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J. G. JACKSON ET AL

2,494,761

THERMAL-MAGNETIC CIRCUIT BREAKER

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2 Sheets-Sheet 1

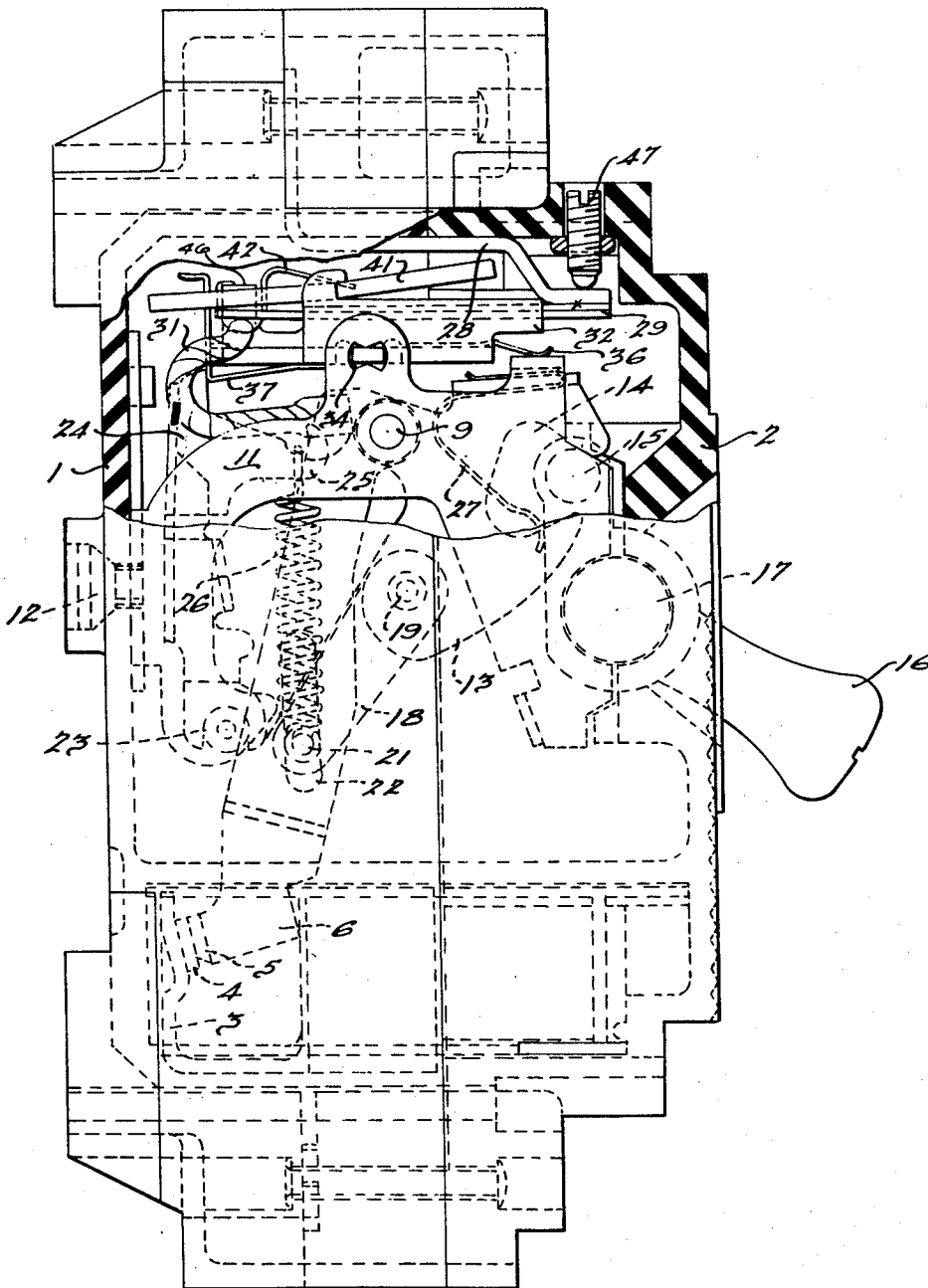


FIG. 1.

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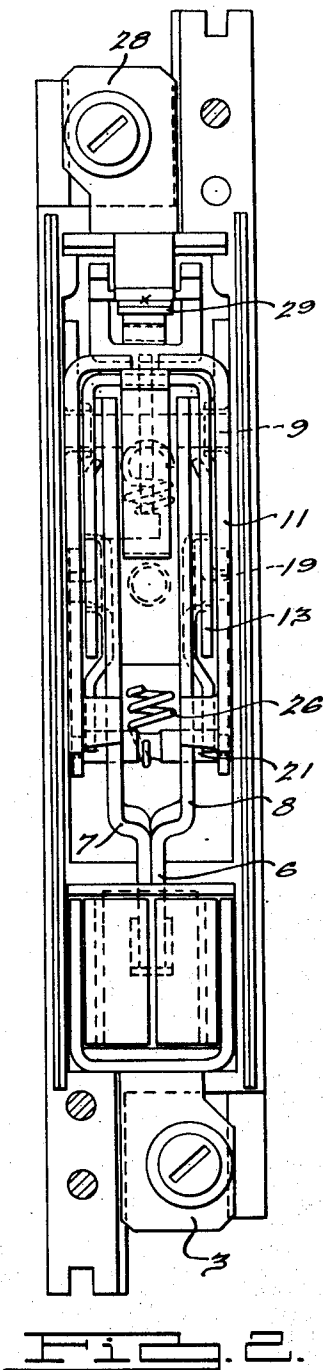
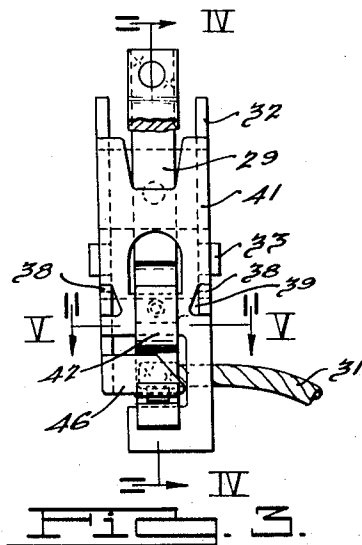
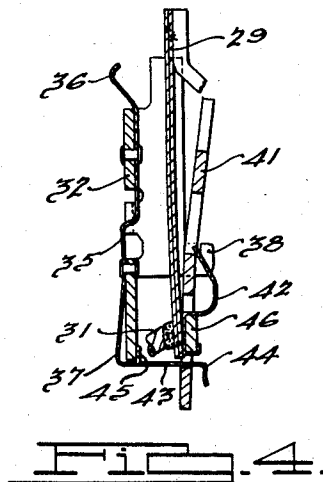
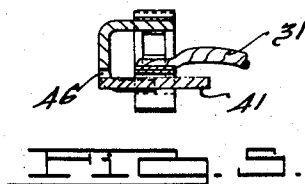
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THERMAL-MAGNETIC CIRCUIT BREAKER

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,494,761

## THERMAL-MAGNETIC CIRCUIT BREAKER

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7 Claims. (Cl. 200—88)

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This invention relates to circuit breakers, and more particularly to the current responsive tripping mechanism for automatic electric circuit breakers.

An object of the invention is the provision of a current responsive tripping mechanism for circuit breakers of combined thermal and magnetic form having improved features of simplicity, reliability and uniformity of tripping operation.

Another object of the invention is the provision of a thermally and magnetically responsive tripping mechanism for circuit breakers in which there is provided a magnetic yoke and armature with the yoke carrying a resilient latching tip, in which a bimetallic member moves both the yoke and armature bodily to unlatching position on thermal trip and in which on magnetic trip the armature moves the resilient latching tip relative to the yoke to effect the unlatching operation.

Another object of the invention is the provision of a current responsive tripping means in accordance with the preceding object in which the yoke is pivotally mounted on a stationary part, in which the armature is pivotally mounted on the yoke and in which the thermally responsive bimetallic member bears upon a part connected to the yoke.

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 longitudinal sectional view through a circuit breaker according to the present invention.

Figure 2 is a front view of the breaker with the cover removed.

Figure 3 is a detail view of the current responsive tripping mechanism of the circuit breaker.

Figure 4 is a sectional view on the line IV—IV of Figure 3.

Figure 5 is a sectional view on the line V—V of Figure 3.

The circuit breaker mechanism with which the current responsive trip of this invention is specifically illustrated in the drawing corresponds in its general construction and operation to the operating mechanism of the three-pole circuit breaker illustrated in the patent to John G. Jackson et al. 2,426,880, granted September 2, 1947, and forms no part of the present invention as it will be understood that the current responsive tripping mechanism may be used with any form of releasable circuit breaker mechanism.

The mechanism may be briefly described as

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comprising an insulating base 1 and cover 2, with a connector 3 at one end of the circuit breaker mounted in the base 1 and carrying a stationary contact 4 with which cooperates a movable contact 5 mounted upon a contact blade 6. The blade 6 is divided into a pair of arms 7 and 8 pivotally mounted upon a pin 9 mounted in a stationary frame 11 secured in the base by the stud 12. Also pivotally mounted on the pin 9 is a yoke-shaped operating member 13 having its opposite side walls cut out as at 14 to receive the hubs 15 on an operating handle 16 pivoting about hubs 17 in suitable grooves in the frame 11 and cover 2. To the operating member 13 are pivoted a pair of lever arms 18 as by extruded hub portions at 19 and the opposite ends of the lever arms 18 are connected by a pin 21 slidably within a slot 22 in the arms 7 and 8 of the contact blade 6.

Upon hubs 23 extruded from the side walls of the frame 11 is pivotally mounted a releasable member 24 having a hook portion 25 between which and the pin 21 is disposed tension spring 26. Upon the bight of the yoke shaped operating member 13 is mounted a resilient spring strip 27 which bears against the handle as shown in Figure 1, and serves to both definitely position the handle and provide a resilient force to throw operating member 13 through its dead center position.

At the upper end of the circuit breaker there is mounted a second terminal connector 28 extending into the interior of the breaker and having mounted at its forward end a bimetallic member 29 whose free end extends adjacent to the back of the base and is connected by a flexible lead 31 to the arm 7 of the contact blade 6. A yoke shaped magnetic element 32 is pivotally mounted on the frame 11 by means of ears 33 disposed in openings 34 in ears carried by the opposite side walls of the frame. Upon the yoke 32 is pivotally mounted a resilient spring strip 35 having an upper portion 36 engaging a stationary part on the frame 11 to bias the yoke into latching position. The back portion of the spring strip 35 is formed to provide a latching tip 37 engaged by the releasable member 24 to normally latch it in position. The opposite side walls of the yoke 32 are provided with hook portions 38 engaging in grooves 39 within an armature element 41 to pivotally support the same upon the yoke. A resilient spring strip 42 retains the armature 41 in pivotal engagement with the yoke and biases it toward deenergized position.

The resilient strip 35 has a horizontally extending portion 3 (Figure 4) terminating in a down-

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wardly extending portion 44 adapted to be engaged by the back portion of the armature 41 to move the latching tip 37 relative to the yoke 32. From the horizontal portion 43 there is pressed out a limiting stop 45 engaging the yoke 32 to limit the position of the latching tip 37 relative to the yoke. The position of the yoke 32 and the latching tip 37 relative to the releasable member 24 is determined by the engagement of the arm 46 on the yoke 32 with the free end of the bimetallic member 29. The position of the free end of the bimetallic element 29 and hence the latching overlap of the resilient latching tip 37 with respect to releasable member 24 is determined by means of the adjusting stud 47 which bears against and locates the interior end of the terminal connector 28.

The general operation of the circuit breaker mechanism is substantially the same as the mechanism shown for the central pole of the patent to Jackson et al. 2,426,880 mentioned above and will be but briefly described hereinafter.

The parts as shown in Figure 1 are in the closed circuit position. Upon manual operation to open the contacts, the handle 16 is rotated in a counterclockwise direction to effect rotation of the member 13 in a clockwise direction (all as viewed in Figure 1). When the pivot point 19 between operating member 13 and the levers 18 passes through the line between the pins 9 and 21, the mechanism passes through the center of the line of force of spring 26 and the contact blade 6 is rotated in counterclockwise direction to move contact 5 to open circuit position. To close the contacts manually, the handle 16 is rotated in reverse or clockwise direction and the mechanism moves through center in the opposite direction to return the contact blade and the movable contact 5 to closed circuit position.

Upon automatic operation, the latching tip 37 is moved as will be hereinafter described to release the member 24 which swings in a clockwise direction under the bias of the spring 26 and moves the line of force of the spring 26 through center to automatically rotate the contact blade 6 in a counterclockwise direction to open circuit position. To restore the circuit breaker after an automatic operation, the handle 16 is rotated to the OFF position whereupon the member 24 is returned to its latched position as shown in Figure 1.

The operation of the current responsive tripping mechanism of this invention is effected thermally by flexing of the bimetallic member 29 upon the occurrence of sustained moderate overloads, is effected magnetically upon the occurrence of heavy overloads and short circuits, and may operate certain intermediate values by the combined action of the thermal and magnetic elements. In tripping thermally, the bimetallic member 29 is heated by the passage of an overload current therethrough and flexes in a clockwise direction as viewed in Figure 1 to bodily rotate the yoke 32, also in a clockwise direction, by the engagement of the free end of the bimetallic member with the arm 46 on the yoke 32. When the latching tip 37 is moved sufficiently to release the member 24, the automatic opening of the circuit breaker will take place as previously described. In this operation the resilient latching tip 37 and the yoke 32 move together as a unit.

In the magnetic tripping operation, upon the occurrence of an overload current of sufficient value the armature 41 will be attracted to the

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yoke 32 and will rotate in a clockwise direction about the engagement of the armature with the yoke at the grooves 39 and hooks 38. As the armature 41 rotates the back portion will engage the depending portion 44 on the resilient strip 35 and will move the latching tip 37 relative to the yoke 32, the yoke 32 in this operation remaining stationary if the current is of sufficient value to effect the magnetic trip before the bimetallic member 29 is heated and flexed. It will be seen that in the normal position of the parts a space exists between the back portion of the armature 41 and the depending portion 44 of the resilient strip 35 so that the armature engages the depending portion 44 with substantially a hammer blow to more readily effect the movement of the latching tip 37 into unlatching position.

With the arrangement shown and described, it will be seen that while the yoke 32 and latch tip 37 are rotated bodily by the bimetallic member 29 in effecting thermal tripping of the breaker, the latching tip 37 is moved alone against its resilient bias and relative to the yoke 32 by the armature member 41 when the breaker trips magnetically.

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 and means releasable to effect separation of said contacts, a pivotally mounted magnetic yoke, means energizing said magnetic yoke in accordance with the current flowing through the breaker, a resilient latch mounted on said magnetic yoke and carrying a latching surface movable relative to said yoke and engaging said releasable means, a magnetic armature pivoted on said magnetic yoke and having a part engageable with said resilient latch to move the latching surface relative to the yoke into unlatching position when the armature is attracted to the yoke upon the occurrence of heavy overload and short circuit currents, and a bimetallic member heated in accordance with the current flowing through the breaker and positioned to move the yoke and the latching surface bodily as a unit into unlatching position as the bimetallic member flexes under heat due to the passage of sustained moderate overload currents.

2. In an automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, a bimetallic member connected in series circuit with said contacts so as to be traversed by the current passing through the breaker, a magnetic yoke pivotally mounted on a fixed part and embracing said bimetallic member so as to be energized by the current passing therethrough, a magnetic armature pivotally mounted on said magnetic yoke, a resilient latch mounted on said magnetic yoke and carrying a latching surface movable relative to said yoke and engaging said releasable means, and an abutment on said magnetic yoke engageable by said bimetallic member as it flexes under heat due to the passage of sustained moderate overload currents to move the yoke and latching surface bodily as a unit into unlatching position, said armature engaging said resilient latch to

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move the latching surface relative to the yoke into unlatching position as the armature is attracted upon the occurrence of heavy overload and short circuit currents.

3. An automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, a bimetallic member connected in series circuit with said contacts so as to be traversed by the current passing through the breaker, a magnetic yoke pivotally mounted on a fixed part and embracing said bimetallic member so as to be energized by the current passing therethrough, a magnetic armature pivotally mounted on said magnetic yoke, a resilient spring strip mounted on said magnetic yoke and formed to provide a latching tip engaging said releasable means, an abutment on said yoke engageable by said bimetallic member as it flexes under heat due to the passage of sustained moderate current overloads to move the yoke and latching tip bodily as a unit into unlatching position, and an abutment on said resilient strip engageable by said armature to effect movement of the latching tip relative to the yoke into unlatching position as the armature is attracted to the yoke upon the occurrence of heavy overload and short circuit currents.

4. An automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, a bimetallic member connected in series circuit with said contacts so as to be traversed by the current passing through the breaker, a magnetic yoke pivotally mounted on a fixed part and embracing said bimetallic member so as to be energized by the current passing therethrough, a magnetic armature pivotally mounted on said magnetic yoke, a resilient spring strip mounted on said magnetic yoke and formed to provide a latching tip engaging said releasable means, an abutment on said yoke engageable by said bimetallic member as it flexes under heat due to the passage of sustained moderate current overloads to move the yoke and latching tip bodily as a unit into unlatching position, an abutment on said resilient strip engageable by said armature to effect movement of the latching tip relative to the yoke into unlatching position as the armature is attracted to the yoke upon the occurrence of heavy overload and short circuit currents, and an extension on said resilient strip engageable with a stationary part to bias the yoke into latching position.

5. An automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, a bimetallic member connected in series circuit with said contacts, so as to be traversed by the current passing through the breaker, a magnetic yoke pivotally mounted on a fixed part and embracing said bimetallic member so as to be energized by the current passing therethrough, a magnetic armature pivotally mounted on said magnetic yoke, a resilient spring strip mounted on said magnetic yoke and formed to provide a latching tip engaging said releasable means, an abutment on said resilient strip engageable with said yoke to determine the normal position of the latching tip relative to the yoke, an abutment on said yoke engageable by said

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bimetallic member as it flexes under heat due to the passage of sustained moderate current overloads to move the yoke and latching tip bodily as a unit into unlatching position and an abutment on said resilient strip engageable by said armature to effect movement of the latching tip relative to the yoke into unlatching position as the armature is attracted to the yoke upon the occurrence of heavy overload and short circuit currents.

6. An automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, a bimetallic member connected in series circuit with said contacts so as to be traversed by the current passing through the breaker, a magnetic yoke pivotally mounted on a fixed part and embracing said bimetallic member so as to be energized by the current passing therethrough, a magnetic armature pivotally mounted on said magnetic yoke, a resilient spring strip mounted on said magnetic yoke and formed to provide a latching tip engaging said releasable means, an abutment on said yoke engageable by said bimetallic member as it flexes under heat due to the passage of sustained moderate current overloads to move the yoke and latching tip bodily as a unit into unlatching position, an abutment on said resilient strip engageable by said armature to effect movement of the latching tip relative to the yoke into unlatching position as the armature is attracted to the yoke upon the occurrence of heavy overload and short circuit currents, an extension on said resilient strip engageable with a stationary part to bias the yoke into latching position, and spring means carried by the yoke engageable with said armature to bias it toward unattracted position.

7. An automatic electric circuit breaker having separable contacts and means releasable to effect separation of said contacts, a bimetallic member connected in series circuit with said contacts so as to be traversed by the current passing through the breaker, a magnetic yoke pivotally mounted on a fixed part and embracing said bimetallic member so as to be energized by the current passing therethrough, a magnetic armature pivotally mounted on said magnetic yoke, a resilient spring strip mounted on said magnetic yoke and formed to provide a latching tip engaging said releasable means, an abutment on said yoke engageable by said bimetallic member as it flexes under heat due to the passage of sustained moderate current overloads to move the yoke and latching tip bodily as a unit into unlatching position, and an abutment on said resilient strip engageable by said armature to effect movement of the latching tip relative to the yoke into unlatching position as the armature is attracted to the yoke upon the occurrence of heavy overload and short circuit currents, the unattracted position of the armature being spaced from the abutment on the resilient strip which it engages so that the engagement is effected with a hammer blow as the armature is moving.

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No references cited.