

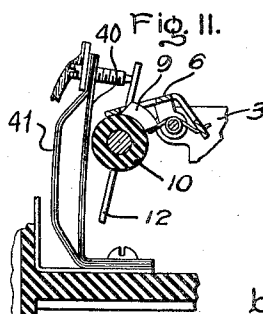
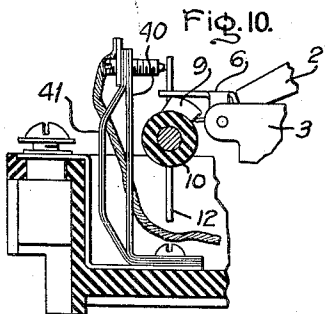
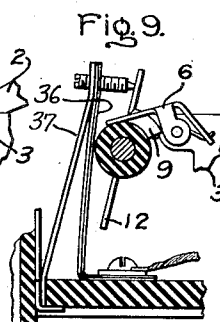
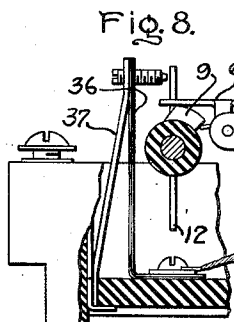
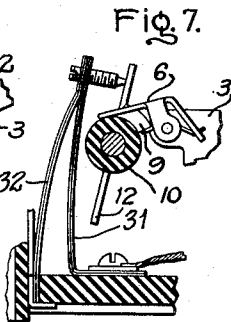
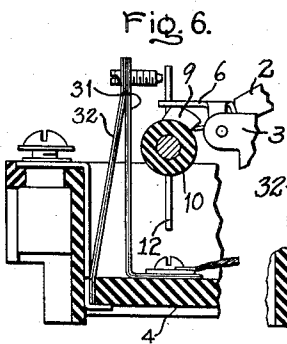
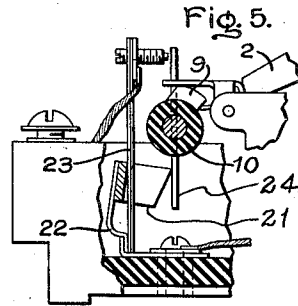
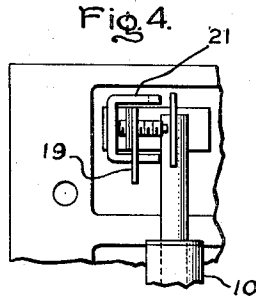
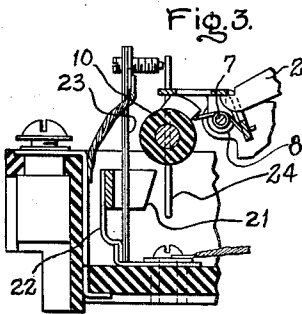
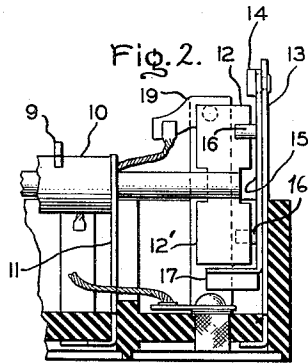
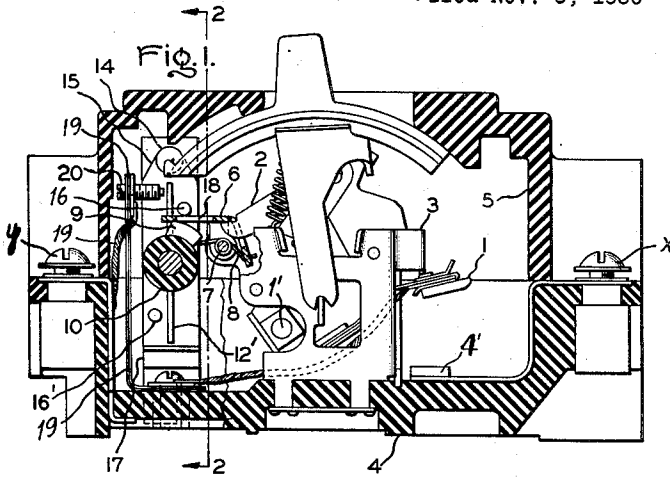
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R. G. PAGE

2,667,548

CIRCUIT BREAKER TRIP CONTROL DEVICE

Filed Nov. 9, 1950



Inventor:
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by *[Signature]*
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UNITED STATES PATENT OFFICE

2,667,548

CIRCUIT BREAKER TRIP CONTROL DEVICE

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pany, a corporation of New York

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10 Claims. (Cl. 200—116)

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My invention relates to circuit breaker trip control devices, and in particular to such devices which are adapted to be shock-resistant.

In circuit breakers of the type shown herein, a movable trip-restraining member is provided, which may be caused to move by thermal and/or magnetic means in response to current overloads to cause tripping or automatic opening of the breaker.

It is desirable that movement of such member be unimpeded by friction as much as possible in order that accuracy of calibration may be maintained. At the same time, it is also desirable that when the breaker is subjected to a physical shock, jarring or vibration, the parts of the trip device shall not be caused to move in such a way as to cause "false" tripping.

It is an object of the present invention to provide tripping means for a circuit breaker which permits tripping by thermal and/or magnetic means but which is not sensitive to physical shock.

It is a further object to provide such a tripping means which shall be simple and inexpensive to manufacture and which shall be reliable in operation.

It is a more specific object of my invention to provide a current responsive circuit breaker latch having means responsive to shock to prevent false tripping of the breaker without in any way inhibiting normal overcurrent operation.

Fig. 1 is a side elevation and partial section of a circuit breaker embodying one form of my invention, the parts being shown in the normal open-circuit position.

Fig. 2 is a sectional view of a fragment of the breaker of Fig. 1, taken on the line 2—2 of Fig. 1.

Fig. 3 is a side elevational view in section of a modified form of my invention utilizing the magnetic member of a tripping mechanism as an inertia latch and showing the parts in their reset position; Fig. 4 is a top view of the tripping mechanism of Fig. 3 and Fig. 5 is the same view as shown in Fig. 3 except that the parts are illustrated in the positions assumed after the mechanism has been subjected to shock.

Fig. 6 is a side elevational view in section of another modification of my invention utilizing a reinforced bimetallic member as a means of minimizing fault tripping due to shock and Fig. 7 illustrates the same view with the parts in the position assumed when the mechanism is tripped.

Figs. 8 and 10 are side elevational views of further modifications utilizing reinforced bimetallic trip members with the parts in the position assumed when the breaker is reset and Figs. 9 and 11 are corresponding views showing parts of the mechanism in the tripped position.

The circuit breaker mechanism is conventionally mounted and may accommodate any

number of poles. In this instance, the invention is shown as applied to a three-pole unit, the base having three chambers (only one shown), in one of which the mechanism is located which controls switching members located in each of the chambers.

The circuit breaker operating mechanism may be of any suitable type. For convenience, I have shown the invention used with an operating mechanism similar to that shown and described in Patent 2,455,753, issued December 7, 1948, to B. E. Getchell.

This operating mechanism shown is of the quick-make quick-break type employing an over-center toggle as more particularly described in the above-mentioned patent.

The mechanism has a switch contact member 1 hinged at 1' and actuated manually in a conventional manner and the circuit is opened automatically in case of an overload. This mechanism is suitably carried by a frame 3 which is mounted in a housing having a base 4 and a cover 5. The stationary switch contact 4' is mounted on the base and connected to the circuit terminal x.

The mechanism is provided with a spring-pressed trip arm 2 which is normally held from moving by suitable latch means to be described and which is releasable to cause automatic opening of the contacts upon the occurrence of predetermined circuit conditions.

Referring to Fig. 1, the trip arm 2 is normally restrained from moving in an upward direction by a restraining latch 6, pivoted at 7. The engagement of trip arm 2 with the latch 6 tends to rotate the latch counter-clockwise about its pivot 7 against the bias of a coiled spring 8. The latch 6 is prevented from rotating in this manner, however, by its engagement with a metal fin 9, carried by latch locking shaft 10.

The shaft 10 is supported for rotation by two brackets 11 (only one shown), and carries at one end thereof two outwardly extending fins 12 and 12'.

Extending upwardly from the base 4, adjacent the fins 12, 12' is a bracket 13, having an L-shaped pendulous inertia member 15 mounted for rotation thereon by means of a pin or rivet 14, and having two projecting pins 16 and 16' and having a weight 17 attached at its foot as by soldering.

Also extending upwardly from base 4 adjacent fins 12 and 12' is a bimetal member or other current actuated member 19 carrying a calibrating screw 20 and in circuit with the switch member 1 and the terminal y.

In operation an excess current traversing member 19 causes it to deflect to the right as seen in Fig. 1 so that the tip of calibrating screw 20 contacts the upper fin 12 and rotates shaft 10

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in a clockwise direction, causing fin 9 to clear opening 18, thereby allowing the latch 6 to rotate slightly in a counter-clockwise direction, releasing the trip arm 2 to cause opening of the breaker.

It will be observed that during such normal overload operation, L-shaped member 15 remains inactive and in no way restrains or aids tripping because of a certain amount of lost motion between the member 15 and the fins 12 and 12', i. e., the shaft 10 and fins 12 and 12' are free to rotate within limits between the pins 16 and 16' of the inertia member 15.

On the occurrence of a shock which tends to cause the upper end of member 19 together with calibrating screw 20 to move to the right to contact fin 12, which action if unrestrained, would cause false tripping. L-shaped member 15 and its weight 17, however, also move to the right when the breaker is subjected to such a shock and this causes pin 16' to contact fin 12', and tends to rotate shaft 10 in a counter-clockwise direction, opposing the action of member 19.

If a shock should occur in such a way as to cause pendulous L-shaped member 15 to move to the left as seen in Fig. 1, pin 16 will come in contact with fin 12 and likewise tend to rotate shaft arm 10 counter-clockwise to restrain tripping.

This is important since the L-shaped member 15, in swinging due to vibration or shock, may get out of phase with the vibration of the bimetal, and be moving to the left as seen in Fig. 1, while the bimetal or some other force tends to rotate shaft arm 10 so as to cause tripping. In such a case, the L-shaped member 15 will still act to prevent such tripping.

In other words, regardless of which way L-shaped member 15 swings about its pivot 14, the engagement of the pins 16, 16', with the fins 12, 12' is such as to exert a force on it in a counter-clockwise direction.

In Figs. 3, 4 and 5, I have shown a magnetic trip element used as an "inertia latch." In this form, 21 is a U-shaped piece of magnetic material such as soft iron, supported on a resilient mounting strip 22 anchored to the base and arranged so as to embrace bimetal 23. Fin 24 is also made of magnetic material so that when a surge of current passes through bimetal 23, the magnet is energized and the effect of the magnetic field will be to pull fin 24 toward magnet 21 to cause tripping.

When this system is subjected to a shock such as would cause the bimetal to move to the right so as to tend to cause tripping, magnet 21 also moves to the right under the effect of the shock as shown in Fig. 5 and prevents fin 24 from moving back, thereby preventing tripping.

The shock-resistance of a circuit breaker embodying my invention may be improved further by means of the special current actuated systems of Figs. 6 to 11.

In Figs. 6, 8 and 10 the parts are shown in the positions assumed in the closed position of the breaker and in Figs. 7, 9 and 11 the same parts are shown in the positions assumed after the breaker has tripped. The parts other than those of the reinforced bimetal members correspond to parts illustrated in Figs. 1 and 2 and the same reference numerals have been used to designate corresponding parts.

In the system of Fig. 6, I provide two bimetal elements 31, 32 joined together at one end, and fixedly supported on the base 4 to form a rigid triangular structure. When subjected to heat,

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such as caused by an excess current, both bimetals deflect as shown in Fig. 7 to cause tripping. The structure being rigid, it is unlikely to bend except by heat.

In the system of Fig. 8, I employ a similar triangular structure made up of two members, one of which, 36, is a bimetallic member, and the other of which 37 is a single metal strip having a high degree of linear expansion. When this system is subjected to heat it deflects as shown in Fig. 9, the bimetal 36 deflecting while the metal strip 37 merely becomes slightly longer.

In the system of Figs. 10 and 11, I provide a bimetal member 40, having connected in parallel therewith, a reinforcing bimetal 41. When subjected to heat, both bimetals deflect as shown in Fig. 11.

It will be seen that in all of the systems of Figs. 6 and 7, 8 and 9, and 10 and 11, I have provided bimetal systems which, although they will deflect when subjected to heat, such as that caused by a current passing therethrough, are extremely rigid and not subject to deflection by shock or vibration.

It will be seen that I have provided a trip device for circuit breakers which is highly shock-resistant and yet simple and inexpensive in construction.

While I have described only certain preferred embodiment of my invention by way of illustration, many modifications will occur to those skilled in the art, and I therefore wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

I claim:

1. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, latching means normally engaging said trip member to restrain its movement and including at least one movable member, means movable in response to the current traversing said contacts to engage said movable member and move it to a latch-releasing position, said current responsive means being similarly movable in response to a shock force in one direction, and an unbalanced inertia member having a lost motion connection with said movable member and movable in response to such shock force to engage said movable member and oppose its movement to latch-releasing position.

2. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, latching means normally engaging said trip member to restrain its movement and including at least one movable member, means movable in response to the current traversing said contacts to engage said movable member and move it to a latch-releasing position, said current responsive means being similarly movable in response to a shock force in one direction, and an unbalanced inertia member having a lost motion connection with said movable member and movable in one direction in response to such shock force and also in the opposite direction to engage said movable member and oppose its movement to latch-releasing position.

3. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, latching means normally engaging said trip member to restrain its movement and including at least one movable member, means movable in response to

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the current traversing said contacts to engage said movable member and move it to a latch-releasing position, said current responsive means being similarly movable in response to a shock force in one direction, and a pendulum swingable in response to such shock force to engage said movable member and oppose its movement to latch-releasing position.

4. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, latching means normally engaging said trip member to restrain its movement and including a rotatable member, means movable in response to the current traversing said contacts to engage said rotatable member and move it to a latch-releasing position, said current responsive means being similarly movable in response to a shock force in one direction, and a pendulum having a lost motion connection with said rotatable member and swingable in either direction to engage said rotatable member and oppose its movement to latch-releasing position, said pendulum being swingable in one direction in response to shock force in said one direction.

5. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, latching means normally engaging said trip member to restrain its movement and including a rotatable member having oppositely extending radial arms, means movable in response to the current traversing said contacts to engage said rotatable member and move it to a latch-releasing position, said current responsive means being similarly movable in response to a shock force in one direction, and a swingable pendulum having a lost motion connection with said rotatable member, said lost motion connection comprising projections on said pendulum engageable with opposite sides of said opposite radial arms whereby one of said projections engages one of said arms upon movement of said pendulum in either direction thereby to oppose movement of said rotatable member to latch-releasing position.

6. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, a releasable latch member normally engaging said trip member to restrain its movement and biased to releasing position, a movable locking member normally engaging said latch member to retain it in latching position, means movable in response to the current traversing said contacts to engage said locking member and move it to release said latch member, said current responsive means being similarly movable in response to a shock force in one direction, and an unbalanced inertia member movable in response to such shock force to engage said movable member and oppose its movement to latch-releasing position.

7. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, a releasable latch member normally engaging said trip member to restrain its movement and biased to releasing position, a rotatable locking member normally engaging said latch member to retain it in latching position, means movable in response to the current traversing said contacts to engage said locking member and move it to release said latch member, said current responsive means being similarly movable in response to a

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shock force in one direction, and an unbalanced inertia member having a lost motion connection with said rotatable locking member and movable in one direction in response to such force and also in the opposite direction to engage said locking member and oppose its movement to latch-releasing position.

8. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, a releasable latch member normally engaging said trip member to restrain its movement and biased to releasing position, a movable locking member normally engaging said latch member to retain it in latching position, means movable in response to current traversing said contacts to engage said locking member and move it to release said latch member, said current responsive means being similarly movable in response to a shock force in one direction, and a swingable pendulum normally spaced from said locking member and movable in response to such shock force to engage said locking member and oppose its movement to latch-releasing position.

9. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, a releasable latch member normally engaging said trip member to restrain its movement and biased to releasing position, a rotatable locking member normally engaging said latch member to retain it in latching position and including a pair of oppositely directed radial arms, means movable in response to current traversing said contacts to engage said locking member and move it to release said latch member, and a swingable pendulum having a lost motion connection with said rotatable locking member and movable in either direction to engage said locking member and oppose its movement to latch-releasing position, said lost motion connection comprising projections on said pendulum normally spaced from and engageable with opposite sides of said oppositely directed radial arms.

10. In a circuit breaker having cooperating switch contacts, a trip member movable to effect automatic separation of said contacts, latching means normally engaging said trip member to restrain its movement and including at least one movable member, a thermally responsive member deformable in response to the current traversing said contacts to engage said movable member and move it to a latch-releasing position, said thermally responsive member being similarly deformable in response to a shock force in one direction, and a U-shaped magnetizable member resiliently mounted to embrace said thermally responsive member and disposed for movement in response to such shock force to a position of engagement with said movable member to oppose movement of said movable member to latch-releasing position.

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