Feb. 23, 1943. J. G. JACKSON 2,312,169

CIRCUIT BREAKER

Filed July 28, 1941 2 Sheets-Sheet 1

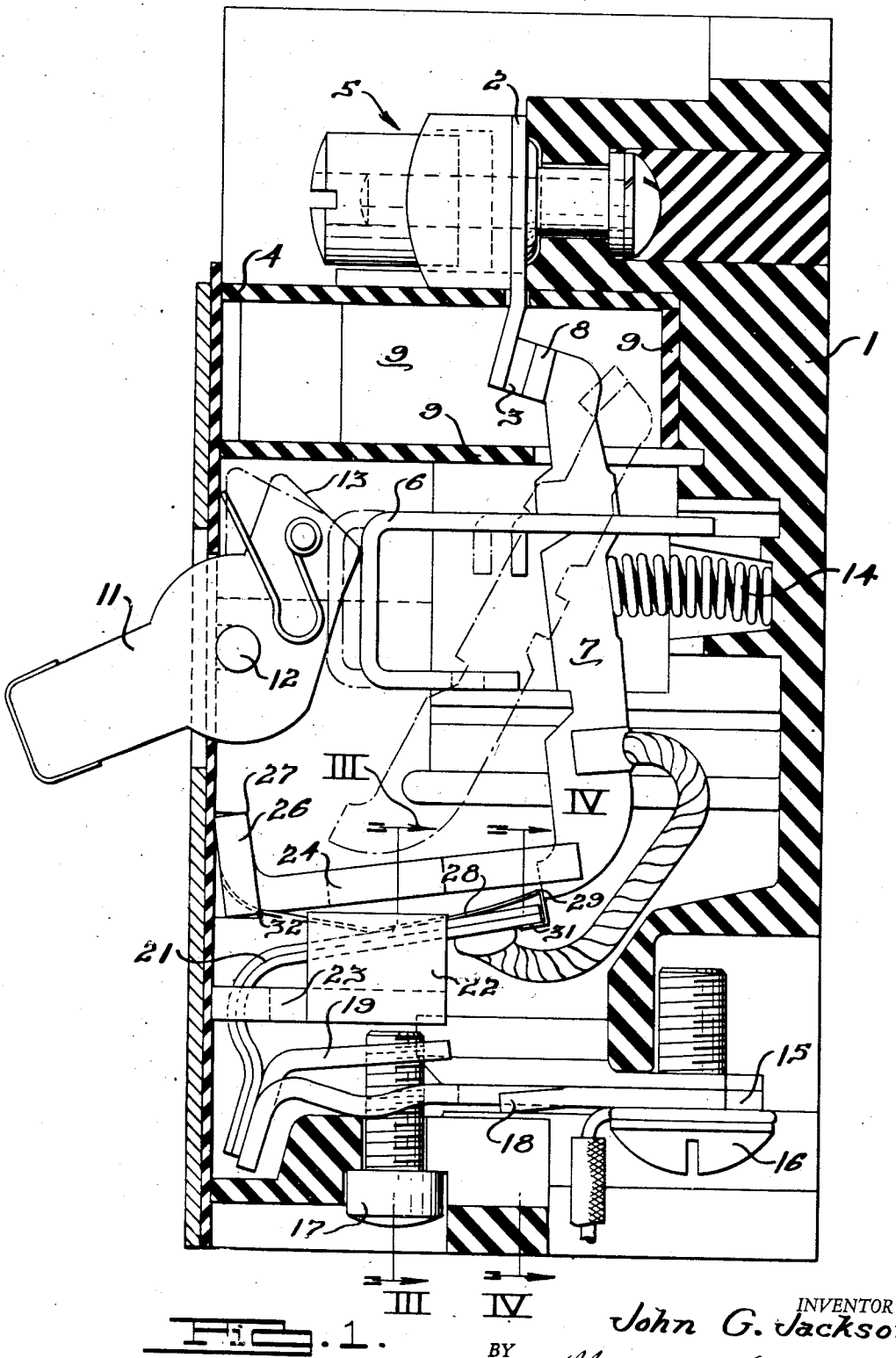


FIG. 1.

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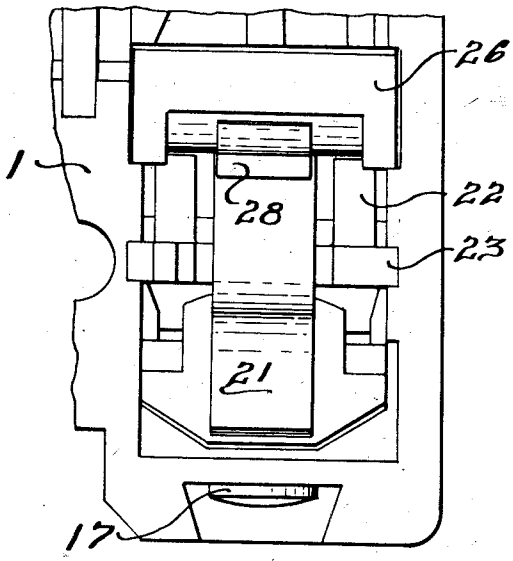


Fig. 2.

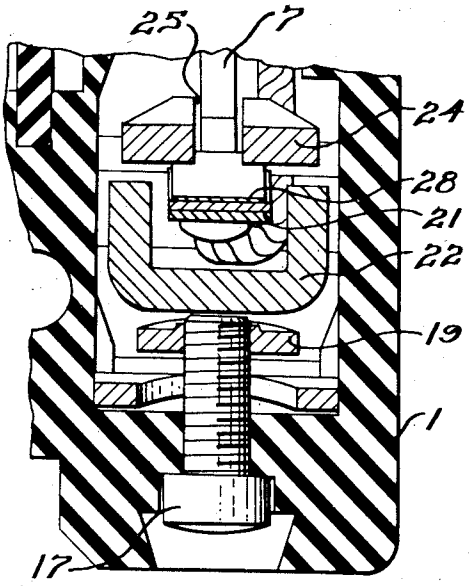


Fig. 3.

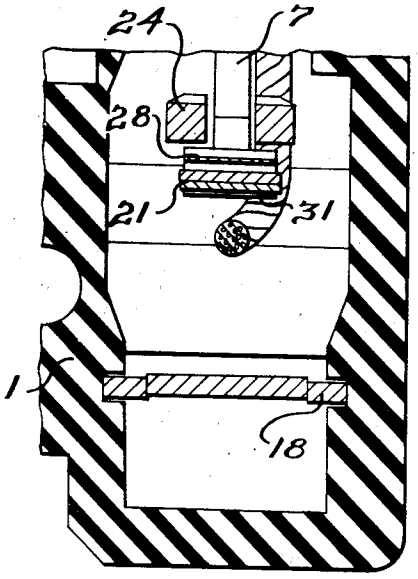


Fig. 4.

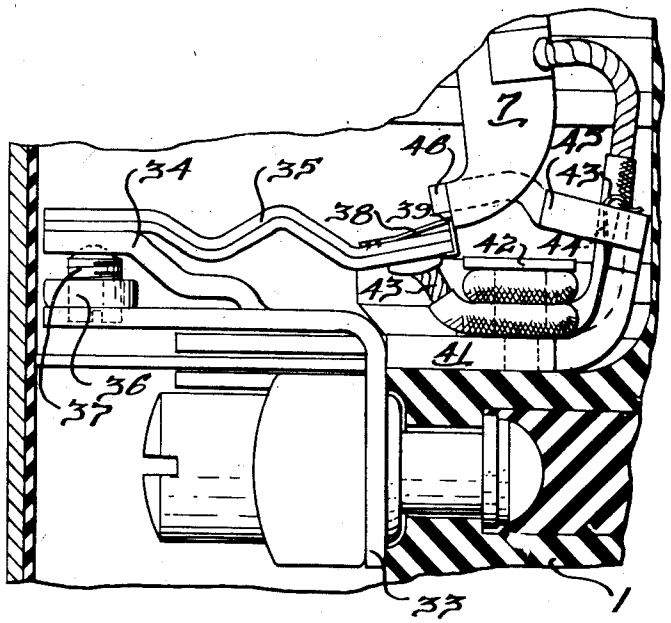


Fig. 5.

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UNITED STATES PATENT OFFICE

2,312,169

CIRCUIT BREAKER

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Application July 28, 1941, Serial No. 404,300

10 Claims. (Cl. 200—88)

This invention relates to automatic electric circuit breakers and more particularly to the current responsive tripping means for effecting the automatic opening of such circuit breakers upon current overload.

One object of the present invention is to provide a simple and economical but effective combined thermal and magnetic tripping means for an automatic electric circuit breaker.

Another object of this invention is to provide tripping means for an automatic electric circuit breaker including a current responsive bimetallic member having supported thereon a latching surface movable bodily with the bimetallic member and also movable magnetically independent of the bimetallic member into a releasing position.

Another object of the invention is to provide a current responsive bimetallic element with a latching surface provided by a thin metallic strip which renders unnecessary the grinding of the latching surface on the bimetal.

Other objects and features of the invention will be readily apparent to those skilled in the art from the specification and appended drawings illustrating certain preferred embodiments in which:

Figure 1 is a vertical sectional view of the form of circuit breaker including the current responsive tripping means of the present invention.

Figure 2 is a detail plan view of the tripping means according to the present invention shown with the circuit breaker cover removed.

Figure 3 is a detail sectional view on the line III—III of Figure 1.

Figure 4 is a detail sectional view on the line IV—IV of Figure 1.

Figure 5 is a partial vertical sectional view of a modification.

The present invention has been illustrated in connection with a circuit breaker mechanism which comprises a base 1 having a conducting strap 2 mounted on one end ledge thereof and carrying at its interior end a stationary contact 3, the connector 2 extending through an opening in a fiber plate 4 which closes the end of the base. Exterior of the plate 4 is a terminal connector 5 for the attachment of circuit wiring. Guided for rectilinear movement within the base is a generally U-shaped element 6 upon whose long leg is pivotally mounted, by interengaging notches, a contact bar 7 carrying at one end a movable contact 8 cooperating with the stationary contact 3. Fiber plates indicated at 9 combine with the plate 4 to enclose the contacts 3 and 8 within an arcing chamber. An operating handle is provided at 11 pivotally mounted upon a shaft 12 and having a cam surface 13 cooperating with the flat surface of the member 6 to effect manual movement of the contact bar 7. A compression spring 14 is disposed between the bottom of the base 1 and the bar 7 to bias the same.

The lower end of the base is provided with an end facing terminal comprising a conducting connector 15 inserted in slots in the opposite side walls of the base from the front and maintained against endwise removal by both a terminal screw 16 and an adjusting stud 17. A mid-portion of the connector is pressed outwardly at 18 to take up any slack or play in the connector mounting. A tab 19 is pressed out of the connector and the stud 17 is threaded into the tab 19 to provide for adjustment of the free end of a bimetallic member 21 welded on the end of the connector, thus providing for adjustment of the calibration of the breaker. Embracing the bimetallic element 21 is a magnetic yoke 22 which is of generally U-shape and which has a widened forward extension at 23 received within slots in the opposite side walls of the base to mount the yoke, as more particularly shown in Figure 2. A magnetic armature element 24 is provided having a central slot 25 through which the latching end of the contact bar passes in its automatic tripping and resetting movements. The upper end of the armature is provided with a widened flange 26 received in slots in the opposite side walls of the base and serving to pivotally support the armature for swinging movement about the point 27. Mounted upon the bimetallic member 21 is a resilient spring strip 28 welded to an intermediate point on the bimetal and extending in opposite directions. At the free end of the bimetal, the strip 28 is formed to provide a latching tip at 29 biased by its resiliency away from the plane of the bimetal but having its latching position limited by the engagement of flange 31 with the lower face of the bimetal. The opposite end of the strip 28 bears against the armature 24 as at 32 to bias it into its unattracted position whose limit is determined by a stop on the base.

The circuit breaker mechanism, as shown in full lines in Figure 1, is in its normally operating closed circuit position. The dotted lines of the mechanism indicate the automatic tripped position in which the circuit through the breaker is open upon the occurrence of an excess current condition. The breaker is reset into latched position by manipulation of the operating handle 11 and the contacts are moved to their manual "on" and "off" positions for normal switching operation also by manipulation of the handle 11, the operation of the mechanism itself being more fully described in my Patent No. 2,096,546 but with the handle operation described in my Patent No. 2,096,545, both issued October 19, 1937. The operation of the tripping mechanism is as follows:

For low current overloads of continued duration, the bimetal 21 becomes heated by the passage of current therethrough and flexes in a clockwise direction to move the latching tip 29 bodily into a position freeing the end of the contact bar 7 which then rotates in a clockwise direction into the dotted line position of Figure 1. Upon the occurrence of heavier overloads, the magnetic elements of the tripping means operate quicker than normal thermal flexing of the bimetal 21 to effect the tripping of the mechanism in a shorter elapsed time than would be taken by the bimetal alone. When the flux induced in the magnetic circuit formed by the yoke 22 and the armature 24 becomes sufficient, the armature rotates in a clockwise direction and strikes the latching tip 29, moving it downwardly against its resilient bias into unlatching position. This movement of the latching tip 29 may be effected without movement of the bimetal 21 so that the only resistance offered to the magnetic movement is the resilient bias in the spring 28.

While the operation of the tripping means for the breaker has been described in terms of thermal or magnetic effects operating separately, it is, of course, possible that they may have a combined operation with the magnetic force insufficient to move the latching tip alone, but where the combined flexing of the bimetal and the magnetic force are sufficient to effect the unlatching movement of the latching tip.

In previous constructions where the contact bar was latched directly to the end of the bimetal, it was found desirable to grind the end of the bimetal into a smooth latching surface. The use of the strip 28 even without the magnetic elements of the tripping means is advantageous in substituting the simple strip mounting for the rather expensive grinding operation.

In the modified form of the invention illustrated in Figure 5, a modified magnetic circuit is provided. This construction shows a connector 33 mounted upon a lower end ledge provided on the breaker base and extending within the breaker where it is provided with a pressed out tab 34 on which a corrugated bimetal 35 is welded. A cross-piece 36 receives the adjusting screw 37. The interior end of the bimetal is provided with a resilient metal strip 38 formed to provide the latching tip 39. The magnetic circuit comprises a magnetic L-shaped piece 41 which carries a pole piece 42 about which is wrapped the flexible lead 43 which interconnects the bimetal 35 and the contact bar 7. A resilient spring hook is provided at 43 mounted at the end of the L-shaped member 41, which hook extends through an opening 44 in an armature member 45, the hook 43 serving not only to retain the armature 45, but also to bias it into its unattracted position. At one side only of the armature 45 there is provided a finger 46 positioned to engage the latching tip 39 eccentrically of its axis to effect its movement into unlatching position. It has been found that the use of a single side finger facilitates the movement of the latching tip into unlatching position with a lower magnetic force than is required if a balanced force at both sides of the tip is exerted. The operation of this tripping unit is substantially the same as that previously described.

While this invention has been described in connection with a particular circuit breaker mechanism to show a complete operative structure, it is understood that the tripping means according to the present invention is not limited to any particular mechanism but may be utilized in many other distinct mechanism forms to which it is adaptable and, while certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In an automatic electric circuit breaker having separable contacts, manual means for effecting engagement and separation of said contacts at will, and means automatically releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, and a thin metal strip mounted on said bimetallic member and formed about an end thereof to provide a latching surface engaged by said releasable means in a direction to apply a compressive force along the length of the main portion of said bimetallic member, said member flexing when heated by the passage of an overload current through the circuit breaker to bodily move said latching surface into releasing position.

2. In an automatic electric circuit breaker having separable contacts, manual means for effecting engagement and separation of said contacts at will, and means automatically releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, a resilient spring strip mounted on said member and formed to provide a latching surface biased by its inherent resiliency to a predetermined position with respect to said bimetallic member, said bimetal flexing when heated by the passage of an overload current through the circuit breaker to bodily move said latching surface into releasing position.

3. In an automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, a resilient spring strip mounted on said member and formed to provide a latching surface biased by its inherent resiliency to a predetermined position with respect to said bimetallic member, said bimetal flexing when heated to bodily move said latching surface into releasing position, and magnetic means for effecting movement of said latching surface against its resilient bias and relative to said bimetallic member into unlatching position, said magnetic means being energized in response to the flow of current through the breaker.

4. In an automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker com-

prising a bimetallic member heated in response to the flow of current through the breaker, a magnetic yoke, means energizing said yoke in response to the flow of current through the breaker, an armature member adapted to be attracted to said yoke upon the passage of an overload current, a resilient spring strip mounted on said bimetallic member and formed to provide a latching tip biased to a predetermined position with respect to said member by the inherent resilience of said strip, said bimetallic member flexing when heated to bodily move said latching tip into unlatching position, said armature, when attracted, engaging and moving said latching tip against its resilient bias into unlatching position independent of movement of the bimetallic member.

5. In an automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, a magnetic yoke, means energizing said yoke in response to the flow of current through the breaker, an armature member adapted to be attracted to said yoke upon the passage of an overload current, a resilient spring strip mounted on said bimetallic member and formed to provide a latching tip biased to a predetermined position with respect to said member by the inherent resilience of said strip, said bimetallic member flexing when heated to bodily move said latching tip into unlatching position, said armature, when attracted, engaging and moving said latching tip against its resilient bias into unlatching position independent of movement of the bimetallic member, the end of said spring strip remote from said latching tip being formed to engage the armature to bias it into its unattracted position.

6. In an automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a serially connected bimetallic member traversed by the current passing through the breaker so as to be heated thereby, a magnetic yoke embracing said bimetallic element so as to be energized by the current traversing the same, an armature member adapted to be attracted to said yoke upon the occurrence of an overload current, a resilient spring strip mounted on said bimetallic member and formed to provide a latching nose biased to a definite position with respect to the plane of the bimetallic member, the flexing of said bimetallic member, when heated, bodily moving said latching nose to releasing position, said armature, when attracted, engaging and moving said latching nose against its resilient bias into releasing position independent of the movement of the bimetallic member.

7. In an automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, a resilient spring strip mounted on said member and formed to provide a latching surface biased by its inherent resiliency to a predetermined position with respect to said bimetallic member, said bimetal flexing when heated to bodily move said latching surface into releasing position, magnetic means for effecting movement of said latching surface against its resilient bias into unlatching position, said magnetic means being energized in response to the flow of current through the breaker, and exerting its force on the latching tip eccentrically of the axis of the spring strip.

8. In an automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, a magnetic yoke, means energizing said yoke in response to the flow of current through the breaker, an armature member adapted to be attracted to said yoke upon the passage of an overload current, a resilient spring strip mounted on said bimetallic member and formed to provide a latching tip biased to a predetermined position with respect to said member by the inherent resilience of said strip, said bimetallic member flexing when heated to bodily move said latching tip into unlatching position, said armature, when attracted, engaging and moving said latching tip against its resilient bias into unlatching position independent of movement of the bimetallic member, said armature engaging said latching tip with its line of force directed eccentrically of the axis of the spring strip.

9. In an automatic electric circuit breaker having separable contacts, manual means for effecting engagement and separation of said contacts at will, and means automatically releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, a resilient spring strip non-self movable in response to temperature change mounted on said member and formed about an end thereof to provide a latching surface engaged by said releasable means, said member flexing when heated by the passage of an overload current through the circuit breaker to bodily move said latching surface into releasing position.

10. In an automatic electric circuit breaker having separable contacts, manual means for effecting engagement and separation of said contacts at will, and means automatically releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means upon the passage of an overload current through the circuit breaker comprising a bimetallic member heated in response to the flow of current through the breaker, a resilient spring strip mounted on said member and carrying a latching surface engaged by said releasable means, said member flexing when heated by the passage of an overload current through the circuit breaker to bodily move said latching surface into releasing position, said latching surface being movable relative to said member against the resilient bias of said spring strip.

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