

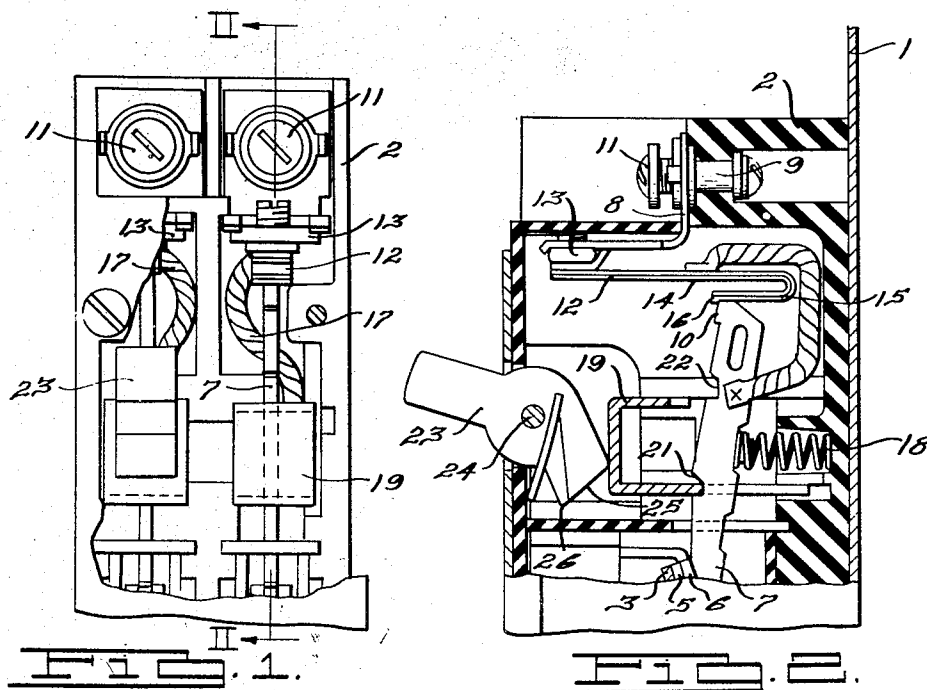
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CIRCUIT BREAKER

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CIRCUIT BREAKER

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This invention relates to current responsive thermostatic elements and more particularly to automatic electric circuit controlling devices employing current responsive thermostatic tripping elements.

An object of the present invention is to provide an improved tripping means for an automatic electric circuit breaker.

Another object of this invention is to provide in an automatic electric circuit breaker thermostatic means for effecting improved operation of the circuit breaker on the occurrence of heavy current overloads.

Another object of this invention is to provide an automatic electric circuit breaker employing a current responsive tripping member with a part thereof being thermally affected on the occurrence of heavy current overloads and the remainder thereof being substantially thermally unaffected.

Another object of this invention is to provide in an automatic electric circuit breaker a unitary tripping member having portions thereof moving in different directions.

Another object of this invention is to provide in an automatic electric circuit breaker an improved tripping member with the latching portion thereof adapted to move in a direction different to the direction of movement of adjacent portions, on the occurrence of moderate overload currents.

Another object of this invention is to provide an automatic electric circuit breaker employing a current responsive tripping member comprising a thermally actuated portion in series circuit with the contact members of the circuit breaker, and a latching portion through which no appreciable current passes and which is thermally influenced for movement by the first portion.

Other objects and features of this 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 partial front elevational view of an automatic electric circuit breaker utilizing a tripping means according to the present invention and in which portions are cut away to show internal parts.

Figure 2 is a vertical sectional view taken on the line II—II of Figure 1.

Referring to the drawings, Figures 1 and 2 illustrate a circuit breaker mechanism specifically disclosed and claimed in the patents of John G. Jackson, No. 2,096,545, issued October 19, 1937,

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and No. 2,132,625, issued October 11, 1938, and both entitled Circuit breakers, and with a current responsive thermostatic tripping element according to the present invention. These figures illustrate one form of circuit breaker in which the tripping element, according to the present invention, may be employed although it is obvious that the tripping element is susceptible of use in any type of circuit breaker or in any other apparatus in which a thermostatic latching member is employed.

The circuit breaker illustrated embodies a metallic mounting plate 1 which may be the back wall of an outer enclosing box against which is mounted an insulating base 2. Generally centrally of this base is mounted a stationary contact plate 3, as by means of a stud and carrying stationary contacts 5 adapted to cooperate with movable contacts 6 on the ends of contact blades 7. Upon ledges at the ends of the base 2 are rigidly supported connectors 8 as by means of spun over portions of metallic inserts 9 which also receive terminal studs 11. To the interior end of each of the connectors 8 is rigidly secured one end of a bimetallic member 12 as by an adjusting means designated generally at 13.

As shown in Figure 2, the bimetallic member 12 is return bent to thereby provide a pair of legs 14 and 15, with the leg 15 having the end thereof bent over as at 16 to effect a hook or latch portion. A flexible lead 17 electrically interconnects the contact blade 7 and the bimetallic member 12. It is to be particularly noted that the flexible lead 17 is secured to the longer leg 14 of the bimetallic member 12 at a point substantially nearer the center thereof than to its lower end and for a purpose to be hereinafter described.

A compression spring 18 biases the movable contact 6 carried by the blade 7 against the stationary contact 5 and biases the end 10 of the blade against the latch 16 of the bimetallic member 12. A U-shaped member 19 having legs of dissimilar length is guided by formations in the base for rectilinear movement at right angles thereto. The longer leg of the member 19 is slotted to receive the blade 7, and the blade at its top edge is provided with a notch 21 received within the top edge of the slot. A second notch 22 is provided in the front edge of the blade and is adapted to engage a shorter leg of the member 19 to serve as a stop for the blade upon rotation as hereinafter described. An operating handle 23 pivotally mounted on a shaft 24 has an interior cam surface which effects rectilinear movement

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of the member 19, which cam surface includes a flat stable portion 25 and a resetting tip 26.

The blade 7 of Figure 2 is in the normal "on" position. To move the parts to the manual "off" position, the handle is rotated counterclockwise until the flat surface 25 engages the top surface of the member 19 which produces a stable position in which the member 19 has been moved toward the bottom of the base and has separated the movable contact at the end of the associated blade 7 from its cooperating stationary contact 5.

In the automatic operation of the breaker, this invention provides for a quicker tripping of the switching parts on the occurrence of short circuits and heavy current overloads than previously obtained in circuit breakers, with consequent added protection to the circuit breaker parts and to the circuit controlled thereby.

To effect this feature of quicker tripping, the tripping means for the circuit breaker comprises the bimetallic member 12 which is return bent and provided with a hook or latch 16 upon its free end, as described above, and the flexible lead 17 secured to the longer leg 14 of the bimetallic member 12 is provided substantially nearer the center of this leg than to an end thereof to thereby place that portion of leg 14 which is to the left of the point of connection of the flexible lead in series circuit with the cooperating contact members 5 and 6 as shown in Figure 2. The flexible lead 17 is of low resistance compared to the resistance of the path through the right hand portion of leg 14 and leg 15 of the bimetallic member and the latching end of the contact bar 7. Accordingly, only a negligible portion of the current through the circuit breaker will flow through the bimetallic path beyond or to the right of the flexible lead connection and any increase in temperature in the right hand portion of leg 14 and in the leg 15 will be effected through conduction from the left hand portion of the leg 14 in which the heat is directly generated by the passage of the current therethrough. The action of this bimetallic member 12 on the occurrence of a moderate overload is quite distinct over the action effected when short circuits or heavy overloads are encountered. When a moderate current overload occurs, that portion of leg 14 of the bimetal 12 which is in series circuit with the contacts will be directly heated by the flow of current therethrough to flex upwardly as viewed in Figure 2, the remainder of the bimetallic member including the leg 15 will also be thermally actuated, deriving heat for actuation through conduction from the directly heated portion. But, leg 15 on being heated will move in a direction opposite to the direction of movement of leg 14 to tend to retain the hook 16 in engagement with the end 10 of the blade 7; thus, on the occurrence of a moderate current overload, leg 15 operates against tripping of the breaker. However, the breaker is so constructed that on the attainment of a predetermined moderate overload current the longer leg 14 will eventually flex sufficiently to compensate for the flexure of leg 15 to cause hook 16 to disengage end 10 of the blade 7 whereupon this blade rotates in a counterclockwise direction about the engagement of the notch 21 with the member 19 and under the bias of spring 18 into a contacts disengaged position, thus interrupting the circuit through the breaker mechanism. To reset the parts after an automatic release, the handle is rotated past the "off" position until the resetting tip 26 is on the top surface of the

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member 19, in which position the contact blade 7 will have engaged the bottom of the arc chamber and moved back into position to engage the latch 16. If the bimetal 12 has cooled sufficiently to assume its normal position, release of the handle will then place the parts in the normal "off" position whereupon clockwise rotation of the handle will again permit the parts to assume the position shown in Figure 2, the closed circuit position.

With the use of a tripping means of this type described rather than a bimetallic latch in which all portions move in the same general direction, the trip time on the occurrence of heavy overloads will be very substantially lessened as will be explained. In the presence of moderate overload currents, leg 15 of the bimetal 12 has a definite substantial movement and in a direction opposite to the direction of movement of the longer leg 14, but with the occurrence of heavy overload currents, series circuit leg 14 will operate to trip the breaker without being opposed by the non-series leg 15 because the leg 14 will be heated for movement thereof before the heat could effect an opposing movement or any substantial opposing movement of the leg 15. The fact that leg 15 provides an opposing movement on moderate overloads directly contributes to the provision of a shorter trip time, in the present breaker, on heavy overloads than the trip time on heavy overloads of breakers employing prior art bimetallic latches. This is true because the amount of overlap between the hook 16 and the end 10 of blade 7 in the present breaker need not be as great as ordinarily required to obtain the desired rating or calibration; the tendency of the shorter leg 15 to move in an opposing direction permits the use of a lesser overlap because the hook 16 will move in a direction to maintain engagement with the end 10 to fulfill the conditions for which the breaker is rated. With the use of a lesser overlap, it is obvious that on the occurrence of a heavy overload the latching means having a lesser distance to move to effect release of the blade 7 will effect tripping in a lesser time. It is this lessening of the amount of overlap between the bimetallic member 12 and the blade 7 then that permits a quicker release of the blade on the occurrence of heavy overloads than is ordinarily obtained, and it is the tendency of the shorter leg 15 to move in an opposing direction that permits the use of a lesser overlap while still providing for the use of a bimetal of proper thermal activity to attain the desired calibration. Lessening the trip time on the occurrence of heavy overloads is definitely a desirable feature for it lessens the possibility of damage to the circuit breaker parts by the heavy overload current.

It is noted that positioning the lead 17 at various points on the bimetal 12 will affect the relative activities of the series element and the latch portion thereof to thus provide tripping elements having different operating characteristics and thereby effect a means of obtaining breakers of various calibrations.

It is evident then that a circuit breaker, by employing a tripping member of a type described herein, wherein a portion opposes release of the contact blade on the occurrence of a moderate overload, will retain its given rating and will not trip out too quickly on moderate overloads and yet will effect a materially faster release of the switching parts on the occurrence of a short circuit or heavy overload, and therefore results in

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better protection to the circuit breaker and its associated circuit.

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, separable contacts controlling the flow of current through the breaker, and thermally responsive means for initiating operation of said contacts to separated position in response to the passage of overload currents through the breaker, said means including a bimetallic member having fixed and free ends, an electrical conductor connected to said bimetallic member intermediate its ends and to said contacts thereby placing only the part of said bimetallic member between its fixed end and the point of connection of said conductor in series circuit with the contacts so as to be traversed by the current passing through the breaker whereby said part of the bimetallic member is directly heated by current flow therethrough, the portion of said bimetallic member between the point of conductor connection and its free end being return bent and carrying a latching surface adjacent the free end thereof which normally maintains the contacts in engaged position, the bimetallic part being quickly heated upon the occurrence of a short circuit current to move said latching surface to initiate separation of said contacts without appreciable influence by said bimetallic portion, said bimetallic portion being heated upon the occurrence of a prolonged moderate overload and flexing in a direction opposite to the direction of flexing of the bimetallic part to oppose the unlatching movement of said latching surface.

2. In an automatic electric circuit breaker, separable contacts controlling the flow of current through the breaker, and thermally responsive means for initiating operation of said contacts to separated position in response to the passage of overload currents through the breaker, said means including a bimetallic member hav-

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ing fixed and free ends, an electrical conductor connected to said bimetallic member intermediate its ends and to said contacts thereby placing only the part of said bimetallic member between its fixed end and the point of connection of said conductor in series circuit with the contacts so as to be traversed by the current passing through the breaker whereby said part of the bimetallic member is directly heated by current flow there-through, the portion of said bimetallic member between the point of conductor connection and its free end being return bent and carrying a latching surface adjacent the free end thereof which normally maintains the contacts in engaged position, the bimetallic part being quickly heated upon the occurrence of a short circuit current to effect movement bodily of the bimetallic portion and of the latching surface without appreciable movement of the latching surface by the bimetallic portion except as an incident to its movement by said bimetallic part, the bimetallic portion being heated by conduction from the bimetallic part upon the occurrence of a prolonged moderate overload and flexing by its return bend in a direction opposite to the flexing of the bimetallic part whereby to move the latching surface away from the bimetallic part and effect an unlatching movement thereof which is a differential of the movements of the bimetallic part and bimetallic portion.

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