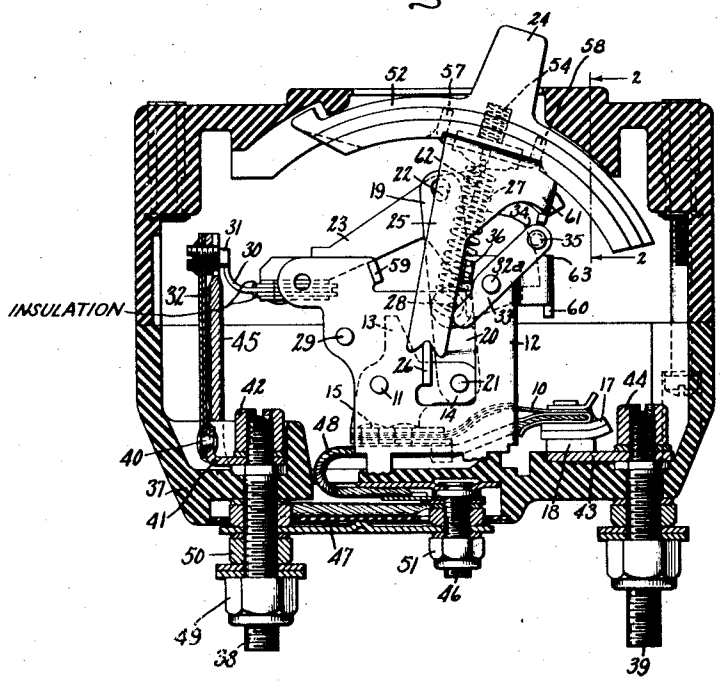


Fig. 2.

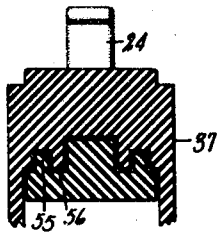
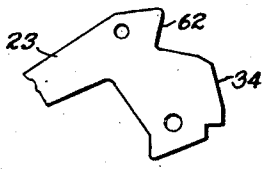


Fig. 3.



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CIRCUIT BREAKER

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3 Claims. (Cl. 201—48)

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My invention relates to circuit breakers, more particularly to manually operated current responsive circuit breakers, and has for its object a simple and reliable circuit breaker provided with means for holding the circuit breaker closed by means of a handle in the event of an overload, together with external means for calibrating the current responsive tripping device and a seal around the handle of the circuit breaker.

In carrying out my invention in one form I provide a pivoted arm on the supporting framework of the circuit breaker which cooperates with the handle and with the normally secured tripping member of the circuit breaker in such manner that, if the handle is held in a predetermined extreme circuit closing position, the current responsively held tripping member is held by the handle to prevent opening of the circuit breaker.

I also provide an electric shunt for the current responsive device, which shunt is secured to the circuit breaker on the exterior of the casing so that it may be readily removed and changed to effect the calibration of the circuit breaker.

To effect a seal around the handle, I mount the handle for spring pressed engagement with a wall of the enclosing casing.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is a side elevation view mainly in section of a circuit breaker provided with my invention; Fig. 2 is a fragmentary sectional view taken along the line 2—2 of Fig. 1 looking in the direction of the arrows; while Fig. 3 is a fragmentary view of a part of the device.

In carrying out my invention in one form I provide a spring contact arm 10 mounted on a pivot 11 between two upright sides of a supporting framework 12, only one side of which is shown. The arm comprises a rigid portion pivoted on the pivot 11 and provided with a stop projection 13 and an operating projection 14. This member has secured to its lower end, as by rivets 15, the spring arm 10 on the end of which is secured a movable contact 17 cooperating with a stationary contact 18.

As shown, the breaker is held in its closed circuit position by means of a toggle consisting of two links 19 and 20, the lower end of the link 20 being pivotally connected by a pivot 21 to the operating projection 14, while the upper end of the link 19 is connected by pivot 22 to the intermediate point of a normally fixed trip arm 23. This toggle is broken to open the circuit

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breaker by moving a handle 24 toward the left hand, as seen in the drawing, the handle being mounted on an inverted U-shaped operating member, only one arm 25 of which is seen, which embraces the supporting framework 12 and has the ends of its arms pivoted on lateral projections 26 secured to the framework. A pair of helical tension springs 27, only one of which is shown, are provided on opposite sides of the toggle. Each spring has one end connected to the movable pivot 28 of the toggle and its other upper end connected to the handle 24. Thus when the handle is moved on its pivot 26 toward the left until the center line of the spring 27 is to the left of the pivot 22, the spring snaps the pivot 28 toward the left thereby opening the circuit breaker. In its open position the projection 13 rests against a stop pin 29.

Normally the left-hand end 30 of the arm 23 is secured by engagement with the end of a screw 31 carried by a thermostat 32, whereby the arm 23 is held against movement in a clockwise direction about its pivot 32a by the force applied by the spring 27. Upon the occurrence of a predetermined maximum current, however, the upper end of the thermostat 32 moves toward the left far enough to release the arm 23 which thereupon moves clockwise about its pivot and effects the movement of the switch arm to an open circuit position.

In order that the arm 23 may be held in the position shown in the drawing, even though it has been released by the thermostat, I have provided a lever 33 forming a connecting member mounted on the fixed pivot 32a. The lower end of this lever engages the operating arm 25 carrying the handle, while its upper end engages an upright portion 34 of the trip arm 23. Actually this arm 33 is provided in two parts which are duplicated on each side of the supporting framework, there being another arm 33 (not shown) on the opposite side of the framework mounted also on the pivot 32a. The upper ends of these arms are connected together by a cross rod 35, which rod is the part engaging the vertically extending portion 34 on the arm 23.

The lever 33 furthermore is so arranged that when the arm 23 is in its normal secured position, as shown in the drawing, the lower end of the lever 33 pushes the arm 25 and with it the handle 24 slightly in a counterclockwise direction about the pivot 26 so that the arm is in appreciable spaced relation from the stop 36. It will be observed that the forces are applied entirely by the helical spring 27, but since it is acting almost

directly on the arm 23, its force applied to the arm 23 overpowers the relatively small amount of its force which opposes movement of the handle toward the left hand. Therefore, the handle is moved slightly away from stop 36.

However, if it is desired to hold the circuit breaker in its closed circuit position, this can be done by moving the handle 24 toward the right hand until the arm 25 comes to rest against the stop 36. This moves the arm 33 through a small angle in a counterclockwise direction about the pivot 32a, whereby the cross bar 35 by engagement with the arm 23 moves the arm slightly in a counterclockwise direction about the pivot 32a. As long as the handle is held in this position, the arm 23 is secured, regardless of the position of the screw 31. As a matter of fact, if the handle 24 is held firmly in the exact position shown in the drawing, the arm 23 will be held against movement when released by the thermostat. However, movement of the handle toward the right into engagement with the stop 36 assures that the contact arm will be held against opening movement.

The latching end 30 of the arm 23 is preferably a metal part which is secured to the end of the arm 23 between layers of insulation so as to be electrically insulated from the arm 23.

The mechanism, as shown, is enclosed in a casing or housing 37 made of a molded electrically insulating material, at the bottom of which the supporting framework 12 is secured. Electrical connections are made with the circuit breaker by means of two connectors or conductors 38 and 39 mounted in the lower wall of the casing and extending through the casing. The conductor 38 also serves as a support for the thermostat 32 whose lower end is electrically and mechanically connected, as by a riveted and brazed joint 40, to a strap member 41 secured on the conductor by a nut 42 inside the casing. In a somewhat similar manner, the stationary contact 18 is mounted on a conducting strap 43 secured to the conductor 39 by a nut 44.

The circuit through the circuit breaker between the external connectors 38 and 39 may be traced from the connector 38 through the thermostat 32 to its upper end and then through a flexible conductor 45 to a secondary lug or connector 46 mounted in the bottom wall of the casing. A second shunt circuit of adjustable resistance is provided by a strap conductor 47 which extends directly on the exterior of the casing from the conductor 38 to the conductor 46. From the conductor 46 a flexible conductor 48 leads to the end of the contact arm, and the circuit then leads through the two contacts and the conductor 39 to the exterior of the circuit breaker.

Calibration or change in the tripping current value is effected very conveniently from the exterior of the casing by interchanging the shunt conductor 47 for one having a suitable electrical resistance. The shunt conductor is provided with an aperture at each end, through which apertures the conductors 38 and 46 extend. Thus, to remove the shunt the nuts 49 and 50 are removed from the conductor 38 and the nut 51 is removed from the conductor 46. The shunt can then be slipped off the conductors and the desired one put in place and then secured by turning the nuts 50 and 51 tightly down against it so as to form a good mechanical, and also good electrical, connection at each end between the shunt and the conductors themselves. The outer nut 49 on the conductor 38 is the usual clamping nut for effecting an electrical connection with an external circuit.

Also, adjustment of the current response of the thermostat, or rather of the amount of deflection required of the thermostat to release the arm 23, can be effected by adjustment of the screw 31. It is contemplated, however, that this screw will be given a standard adjustment when the breaker is assembled, and thereafter calibration of the thermostat to trip open the breaker in response to a desired current through the contacts will be effected by applying a suitable shunt 47. The shunts, for example, may be constructed with resistance values to give predetermined circuit breaker current ratings and stamped with those values, such as 50, 75 and 100 amperes. It will be understood that any current value above the particular current value for which the breaker is calibrated will cause heating of the thermostat and distortion of it sufficient to open the circuit breaker, provided the circuit breaker is not held closed manually by means of the handle 24, as previously described.

Another feature of the circuit breaker is a dust-tight and substantially air- and liquid-tight seal provided between the handle 24 and the sides of the aperture of the casing through which the handle extends. To provide for this seal, the handle is provided with an arcuate portion 52 extending in the direction of its motion, this arcuate portion having for its center the pivot of the handle on the projection 26. By means of a compression spring 54 the handle is forced outward with the arcuate portion resting against and overlapping the complementary inner wall of the casing on each side of the aperture. Also, as shown in Fig. 2, the arcuate portion 52 with the handle secured at approximately its middle, is provided with ridges and grooves extending in the direction of movement of the handle which fit closely with complementary grooves and ridges in the upper surface of the casing. Thus, as shown in Fig. 2, the handle is provided with a ridge 55 and groove 56 on each side of the aperture through which the handle extends.

To facilitate this mounting of the handle on the inverted U-shaped metal operating member of which the arm 25 is a part, radially extending projections 57 and 58 are provided on this member which cooperate with recesses in the handle. Thus the handle is free to move radially outward in accordance with the force applied by the spring 54.

A second stop 59 limits the movement of the arm 25 in a counterclockwise direction, and a stop 60 is provided on the frame, against which the end of the contact arm comes to rest in the open circuit position.

When the arm 23 is moved clockwise on overload to open the circuit breaker, it can be brought back with its end 30 in latching engagement with the screw 31 by means of the handle, assuming that the thermostat is allowed to cool and bring the screw back into latching position. To effect this, the handle may be moved in either direction.

When the trip arm 23 is released by the thermostat, the spring 27 causes it to move clockwise about its pivot 32. At the same time the trip arm, by engagement with the cross rod 35, moves the lever 33 clockwise so that the lever 33 in turn moves the operating arm 25 counterclockwise about its pivot 26. This movement of the operating member 25 carries the upper end of the spring 27 toward the pivot 22, the pivot and the spring moving toward each other. When the

pivot reaches a position to the right of the center line of the spring, the spring snaps the toggle to its broken position thereby opening the circuit breaker. During this opening movement, the spring biases the handle toward the left to a central position in which a projection **61** on the operating member **25** rests against a stop projection **62** (Fig. 3) on the trip arm **23**. The trip arm **23** is brought to rest by the engagement of the cross rod **35** with the projection **63** on the frame.

If the handle **24** after this automatic opening is moved toward the left, the engagement of the projection **61** with the projection **62** on the trip arm **23** effects counterclockwise movement of the arm until its left-hand end is moved downward to its latching position. On the other hand, if the handle is moved toward the right hand from this central position, its engagement with the lever **33** causes this lever to reset the lever **23** while at the same time the circuit breaker is closed.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination in a circuit breaker provided with an enclosing casing made of insulating material and with switch contacts, operating mechanism therefor, and current responsive tripping means for said contacts inside said casing, of first and second conductors mounted in a wall of said casing and extending therethrough for the external connection of said circuit breaker in a predetermined circuit, an intermediate conductor mounted in a wall of said casing and extending therethrough, electric connections inside said casing including said current responsive means between said first conductor and said intermediate conductor, a current calibrated shunt conductor on the exterior of said casing electrically connected between said first conductor and said intermediate conductor, and an electric connection inside said casing from said intermediate conductor through said contacts to said second conductor.

2. The combination in a circuit breaker provided with an enclosing casing made of insulating material and with switch contacts, operating mechanism therefor, and a bimetallic thermostat for tripping said contacts mounted inside said casing, of means for effecting a predetermined standard adjustment of said thermostat for all current values at which said contacts are tripped, first and second conductors mounted in a wall of said casing and extending therethrough for the external connection of said circuit breaker in a predetermined circuit, an intermediate conductor mounted in a wall of said casing and extending therethrough, electric connections inside said casing including said thermostat between said first conductor and said intermediate conductor, a shunt conductor on the exterior of said casing electrically connected between said first conductor and said intermediate conductor for determining the final current tripping value of said thermostat, and an electric connection inside said casing from said intermediate conductor through said contacts to said second conductor.

3. The combination in a circuit breaker provided with an enclosing casing made of insulating material and with switch contacts, manually operated operating mechanism therefor, and a bimetallic bar thermostat for normally holding said operating mechanism to maintain said contacts in engagement with each other after they have been moved into engagement by said manual operating means, of adjustable holding means for said operating mechanism on the movable end of said thermostat, said holding means having a predetermined standard adjustment for all contact current tripping values of said thermostat, of first and second conductors mounted in a wall of said casing and extending therethrough for the external connection of said circuit breaker in a predetermined circuit, an intermediate conductor mounted in a wall of said casing and extending therethrough, electric connections inside said casing including said thermostat between said first conductor and said intermediate conductor, a shunt conductor on the exterior of said casing electrically connected between said first conductor and said intermediate conductor, and an electric connection inside said casing from said intermediate conductor through said contacts to said second conductor, said shunt conductor shunting around said thermostat a predetermined amount of the current passing through said contacts thereby to fix the value of the current through said contacts effecting separation of said contacts by said thermostat independently of said standard adjustment of said holding means.

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