

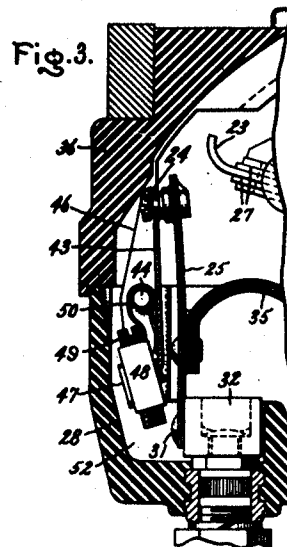
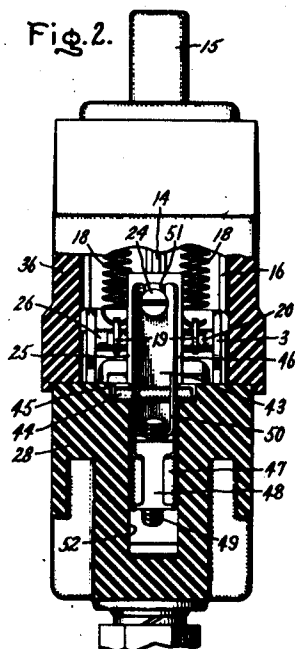
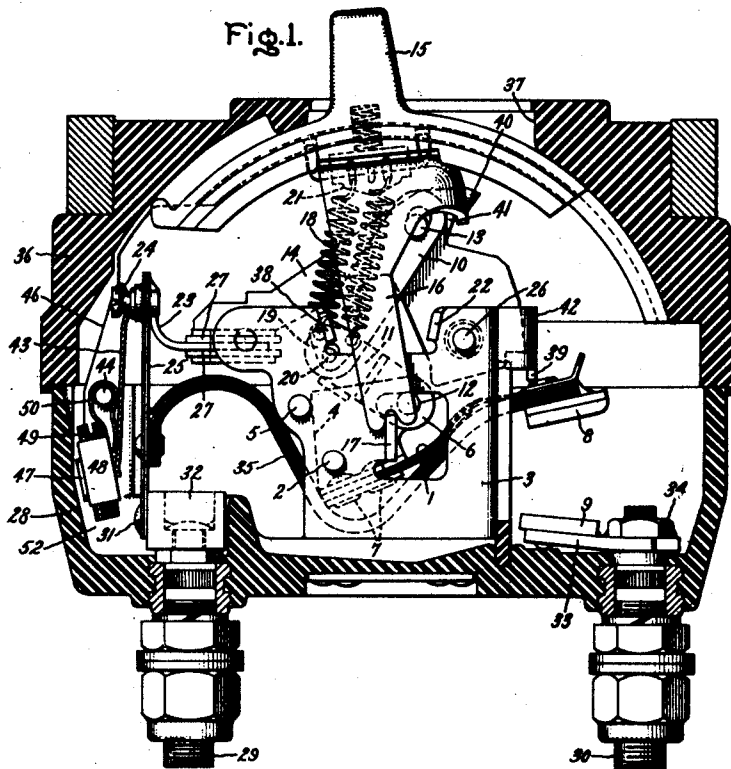
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CIRCUIT BREAKER

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CIRCUIT BREAKER

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4 Claims. (Cl. 74-2)

1 My invention relates to circuit breakers and more particularly to manually operated current responsive circuit breakers. From one viewpoint, my invention comprises an improvement in circuit breakers of the type disclosed in the co-
5 pending application of Fred G. von Hoorn for "Circuit Breaker," Serial No. 492,284, filed June 25, 1943, now Patent No. 2,422,508, and assigned to the same assignee as the instant application.

It is an object of my invention to provide a new and improved circuit breaker of the type described especially constructed to withstand shock.

It is another object of my invention to provide a circuit breaker having a current responsive thermal trip mechanism in which provision is made to prevent tripping of the mechanism when the breaker is subjected to severe shock or vibration.

It is a further object of my invention to provide a shock resistant circuit breaker which is simple in construction and reliable in operation.

In the accompanying drawing, Fig. 1 is a side elevation view in section of a circuit breaker constructed in accordance with my invention; Fig. 2 is an end view of a portion of the thermal trip mechanism, and Fig. 3 is a view of part of the current responsive mechanism in tripped position.

In carrying out my invention, in one form I provide a spring contact arm 1 mounted on a pin 2 supported between two upright sides of a supporting framework 3, only one side of which is shown. The contact arm comprises a rigid portion 4 pivoted on the pin 2 and adapted to engage a stop 5. It is also provided with an operating projection 6. The contact arm has secured to its lower end, as by rivets 7, the spring arm 1 on the end of which is secured a movable contact 8 cooperating with a stationary contact 9.

The breaker mechanism includes a toggle consisting of two links 10 and 11, the lower end of the link 11 being pivotally connected by a pin 12 to the operating projection 6, while the upper end of the link 10 is connected by pin 13 to the intermediate point of a normally fixed trip operating arm 14. Fig. 1 shows the breaker in open position. This toggle is set to close the circuit breaker by moving a handle 15 toward the right, as seen in the drawing. The handle is mounted on an inverted U-shaped operating member, only one arm 16 of which is seen, which embraces the supporting framework 3 and has the ends of its arms pivoted on lateral projections 17 secured to the framework. Two pairs of helical tension
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2 springs 18 are provided on opposite sides of the toggle. Each spring has one end connected to a plate 19 carried by the movable pivot 20 of the toggle and its other upper end connected to a clip 21 set in the operating member 16. Thus when the handle is moved on its pivot 17 toward the right until the center lines of the springs 18 are to the right of the pivot 13, the springs snap the pivot 20 toward the right thereby closing the circuit breaker. Movement of the operating arm 16 is limited by a stop 22. In its open position the rigid portion 4 of the contact arm rests against the stop pin 5.

Normally the left-hand end 23 of the arm 14 is secured by engagement with the end of a screw 24 carried by a thermostat or bimetallic blade 25, whereby the arm 14 is held against movement in a clockwise direction about its pivot 26 by the force applied by the springs 18. Upon the occurrence of a predetermined maximum current, however, the upper end of the thermostat 25 moves toward the left far enough to release the arm 14 which thereupon moves clockwise about its pivot and effects the movement of the contact arm to an open circuit position. The latching end 23 of the arm 14 is preferably a metal part which is secured to the end of the arm between layers of insulation 27 so as to be electrically insulated from the arm 14.

30 The mechanism, as shown, is enclosed in a casing or housing 28 made of a molded electrically insulating material, at the bottom of which the supporting framework 13 is secured. Electrical connections are made with the circuit breaker by means of two connectors or conductors 29 and 30 mounted in the lower wall of the casing and extending through the casing. The conductor 29 also serves as a support for the thermostat 25 whose lower end is electrically and mechanically connected, as by a riveted and
35 brazed joint 31, to a collar 32 secured on the conductor inside the casing. In a somewhat similar manner, the stationary contact 9 is mounted on a conducting strap 33 secured to the conductor 30 by a nut 34.

The circuit through the breaker between the external connectors 29 and 30 may be traced from the connector 29 through part of the thermostat 25, then through a flexible conductor 35 to the end of contact arm 1 and the movable contact 8. When the contacts 8 and 9 are closed, the circuit then leads through the two contacts and the conductor 30 to the exterior of the circuit breaker.

Adjustment of the current response of the

thermostat, or rather of the amount of deflection required of the thermostat to release the arm 14, can be effected by adjustment of the screw 24. It is contemplated, however, that this screw will be given a standard adjustment when the breaker is assembled. 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.

The mechanism thus far described is assembled together within the insulating casing 28 and then an insulating cover 36 is placed on the casing and held in position by bolts (not shown) extending through the four corners of the cover and casing. The handle 15 moves back and forth in an elongated slot 37 in the casing. Movement of the handle 15 and operating arm 16 in a clockwise direction is limited by the aforementioned stop 22. Movement of the handle in a counter-clockwise direction is limited by a second stop 38 struck up from the frame 3. A stop 39 is formed on the end of the frame against which the end of the contact arm 1 comes to rest when the circuit breaker is in open position.

When the arm 14 is released by the thermostat on overload, it moves clockwise to open the circuit breaker. It can be brought back with its end 23 in latching engagement with the screw 24 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 is moved in a counter-clockwise direction. After the arm 14 is latched with the thermostat, the handle may be moved clockwise to close the circuit breaker.

When the trip arm 14 is released by the thermostat, the springs 18 cause it to move clockwise about its pivot 26. This movement of the trip member 14 moves the pivot 13 to a position to the right of the center line of the spring so that 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 40 on the operating member 16 rests against a stop projection 41 on the trip arm 14. The trip arm 14 is brought to rest by the engagement of the arm with an abutment 42 on the frame 3.

If the handle 15 after this automatic opening is moved toward the left, the engagement of the projection 40 with the projection 41 on the trip arm 14 effects counter-clockwise movement of the arm until its left-hand end is moved downward to its latching position.

The circuit breaker thus far described is substantially the same as that disclosed in my aforementioned copending application, Serial No. 492,284. For most installations, such a circuit breaker is well suited for use as a current responsive circuit interrupter. However, when used in installations subjected to extreme shock or vibration, there is a tendency for the current responsive mechanism to snap open. The purpose of my present invention is to overcome this difficulty.

When subjected to shock, there is a tendency for the bimetal 25 to vibrate or flex slightly to release the end 23 of the trip arm to open the breaker. Since the bimetal 25 is fastened at its lower end and extends upwardly freely in space, the inertia of the screw 24, as well as the inertia of the bimetal itself, tends to rock the bimetal about the point at which it is fastened to the

casing. This tendency is overcome by providing the breaker with a pendulum which compensates for the tendency of the bimetal to deflect under conditions of shock or vibration.

To this end, I provide a pendulum 43 freely mounted on a pin 44 which, in turn, is mounted in a recess 45 in the lower casing 28. The pendulum is formed of sheet metal having spaced side walls 46 in which the pivot pin 44 is mounted. At one end of the pendulum, the side walls are bent over, as indicated at 47, to engage a counterweight 48 which is thus held in fixed position at the lower end of the pendulum. A screw 49 extends through the counterweight and may be threaded up and down to adjust the pendulum to compensate for different shock forces. It is held in adjusted position by frictional engagement with a spring 50 looped around pin 44. At the end opposite the counterweight, the pendulum is provided with a notch 51 for receiving the latch screw 24 so that the upper end of the pendulum is tied to the upper end of the bimetal thermostat 25. When in position on the casing 28, the pendulum rests in a recess 52 in which it is free to tilt back and forth.

It will be apparent that the pendulum does not interfere with the normal action of the bimetal 25 when the latter is deflected due to the heating effect of overload currents. Under such conditions, the bimetal simply moves to the left to release the trip arm 14; at the same time, the pendulum 43 pivots freely about the pin 44. This position of the parts is shown in Fig. 3. Since the weight of the pendulum is supported by the pin 44, the upper end of the pendulum floats in sliding engagement with the screw 24 so that no distorting forces are applied to the bimetal strip 25.

On the other hand, when the circuit breaker is subjected to a severe shock, any tendency of the upper end of the thermostat to move, for example to the left in the figures, will be immediately resisted by a corresponding movement of the upper end of the pendulum toward the right. This movement of the pendulum is induced by the tendency of the weight 48 to move to the left on the opposite side of the pivot 44. Thus, it will be seen that any movement of the weight 48 to the left will cause a corresponding movement of the upper end of the pendulum to the right, thereby effectively preventing movement of the bimetal strip to the left to cause unlatching of the trip arm 14. Should the shock come from the right as seen in Fig. 1 of the drawing, the effect on the pendulum 48 may be to tend to draw the bimetal 25 out of latching position with the arm 23. However, by the same shock, the bimetal 25 is itself being urged more strongly into latching position by an amount equal and opposite to the unlatching effect of the shock on the pendulum. Thus, regardless of the direction of applied shock forces, the arrangement prevents the thermal trip mechanism from tripping under conditions of severe shock or vibration.

The pendulum construction is one which may be easily applied to existing circuit breakers of the type disclosed in my aforementioned application, Serial No. 492,284. No modification of the circuit breaker mechanism is necessary other than the provision of the mounting slot and recess in the casing 28. These may be easily formed during the molding operation. The shock resistant circuit breaker is one which provides an accurate and positive operating thermal trip mechanism since the pendulum mechanism does

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not interfere with the operation under current overloads. Sensitiveness and reliability of the mechanism are not impaired. At the same time, the pendulum provides an effective means of preventing tripping of the mechanism when the circuit breaker is subjected to shock or vibration.

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

1. The combination of a support having mounted thereon a device which is adapted to be restrained and is biased to move upon being released, a deflectable element having a latch adapted to engage said device for restraining the same, said element and said latch being subject to deflection in an unlatching direction by mechanical shocks and a mass pivotally mounted on said support so as to tend to move under shock, said mass having secured thereto a substantially rigid arm positioned to bear against said deflectable element and, upon the occurrence of a shock, to exert a force directly against said element in a direction to oppose deflection in said unlatching direction of said element by such shock.

2. In a current responsive circuit breaker the combination of, a support, a trip arm for opening and closing the circuit breaker contacts, a bimetallic strip, one end of the strip being mounted on the support, the other upstanding free end engaging the trip arm to latch it in position, a substantially rigid member pivotally mounted on said support, a counterweight secured to one end of said member and the other end of said member engaging the free end of said strip, whereby upon the occurrence of a shock tending to move said free end of said strip in a direction to unlatch said trip arm, a force is applied to said strip by said other end of said member opposing such motion.

3. In a current responsive circuit breaker the combination of, a support, a trip arm for opening and closing the circuit breaker contacts, a bimetallic strip, one end of the strip being mounted

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on the support, the other upstanding free end being provided with a screw for engaging the trip arm to latch it in position, a substantially rigid member pivotally mounted on said support, a counterweight secured to one end of said member and the other end of said member having a slot for engaging said screw, whereby upon the occurrence of a shock tending to move said free end of said strip in a direction to unlatch said trip arm, a force is applied to said strip by said other end of said member to oppose such motion.

4. In a current responsive circuit breaker the combination of, a support, a trip arm for opening and closing the circuit breaker contacts, a bimetallic strip, one end of the strip being mounted on the support, the other upstanding free end engaging the trip arm to latch it in position, a substantially rigid member pivotally mounted on said support, a counterweight secured to one end of said member, means for adjusting the position of the center of mass of said counterweight from the pivot axis, the other end of said member engaging the free end of said strip, whereby upon the occurrence of a shock tending to move said free end of said strip in a direction to unlatch said trip arm, a force is applied to said strip by said other end of said member opposing such motion.

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