May 19, 1953 R. N. ROWE 2,639,347

ELECTRIC CIRCUIT BREAKER

Filed Dec. 4, 1948

Fig. 1.

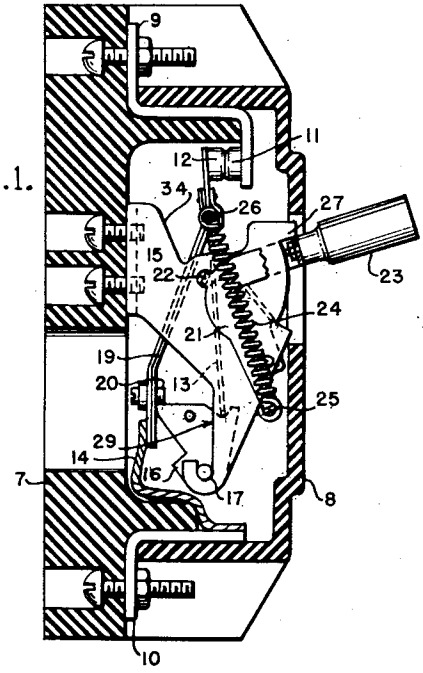



Fig. 2.

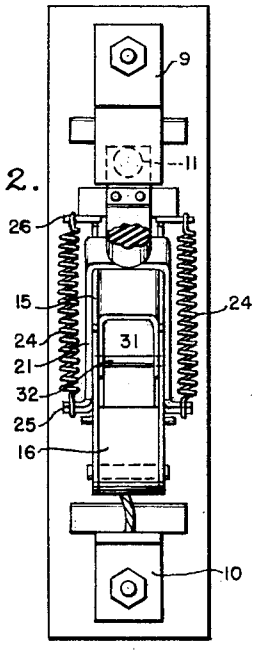



Fig. 3.

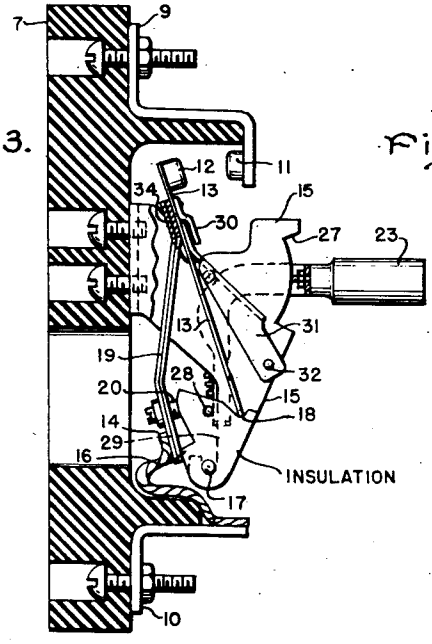
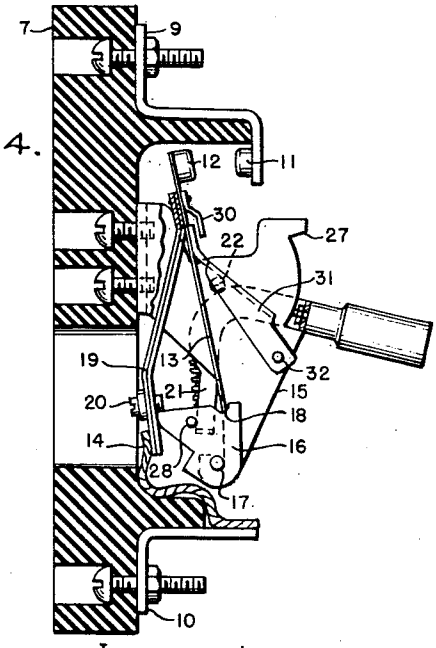



Fig. 4.




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## ELECTRIC CIRCUIT BREAKER

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Application December 4, 1948, Serial No. 63,578

9 Claims. (Cl. 200—116)

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My invention relates to the type of switch in which the circuit may be opened and closed manually, opened automatically upon an overload and reset manually.

The main object is to provide a compact form of mechanism of the toggle type which is simple, reliable and inexpensive.

Another object is to provide a maximum contact pressure with a minimum latch pressure.

Another object is to provide a circuit breaker of the foregoing type which is simple in construction and easy to assemble and calibrate.

Another object is to provide a circuit breaker in which the accuracy of calibration does not depend on or vary with dimensional stability of the supporting frame or housing.

The drawing shows an enclosed switch in which Fig. 1 is a longitudinal sectional view through a housing and showing switch mechanism involving one form of my invention in its closed circuit position.

Fig. 2 is a plan view of the parts of Fig. 1, with the cover removed.

Fig. 3 is a view similar to Fig. 1 but with the switch parts in the automatically tripped position.

Fig. 4 is a longitudinal sectional view of the base of the housing with the mechanism in the manually open circuit position.

The housing consists of an insulating base 7 with an insulating cover 8. The terminals 9 and 10 are secured to the base. The stationary contact 11 is connected to terminal 9 and the movable switch contact 12 is carried by the switch arm 13 which is hinged to the trip member 16 and moves between the walls of the U-shaped frame 15.

The trip member 16 of insulating material is pivoted at 17 in the frame and supports one end of the switch arm 13 in the hinge bearing or pivot 18. The bimetal latch arm 19 is secured at one end to the switch arm 13 near contact 12 and near its other end carries an adjustable stud 20 which coacts with the trip member 16 and is connected to terminal 10 by the flexible conductor 14.

The manually operable lever 21 is pivoted at 22 in the frame and has a knob or handle 23. The springs 24, 24 connect the end 25 of lever 21 with the lugs 26 on the switch arm 13 near the contact end 12. The springs thrust the switch member 13 against the trip member at one side of the pivot 17 and thrust the latch member 19 against the trip member at the opposite side of the pivot 17.

In the normal "on" position, the over-center

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springs 24, 24 pull against the lever 21 which is pivoted at 22 and bias the handle of the lever against the shoulder 27 on the frame. The principal reacting forces of the springs are taken up by the switch arm 13 bearing against the trip member at 18 and in turn pressing against the hinge 17 in the frame. The springs tend to rotate the trip member clockwise as viewed in the drawings but are opposed by the pressure of the trip member against the latch stud 20.

To open the circuit manually, the lever 21 is turned clockwise (as viewed in Fig. 1). This carries the end 25 of the lever and spring to the opposite left-hand side of the center line passing through the points 22 and 26 and snaps the switch arm and trip member as a unit about the pivot 17 to the "off" position, the lever 21 resting against the pin 28 on the trip member and the switch member resting against the frame at 34 and the tip of arm 19 pressing against the trip member as shown in Fig. 4. Reversal of the action closes the circuit.

As shown in Figs. 1 and 2, the pivot 18 lies on the right-hand side of the line joining the spring connection lugs 26 with the trip member pivot 17, i. e. on the side in the circuit-closing direction. The portion of the switch arm 13 lying between the pivots 26 and 18, therefore, constitutes one arm of a toggle, the other arm being formed by the portion of the trip member 16 lying between the pivots 17 and 17. This toggle is normally in compression due to the force of the springs 24, and is moreover normally in a slightly over-set condition, as shown in the drawings, since the knee pivot 18 is on the right-hand side of the line joining pivots 26 and 17.

Upon the occurrence of excess current through the breaker contacts, the bimetal arm 19 is warped in a direction away from the arm 13 by the heat developed by the passage of current therethrough. When the bimetal arm 19 has deflected sufficiently, it disengages the stud 20 from the trip member 16. The entire horizontal component the spring 24 is then exerted upon the trip member 16 at the pivot 18. This causes the toggle formed by members 13 and 16 to collapse, the trip member 16 turning clockwise so that the lower end of the switch arm 13 shifts slightly toward the right hand and the switch arm moves downward endwise until the bracket 30 engages the end of the guide arm 31 as shown in Fig. 3. This guide arm 31 is mounted on a fixed pivot 32 on the side of the spring 24 opposite the switch arm 13 when the switch arm is in the closed position as shown in Fig. 1. Thereafter the switch

arm 13 carrying the movable contact 12 and the bimetal arm 19 is mounted on the guide arm and is rotated by the springs 24 about the pivot 32 to the fully tripped open position of Fig. 3, the switch arm being connected at its end by the bracket 30 to the end of the guide arm 31 so as to be supported by the guide arm. The bracket 30 provides for relative sliding movement between the end of the guide arm and the switch arm during manual operation of the circuit breaker.

The guide member 31 as described provides for movement of the lower ends of the operating springs 24 to positions a substantial distance to the right of the pivot 18 of the switch arm, as shown in Fig. 1, while at the same time providing for automatic opening. It will be observed that with the operating springs in the position of Fig. 1, a high contact pressure is obtained for a given spring force because of the relatively large component of the spring pressure toward the right hand.

This tripping action as described will occur regardless of whether the operating handle 23 is held in the closed position as shown in Fig. 1. As the described opening action occurs, however, the springs 24 are carried across the pivot point 22 of the handle so that if the handle is manually restrained during tripping, it will immediately be moved clockwise to the mid-position as indicated in Fig. 3 upon its release thereafter. If the handle is not restrained, it will move to the mid-position as shown immediately upon tripping.

In the mid or tripped position of Fig. 3, the handle and operating lever 21 are biased in a clockwise direction by the springs 24 against the pin 28 carried by the trip member 16.

To reset or prepare the breaker for use after an automatic opening, the bimetal having cooled sufficiently, it is merely necessary to move the switch handle clockwise from the position of Fig. 3 to the position of Fig. 4. During this movement, the handle rotates trip member 16 in a clockwise direction by reason of the engagement of the lever 21 with the pin 28 until the latching portion of trip member 16 is returned to the position of Fig. 4, i. e. moved past the latch stud 20 so as to be secure thereby.

It will be seen that I have provided an extremely simple mechanism which furnishes all the desirable attributes of an automatic circuit breaker, i. e. operates with a quick-make-and-break or snap action, is trip-free (i. e. cannot be held closed on an overload), and is trip-indicating (i. e. handle goes to a mid-position on tripping).

Moreover, by reason of the construction shown, the accuracy of calibration does not depend upon or vary with dimensional stability of the supporting frame or housing because calibration is determined by adjusting the spacing between the tip of stud 20 and the end of arm 13 in relation to the trip member 16. It is, therefore, possible to calibrate the mechanism apart from the frame or housing by merely comparing these two parts such as by pre-assembling them with the aid of a supporting jig.

I claim:

1. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, latching means normally engaged to secure said switch member against pivotal movement relative to said trip member, a spring connected to said switch member for applying an endwise force pressing said switch member against said trip member, manual means for moving said spring to move the direction of its force from one side to the other of the pivot of said trip member to effect movement of said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, and means responsive to the current through said contacts for disengaging said latching means upon the occurrence of a predetermined high current thereby to provide for pivotal movement of said switch member relative to said trip member.



2. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, a latch arm having one end secured to said switch member and its other end in engagement with said trip member on the opposite side of said pivot thereby normally to secure said switch member against pivotal movement relative to said trip member, an operating member, a spring having its ends connected respectively to the movable end of said switch member and to said operating member for pressing said switch member and said latch arm against said trip member and upon movement of said operating member for moving said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, and means responsive to the current through said contacts for causing said latch arm to disengage said trip member upon the occurrence of a predetermined high current thereby to provide for pivotal movement of said switch member relative to said trip member.

3. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, a bimetal latch arm having one end secured to said switch member adjacent its movable end and extending into engagement with said trip member on the opposite side of said pivot thereby normally to secure said switch member against pivotal movement relative to said trip member, a pivotally mounted operating lever, an over-center spring having its ends connected respectively to the movable end of said switch member and the end of said operating lever so that movement of said operating lever effects snap movement of said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, and connections for heating said bimetal arm in response to the current through said contacts to cause said bimetal arm to disengage said trip member upon the occurrence of a predetermined high current thereby to provide for pivotal movement of said switch member relative to said trip member.

4. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement

with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, latching means normally engaged to secure said trip member against pivotal movement relative to said switch member, a spring connected at one end to said switch member for applying an endwise force pressing said switch member against said trip member, means for moving the other end of said spring to move the direction of its force from one side to the other of the pivot of said trip member thereby to move said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, a guide arm having a pivot on the side of said spring force direction opposite said switch member when said switch member is in said closed circuit position, a connection between the movable end of said guide arm and said switch member for mounting said switch member on said guide arm upon endwise movement of said switch member, and means responsive to the current through said contacts for disengaging said latching means upon the occurrence of a predetermined high current whereupon said trip member turns on its pivot and said switch member moves endwise into mounting engagement with said guide arm for movement by said spring about the pivot of said guide arm to an open circuit position.

5. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, a bimetal latch arm having one end secured to said switch member and its other end engaging said trip member on the opposite side of said pivot, a spring connected at one end to said switch member for applying an endwise force pressing said switch member against said trip member, means for moving the other end of said spring to move the direction of its force from one side to the other of the pivot of said trip member thereby to move said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, a guide arm having a pivot on the side of said spring force direction opposite said switch member when said switch member is in said closed circuit position, a connection between the movable end of said guide arm and said switch member for mounting said switch member on said guide arm upon endwise movement of said switch member, and connections for heating said bimetal arm in response to the current through said contacts so as to cause said bimetal arm to disengage said trip member upon the occurrence of a predetermined high current whereupon said trip member turns on its pivot and said switch member moves endwise into mounting engagement with said guide arm for movement by said spring about the pivot of said guide arm to an open circuit position.

6. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, latching means normally engaged to secure said switch member against pivotal movement relative to said trip member, a spring connected to said switch member for applying an endwise force pressing said switch member against said trip member, manual means for moving said spring to move the direction of its force from one side to the other of the pivot of said trip member to effect movement of said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, means responsive to the current through said contacts for disengaging said latching means upon the occurrence of a predetermined high current, a guide arm having a pivot on the side of said spring force direction opposite said switch member when said switch member is in said closed circuit position, and a connection between said guide arm and said switch member providing for movement of said switch member relative to said guide arm during manual operation of said switch member but supporting said switch member on said guide arm upon disengagement of said latching means thereby to provide for movement of said switch member together with said guide arm by said spring to an open circuit position.

7. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, a latch arm mounted on said switch member extending into engagement with said trip member on the opposite side of said pivot thereby normally to secure said switch member against pivotal movement relative to said trip member, an elongated spring connected at one end to said switch member for applying an endwise force pressing said switch member and latch arm against said trip member, means for moving the other end of said spring from one side to the other of the pivot of said trip member to effect movement of said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, means responsive to the current through said contacts for causing said latch arms to disengage said trip member upon the occurrence of a predetermined high current, a guide arm having a pivot on the side of said spring opposite said switch member when said switch member is in said closed circuit position, and a connection between said guide arm and said switch member providing for movement of said switch member relative to said guide arm during manual operation of said switch member but supporting said switch member on said guide arm upon disengagement of said trip member by said latch arm thereby to provide for movement of said switch member together with said guide arm by said spring to an open circuit position.

8. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, a bimetal latch arm secured to said switch member and extending into engagement with said trip member on the opposite side of said pivot thereby normally to secure said switch member against pivotal movement relative to said trip member, an operating member, a spring having its ends connected respectively to said switch member and

said operating member so that movement of said operating member effects movement of said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, connections for heating said bimetal arm in response to the current through said contacts so as to cause said arm to warp and disengage said trip member upon the occurrence of a predetermined high current, a guide arm having a pivot on the side of said spring opposite said switch member when said switch member is in said closed circuit position, and a loose connection between said guide arm and said switch member, said connection providing for movement of said switch member relative to said guide arm during manual operation of said switch member but supporting said switch member on said guide arm upon disengagement of said trip member by said bimetal arm thereby to provide for movement of said switch member together with said guide arm by said spring to an open circuit position.

9. A circuit breaker comprising a stationary contact, a pivotally mounted trip member, a switch member having a contact at one end movable to a closed circuit position into engagement with said stationary contact and having its other end pivotally mounted on said trip member on one side of the pivot of said trip member, a bimetal latch arm having one end secured to said switch member adjacent its movable end and extending into engagement with said trip member on the opposite side of said pivot thereby normally to secure said switch member against pivotal movement relative to said trip member, a pivotally mounted operating lever, an over-center spring having its ends connected respectively to the movable end of said switch member and the end of said operating lever for applying an endwise force pressing said switch member and bimetal arm against said trip member so that movement of said operating lever to move its end of said spring from one side to the other of the pivot of said trip member effects snap movement of said switch member and said trip member as a unit about the pivot of said trip member between closed and open circuit positions, connections for heating said bimetal arm in response to the current through said contacts so as to cause said arm to warp and disengage said trip member upon the occurrence of a predetermined high current, a guide arm having a pivot on the side of said spring opposite said switch member when said switch member is in said closed circuit position, and a sliding connection between the movable end of said guide arm and the movable end of said switch member, said connection providing for relative sliding movement between said ends during manual operation of said switch member but supporting said switch member on said guide arm upon disengagement of said trip member by said bimetal arm thereby to provide for movement of said switch member together with said guide arm by said spring to an open circuit position.



RAYMOND N. ROWE.


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