

Aug. 31, 1943.

J. G. JACKSON ET AL

2,328,458

CIRCUIT BREAKER

Filed Nov. 7, 1940

3 Sheets-Sheet 1

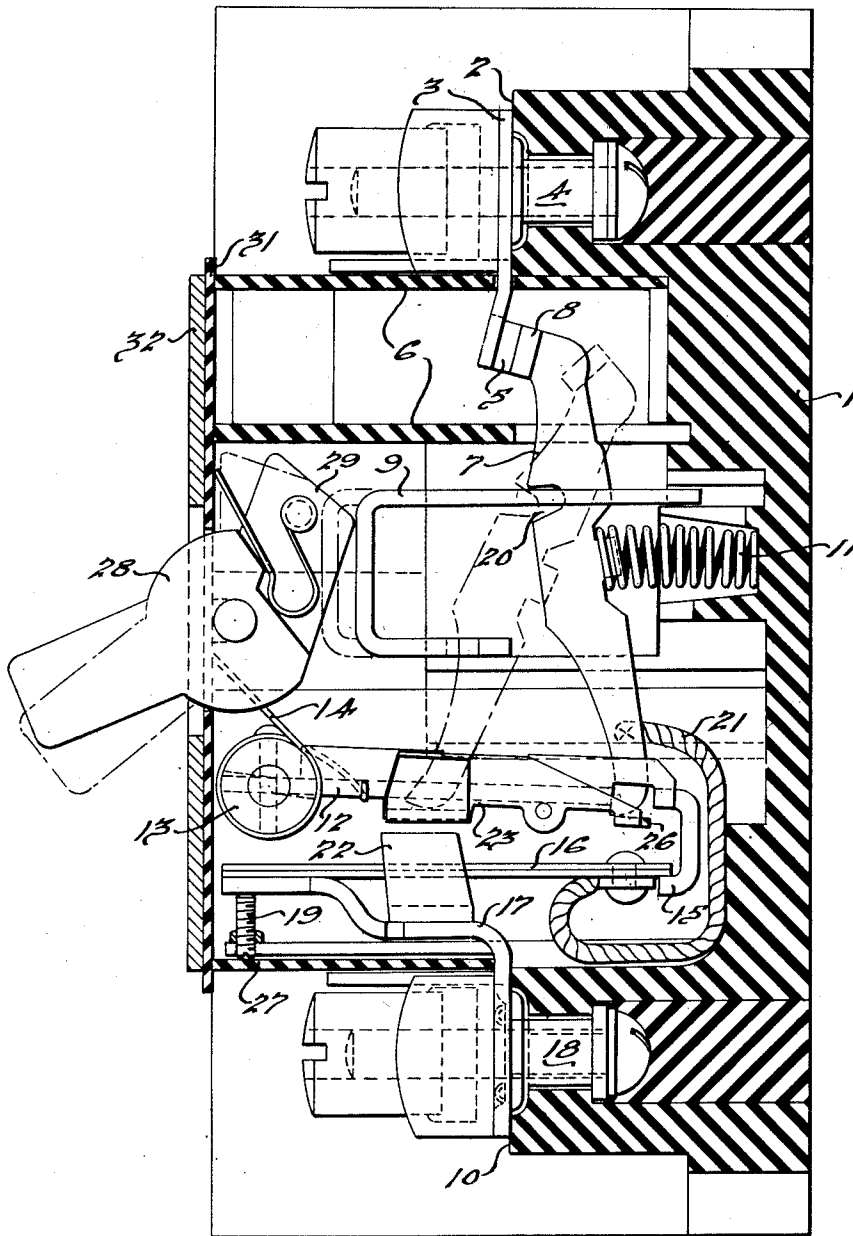


FIG. 1.

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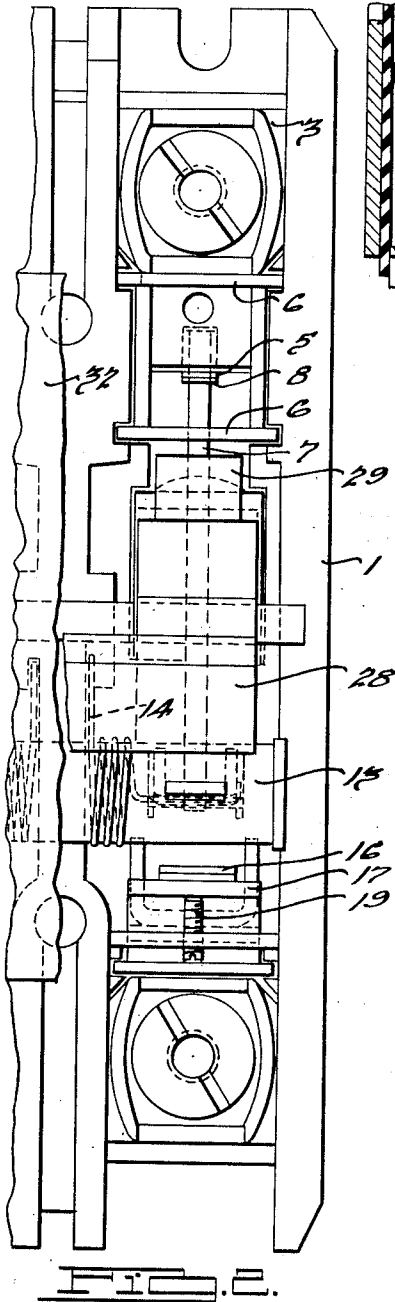
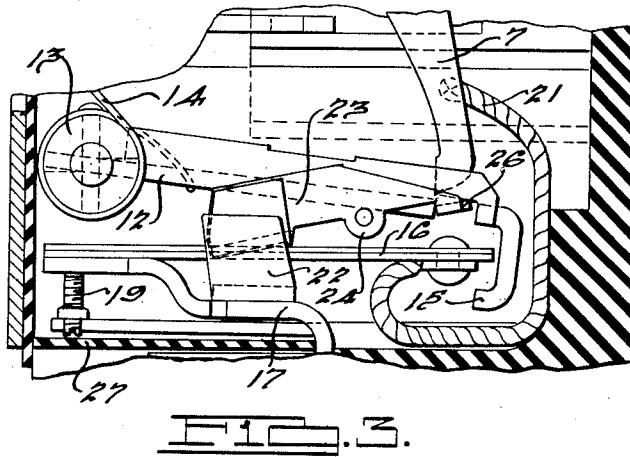
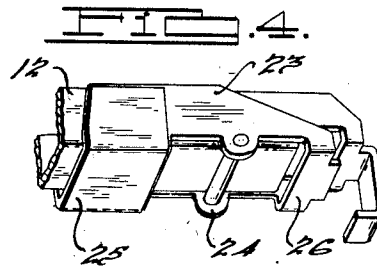
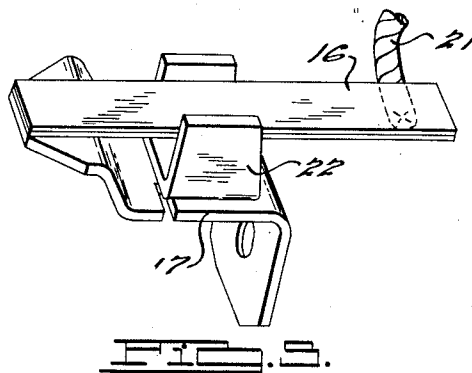
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CIRCUIT BREAKER

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3 Sheets-Sheet 2



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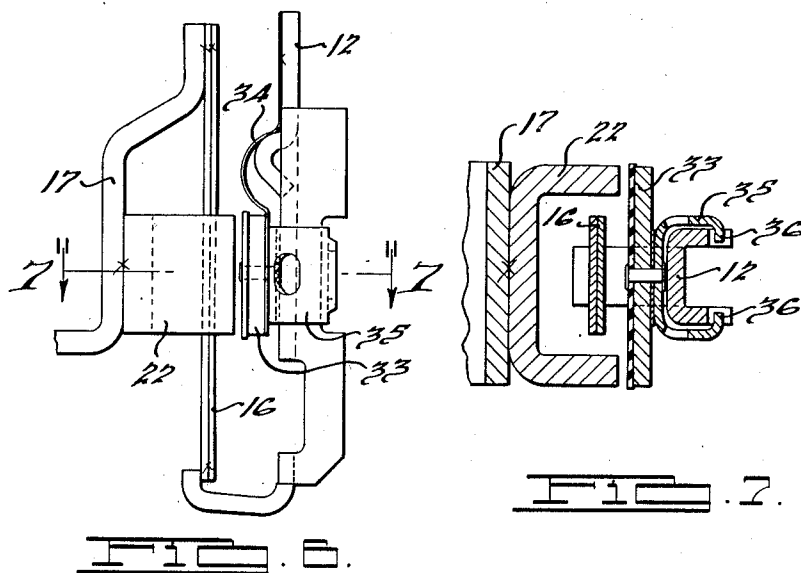
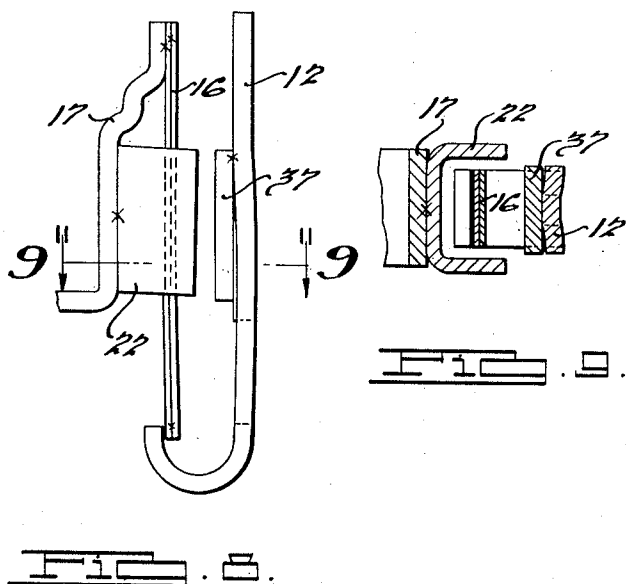
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CIRCUIT BREAKER

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3 Sheets-Sheet 3



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2,328,458

CIRCUIT BREAKER

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Application November 7, 1940, Serial No. 364,630

9 Claims. (Cl. 200—88)

This invention relates to electrical circuit controlling instrumentalities, and more particularly to circuit breakers automatically operable to open the circuit upon the occurrence of current overloads.

One object of this invention is to provide an improved form of current responsive releasing means for a circuit breaker which simply, but effectively, combines the action of a thermally responsive member operating primarily on light overloads and a magnetically responsive member operating primarily on relatively heavy overloads.

Another object of the invention is to provide an electromagnetic circuit breaker with a combined thermal-magnet tripping device in which both the thermally and magnetically responsive elements operate on means for latching a releasable part on the breaker.

Another object of the invention is the provision in an automatic electric circuit breaker of a magnetically responsive member, with or without a combined thermally responsive member, which is mounted to exert a force multiplying unlatching bias on the latching element of the circuit breaker.

Another object of the invention is the provision in an automatic electric circuit breaker of a magnetically responsive member, with or without a combined thermally responsive member, which has a lost motion connection with a latching element for the breaker so that movement of the magnetic member will strike a sharp blow on the latch to initiate its unlatching movement.

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

Figure 1 is a vertical sectional view through a circuit breaker according to the present invention.

Figure 2 is a front elevational view of the circuit breaker according to the present invention with the front cover removed.

Figure 3 is a partial sectional view similar to Figure 1, and showing the parts at the instant the breaker mechanism is automatically released.

Figure 4 is a fragmentary perspective view of the latching element and magnetically responsive member of the circuit breaker of Figures 1 to 3.

Figure 5 is a perspective view of the thermally responsive member and the stationary field magnet of the circuit breaker of Figures 1 to 3.

Figure 6 is a detailed side view of a modified form of current responsive releasing means.

Figure 7 is a sectional view on the line VII—VII of Figure 6.

Figure 8 is a detailed side view of a simplified form of the current responsive releasing means.

Figure 9 is a sectional view on the line IX—IX of Figure 8.

In the drawings, the current responsive tripping means of this invention have been illustrated in connection with a multipole circuit breaker generally similar to that disclosed in Patent 2,096,544, granted October 19, 1937, for Circuit breaker. It is, however, to be understood that the current responsive tripping means may be utilized in connection with other forms of circuit breaker mechanisms which may include either single or multipole construction and the particular mechanism shown is by way of example in compliance with the patent statutes.

The circuit breaker herein illustrated comprises a base 1 having a plurality of individual compartments therein for the individual poles of the breaker. End ledges 2 and 10 are provided at the ends of each pole compartment. Upon the upper ledge 2 of each pole is mounted a connector 3 by means of a spun over portion of a metallic insert 4. At the inner end of this connector is disposed a stationary contact 5 within an arc chamber formed by insulating walls 6, the upper wall 6 further serving to seal off the upper end of the pole compartment. Through a slot in the lower wall 6 extends a contact carrying bar 7 having a contact 8 thereon cooperating with stationary contact 5. The bar 7 is provided with a notch 20 engaging in an elongated notch in a leg of a reciprocable member 9. A compression spring 11 biases the bar 7 in the upward direction.

The opposite end of the bar 7 is normally restrained by a latch 12 secured at its front end within a shaft 13 which is common to all the poles of the multipole form of breaker. The latch 12 may be rigidly connected to the shaft 13 as in Patent 2,096,544, aforesaid, or a limited lost motion may be provided so that the current responsive means will have the unlatching resistance of only one latch as disclosed and claimed in Patent 2,132,629, granted October 11, 1938, for Circuit breaker. A spring 14 biases the latch 12 into latching position. The latch 12 is of general L-shape and is provided with an abutment toe 15 adapted to be engaged by a bimetallic element 16 which is mounted upon a connector 17 secured to the lower end ledge 3 by a

spun over portion of a metallic insert 18. The free end of the connector 17 is movable by a stud 19 to determine the position of the bimetal element 16 and hence the calibrating point for the circuit breaker pole. A flexible lead 21 interconnects the free end of the bimetal element 16 with the bar 7. Upon the connector 17 is mounted a generally U-shaped magnetic piece 22 having its legs disposed on opposite sides of bimetallic element 16. Upon the latch 12 is pivoted a magnetically responsive armature member 23, these parts being shown in perspective view in Figures 5 and 4 respectively. The magnetically responsive armature member 23 is pivoted on the latch 12 by being pivoted on a shaft 24 which is welded or otherwise secured to the latch. The front portion 25 of the element 23 constitutes the armature which is attracted toward the field magnet 22 upon the passage of a predetermined overload current through the circuit breaker. This movement of the armature 25 effects rotation of the element 23 with respect to the latch 12; however, the back portion 26 of the element 23 bears against the end of the bar 7 and as the bar is restrained from moving longitudinally, the portion 26 will be prevented from movement with respect to the bar and other parts. As a result of the bias to rotate the element 23 and the holding of the back portion 26, the net result is a rotation of the latch 12 in a clockwise direction; and, since the distance from the pivot pin 24 to the back portion 26 is less than the distance from the armature 25 to the back portion 26, a force multiplying action will be exerted which will enhance the effectiveness of the magnetically operated releasing means.

The pole compartments are sealed at their lower ends by insulating walls 27 and the circuit breaker is manually operated with an operating member 28 common to all poles of the breaker and which carries a plurality of camming portions 29 cooperating with the front face of the reciprocable elements 9 to effect manual operation of the breaker as well as resetting after an automatic opening. The breaker is closed against access by an insulating sheet 31 and a front metallic cover 32 sealed to the base.

The manual operation of the circuit breaker is identical with that explained in connection with my previous patents cited heretofore. The operation of the breaker on low overloads is also the same as in my previous patents, since the passage of this low overload current through bimetal 16 causes it to flex in a clockwise direction to move the latch 12 into unlatching position, whereupon the bar 7 also rotates in a clockwise direction under the action of spring 11 to automatic circuit open position. As previously explained, the latches 12 of the multipole breaker may be rigidly connected to the common shaft or may have a limited lost motion connection therewith. Where the latches have the positive connection, the movement of the latch 12 by a cooperating bimetal through which an overload is passing also effects immediate rotation of the shaft 13 and consequent movement of all other latches 12, whether their bimetals are connected or not. Accordingly, all of the bars 7 or all the breaker poles will be released, and consequently all the contacts of the breaker open upon the occurrence of an overload, in one or all of the poles. Where a limited lost motion is provided between each of the latches 12 and a common shaft 13, each latch 12 will be moved by its associated affected bimetal independently of the shaft 13 and of the

other latches into a position where it unlatches its associated bar 7. Then, as the bar 7 rotates into open position, it effects a further movement of its latch 12, and as the lost motion is provided to be taken up at the point of latch release, the common shaft 13 will be rotated by this further movement of the releasing latch 12 and the rotation of the shaft 13 will effect unlatching movement of other and unaffected latches 12 in the same manner as where the latches and common shaft are rigidly connected. This unlatching operation in the automatic opening of the breaker is the same for both thermal and magnetic response, it being understood that the magnetic release is effected by the magnetic elements previously described and that the latch movement may be independent of and relative to the serially connected bimetal 16. On low overloads the circuit breaker will be provided with the desired time lag in its operation. However, on heavy overloads and short circuit, the opening operation of the breaker will be magnetic and without delay. The magnetic parts can be seen to be extremely simple, requiring only the embracing of the current path to produce the desired operation. Further, the force multiplying action through the pivoting of the element 23 provides the desired unlatching force without a definite winding and with only a relatively small amount of iron in the magnetic circuit.

Figures 6 and 7 show a modified form of the invention in which the pivoted element 23 has been replaced by an armature element 33 which is mounted on the latch 12 by means of a light spring 34 which gives it a relatively light bias against the latch 12. Rigid with the armature 33 is a C-shaped bracket 35 whose open arms 36 are adapted to engage the back surface of the latch 12 but which are normally held spaced therefrom by the small bias of the spring 34. This construction provides for a lost motion between the latch 12 and the armature 33 so that initial movement of the armature takes place without moving the latch and the initial latch movement is effected by a hammer blow from the engagement of the moving armature arms 36 therewith.

The constructions of Figures 1 to 5 and Figures 6 and 7 are similar with the main difference that the preferred embodiment incorporates a force-multiplying, prying action for the unlatching movement whereas the structure of Figures 6 and 7 relies on a light hammer blow to overcome static friction and to initiate the unlatching movement.

In Figures 8 and 9 a greatly simplified form of the invention is shown which will be sufficient for certain applications. Here the armature 37 is mounted directly on the latch 12 and upon the attraction of the armature 37 the latch 12 will be bodily moved therewith. While the latch 37 in this embodiment is shown as a piece added to the latch 12, it is understood that the latch 12 may itself serve as the armature if it is of sufficient size to produce the desired magnetic force. This embodiment is, of course, the simplest but it requires a greater magnetic effect before the unlatching movement is secured, since it has neither the prying action of the preferred embodiment nor the light hammer blow of the embodiment of Figures 6 and 7.

While certain preferred embodiments of this invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily appar-

ent 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, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, means for latching said releasable means, means biasing said latching means into latching position, an armature element having a lost motion connection with said latching means, a stationary magnetic circuit energized in response to current flow through the breaker and adapted to attract said armature element to effect movement of the latching means to unlatching position, and means biasing said armature element with respect to the latching means into a position remote from the magnetic circuit whereby attraction of the armature element is initially effected without moving the latching means so that the armature element engages the latching means with a hammer blow to initiate its movement to unlatching position.

2. In an automatic electric circuit breaker, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, means for latching said releasable means, means biasing said latching means into latching position, a bimetallic element connected in series circuit with said contacts and operating in response to a predetermined current to move the latching means into releasing position, an armature element having a lost motion connection with said latching means, a stationary magnetic circuit energized in response to current flow through the breaker and adapted to attract said armature element to effect movement of the latching means to unlatching position, and means biasing said armature element with respect to the latching means into a position remote from the magnetic circuit whereby attraction of the armature element is initially effected without moving the latching means so that the armature element engages the latching means with a hammer blow to initiate its movement to unlatching position.

3. In an automatic electric circuit breaker, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, means for latching said releasable means, means biasing said latching means into latching position, a bimetallic element connected in series circuit with said contacts and operating in response to a predetermined current to move the latching means into releasing position, an armature element mounted on said latching means by a limited lost motion connection providing for relative movement therebetween, a stationary magnetic circuit adapted to attract said armature to move the latching means to unlatching position, means biasing the armature with respect to latching means in the direction of latching movement, said spring bias being less than the resistance offered by the latching means to unlatching movement whereby initial movement of the armature will be effected without moving the latching means so that the armature will become engaged with the latching means while it is in motion to effect a hammer blow to initiate the opening movement of the latching means.

4. In an automatic electric circuit breaker, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation

of said contacts to open the circuit, means for latching said releasable means, means biasing said latching means into latching position, an armature element pivotally mounted on said latching means at a point intermediate its ends, a stationary magnetic circuit energized in response to current flowing through the breaker and positioned to exert a magnetic force upon one end of said armature element, the opposite end of said armature element engaging a part stationary at least during the unlatching movement, whereby a force multiplying, prying action is exerted on said latching means in response to the attraction of said armature element by the magnetic circuit.

5. In an automatic electric circuit breaker, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, means for latching said releasable means, means biasing said latching means into latching position, an armature element pivotally mounted on said latching means at a point intermediate its ends, a stationary magnetic circuit energized in response to current flowing through the breaker and positioned to exert a magnetic force upon one end of said armature element, the opposite end of said armature element engaging with said releasable means as an abutment whereby a force multiplying prying action is exerted on the latching means in response to the attraction of the armature by the magnetic circuit.

6. In an automatic electric circuit breaker, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, means for latching said releasable means, means biasing said latching means into latching position, a bimetallic element connected in series circuit with said contacts and operating in response to a predetermined current to move the latching means into releasing position, an armature element pivotally mounted on said latching means at a point intermediate its ends, a stationary magnetic circuit energized in response to current flowing through the breaker and positioned to exert a magnetic force upon one end of said armature element, the opposite end of said armature element engaging a part stationary at least during the unlatching movement, whereby a force multiplying, prying action is exerted on said latching means in response to the attraction of said armature element by the magnetic circuit.

7. In an automatic electric circuit breaker, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, means for latching said releasable means, means biasing said latching means into latching position, a bimetallic element connected in series circuit with said contacts and operating in response to a predetermined current to move the latching means into releasing position, an armature element pivotally mounted on said latching means at a point intermediate its ends, a stationary magnetic circuit energized in response to current flowing through the breaker and positioned to exert a magnetic force upon one end of said armature element, the opposite end of said armature element engaging with said releasable means as an abutment whereby a force multiplying prying action is exerted on the latching means in response to the attraction of the armature by the magnetic circuit.

8. In an automatic electric circuit breaker,

cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, a bimetallic element having relatively fixed and free ends, a latching member extending substantially parallel to said bimetallic element and pivoted at one end adjacent the fixed end of said bimetallic element and having its free end engaging the free end of the bimetallic element so as to be moved thereby in one direction and movable relative thereto in the same direction, said latching member engaging and latching said releasable means, and a stationary field magnet embracing a current path through the breaker so as to be energized in response to flow of current therethrough and operative to effect movement of said latch member in response to the flow of an overload current and operative to move said latch member independently of the bimetal.

9. In an automatic electric circuit breaker, cooperating contacts controlling the circuit through the breaker, means releasable to effect separation of said contacts to open the circuit, a bimetallic element having relatively fixed and

free ends, a latching member extending substantially parallel to said bimetallic element and pivoted at one end adjacent the fixed end of said bimetallic element and having its free end engaging the free end of the bimetallic element so as to be moved thereby in one direction and movable relative thereto in the same direction, said latching member engaging and latching said releasable means, a stationary field magnet embracing a current path through the breaker so as to be energized in response to flow of current therethrough, and an armature element mounted on said latch member in a position to be attracted by said field magnet in response to the flow of an overload current and operative to move said latching member independently of the bimetal, said armature being movable relative to said latching member in its attracted movement so as to facilitate at least the initial unlatching movement of the latching member.

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