Dec. 29, 1931. T. LINDSTROM 1,838,950

CIRCUIT BREAKER

Filed Nov. 26, 1930

Fig. 1.

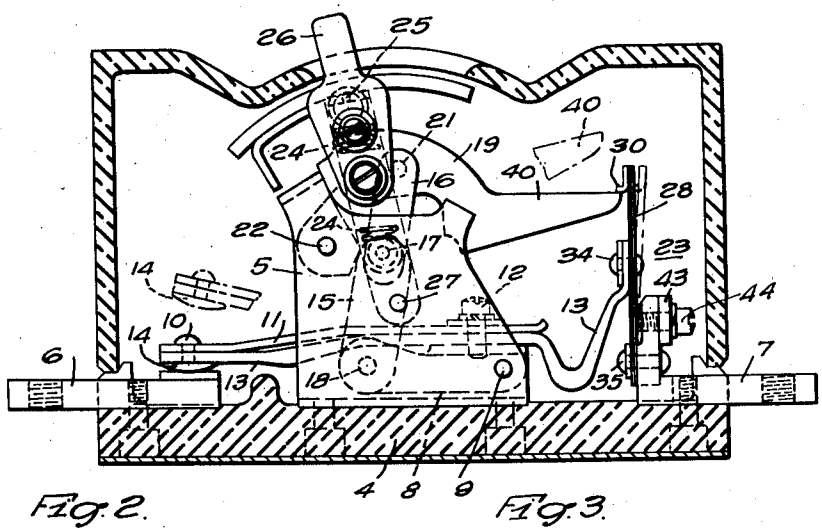


Fig. 2.

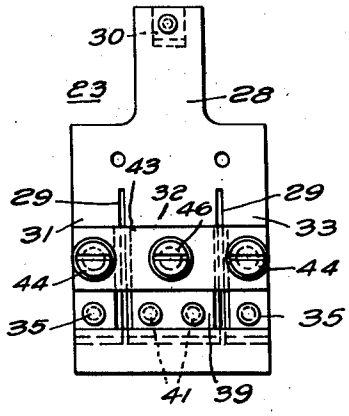


Fig. 3.

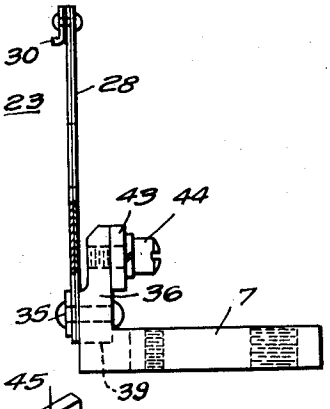


Fig. 4.

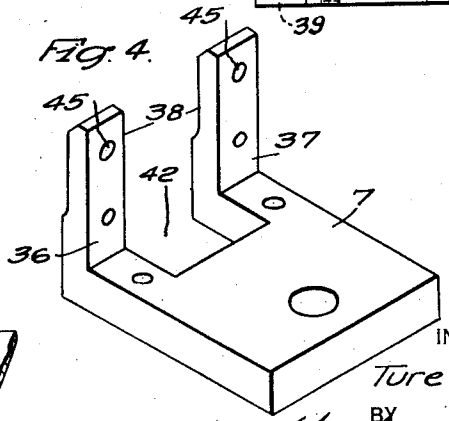
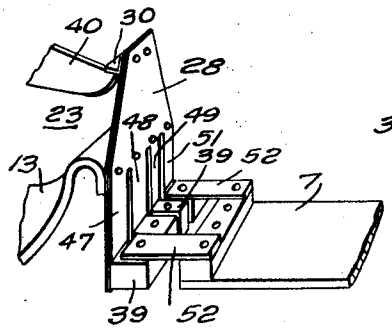


Fig. 5.



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UNITED STATES PATENT OFFICE

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CIRCUIT BREAKER

Application filed November 26, 1930. Serial No. 498,409.

My invention relates to circuit breakers and particularly to circuit breakers and to tripping mechanisms therefor that are current responsive for tripping to open position under overload and short circuit conditions.

An object of my invention is to provide a tripping device for circuit breakers wherein a bimetal thermal element serves to releasably retain a circuit breaker in operative closed position and wherein the thermal element may be utilized with circuit breakers having different current ratings by altering the path of the current through the thermal element.

A further object of my invention is to provide a thermal element for releasably obtaining a circuit breaker in operative closed position wherein the operating characteristics of the thermal element may be varied without altering the shape thereof.

A further object of my invention is to provide a thermal element for controlling circuit breakers and other electrical apparatus wherein the thermal element is slotted for providing a plurality of conductive portions that conduct current through the element in parallel paths and wherein the portions may be selectively connected in an electric circuit for varying the operating characteristics of the element.

These and other objects that will be made apparent throughout the further description of my invention are attained by means of the apparatus hereinafter described and illustrated in the accompanying drawings, wherein:

Figure 1 is an elevational view, partially in section, of an enclosed circuit breaker with which my improved current-responsive device is associated,

Fig. 2 is an end elevational view of the bimetal thermal element disclosed in Fig. 1,

Fig. 3 is a side elevational view of the thermal element shown in Fig. 2,

Fig. 4 is a perspective view of a support terminal employed in the current-responsive device shown in Fig. 1, and

Fig. 5 is a perspective view of a modified form of current-responsive thermal device.

Referring to the drawings, the circuit breaker to which the improved trip mechanism is applied comprises an insulating base 4, upon which is mounted a metal supporting frame 5, terminal contact 6 and a terminal 7. The movable contact arm 8 is pivotally mounted for oscillatory movement about the pivot shaft 9, and a spring-metal contact arm 11 is attached thereto by means of an attaching screw 12, which serves also to connect a flexible conductor 13 to the contact arm 8. The outer end of the spring member 11 is provided with a movable contact 14 that is secured to the free end of the spring member 11 by means of a rivet 10 which serves to clamp one end of the flexible conductor 13 between spring member and the contact.

The contact arm 8 is actuated by means of a pair of toggle links 15 and 16 that are pivotally connected by a knee pivot shaft 17, the link 15 being pivotally connected to the contact arm 8 by a pivot shaft 18, and the link 16 being pivotally connected to a cradle 19 by means of a pivot shaft 21.

The cradle 19 is mounted upon the frame 5 for oscillatory movement about a pivot shaft 22, mounted on the frame 5, and is releasably retained in its operative closed position shown in Fig. 1 by means of a current-responsive trip device 23, which will be hereinafter described.

When the toggle links 15 and 16 are in the straightened position, shown in Fig. 1, they serve to retain the contact arm 8 in closed position, wherein the contact 14 engages the contact 6. The toggle links are actuated to collapsed or opened position by means of a tension spring 24 that is pivotally connected, at one end, to the knee pivot shaft 17 and, at the other end, to a pivot pin 25, carried by an operating handle 26 that is mounted for oscillatory movement about a pivot shaft 27 which is supported by the frame 5.

Clockwise movement of the operating handle 26 causes the center of the pin 25 to be moved beyond a center line through the pivot shafts 17 and 21, which results in moving the knee pivot 17 to the right. This movement, by reason of the contraction of the spring 24, causes the toggle links to collapse and move the contact 14 to the position shown in

dotted lines in Fig. 1, with a snap action. Counter clockwise movement of the operating handle 26 causes closing of the contact 14, when the center of the pin 25 has again moved across the said center line of the toggle pivots 17 and 21.

When the cradle 19 is released, in response to an overload or a short-circuit condition, the contraction of the spring 24 causes the movable contact 14 to move instantly from engagement with the contact 6 and also causes collapse of the toggle when the cradle has moved the pivot pin 21 in a counter clockwise direction beyond a center line through the knee pivot 17 of the toggle and the pin 25. The operating handle 26 is also moved to an intermediate position, indicating that the circuit breaker has opened automatically. Manual operation of the contact 14 to open and to closed position is accordingly accomplished through the movement of the operating handle 26, and automatic operation of the circuit breaker to open position occurs when the cradle 19 is released.

The tripping device 23 for releasably retaining the circuit breaker in closed position comprises a flat strip 28 of bimetal that is provided with two longitudinal slots 29 to divide the fixed end of the strip into three conductive portions 31, 32 and 33 which constitute three parallel conductive paths for current flowing through the strip. The strip is conductively connected to the flexible conductor 13, at a point near its central portion, by means of rivets 34, and the end portions 31 and 33 of the strip are secured to the terminal 7 by rivets 35 which extend through the supporting arms 36 and 37 that extend at right angles to the body of the terminal 7, as indicated in Figs. 1 and 4. The outer ends of the arms 36 and 37 are cut away at 38 in order to prevent engagement of the strip portions 31 and 33 except at the point where the strip is riveted to the arms and to permit of a limited deflection of the bimetal strip when an excessive current, such as an overload or a short circuit, occurs in the circuit associated with the circuit breaker, it being understood that, in the present instance, the bimetal strip is connected in series with the circuit-breaker contacts.

The central portion 32 of the strip is provided with a plate 39 that corresponds, in shape, to the arms 36 and 37 and is secured to the portion 32 by means of rivets 41. The plate 39 is positioned in the space 42 between the arms 36 and 37 of the block 7 in such manner that it does not conductively engage the block 7.

During normal operation, the current supplied to the block 7, by means of a feed conductor (not shown), passes through the outer portions 31 and 33 of the bimetal strip 28 in parallel paths and then flows through the flexible conductor 13, which is connected to the movable contact 14 of the circuit breaker. The dimensions of the portions 31 and 33 are such that normal currents passing through the bimetal element will not sufficiently heat it to cause sufficient deflection to release the circuit breaker, but, when an overload current condition exists for a predetermined time, the fixed end of the bimetal element is heated sufficiently to cause the outer free end to be laterally deflected sufficiently to release the latch clip 30 from engagement with the latch arm 40 of the circuit breaker and thus cause the circuit breaker to move to open position with a snap action. This operation also occurs when a short-circuit condition exists, at which time the bimetal element is rapidly heated, and the circuit breaker is opened substantially without delay.

In the event that the bimetal element is utilized with a circuit breaker having a higher current rating than that for which the portions 31 and 33 are designed, in order to cause an equal time delay before the circuit breaker opens, under a corresponding overload condition, it is necessary to provide a larger conductive path for the current through the bimetal strip. This is accomplished by connecting the arms 36 and 37 to the plate 39 by means of a detachable connecting link 43 that is retained in position by means of screws 44 which engage threaded holes 45 in the outer ends of the arms 36 and 37 and by means of a screw 46 that engages a threaded hole in the plate 39. When the link 43 is in place, the current through the bimetal strip flows in parallel circuits through the three conductive portions 31, 32 and 33. It is apparent that more current can pass through the three conductive portions than can pass through the outer portions 31 and 33 without raising the temperature of the bimetal strip and, therefore, when the link 43 is in place, the bimetal element may be used with a circuit breaker having a greater current rating than when only the portions 31 and 33 are connected in the circuit.

It will be understood that the bimetal strip may be divided into any desired number of conductive portions for providing parallel conducting paths and that, by placing a plate 39 on selective intermediate portions and connecting them, by means of a link 43, to the outer portions 31 and 33, the bimetal element may be given any desired operating characteristic.

In Fig. 5, I have shown a modified form of trip device wherein the bimetal strip 28 is divided into four conductive portions 47, 48, 49 and 51, each having a plate 39 which may be selectively connected to the terminal 7 by links 52. If the widths of the portions 47 to 51, inclusive, are all different, as indicated in Fig. 5, a large variety of conductive paths may be selected for changing the operating characteristics of the bimetal strip.

For instance, four different operating characteristics are provided by connecting only one of the several portions to the terminal 7, the characteristic depending upon which portion is connected in the circuit. These characteristics may be further varied by connecting two or more of the conductive portions in the circuit as desired.

From the foregoing, it is apparent that I have provided a current-responsive device for a circuit breaker or other electrical apparatus wherein a single bimetal strip is capable of being used with a variety of electrical apparatus having different current ratings. This is of particular advantage, since bimetal elements of standard construction, which may be made in large quantities, may be used in a variety of apparatus, thereby reducing the manufacturing cost by reducing the number of dies required for production, and by reducing the stock that would be required in the event that a separate type of bimetal element were used with each different type of circuit breaker or electrical device.

A single circuit breaker of the type above described may be used in connection with a number of circuits having current values less than the maximum value for which the circuit breaker is practical, and, by simply changing the operating characteristic of the bimetal element, the same circuit breaker may be used for protecting circuits having different current values. For example, a circuit breaker having a maximum protecting value of 50 amperes and provided with a current-responsive device of my improved form may be set to open the circuit on a 10% overload, a 20% overload or a 30% overload within the same predetermined time after the overload occurs, or the same circuit breaker may be used for protecting a circuit having a value of 25 amperes when any predetermined value of overload occurs and within the same predetermined time, as above indicated.

While I have illustrated but two embodiments of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated, without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. A trip device for a circuit breaker comprising a bimetal strip conductively connected in a circuit associated with the circuit breaker and having one end fixed and the other end free, the free end being adapted to releasably retain the circuit breaker in closed position and the fixed end being slotted inwardly to provide a plurality of conductive portions constituting parallel conductive paths, and means for selectively connecting the said portions in the said circuit.

2. A trip device for a circuit breaker comprising a bimetal strip conductively connected in a circuit associated with the circuit breaker, the bimetal strip having one end fixed and the other end free, the free end being adapted to releasably retain the circuit breaker in closed position and the fixed end being slotted inwardly to provide a plurality of conductive portions constituting parallel conductive paths, and a support terminal for the fixed end of the strip having means whereby one or more of the said portions may be selectively connected in the said circuit.

3. A current-responsive device comprising a bimetal strip having one end fixed and one end free and connected, near the free end, to an electric circuit and having its fixed end slotted for providing a plurality of conductive portions constituting parallel conductive paths, and a terminal connected in the circuit and having means whereby the said portions may be selectively connected to the said terminal.

4. A current-responsive device comprising a thermal strip having one end slotted for providing a plurality of commonly connected conductive portions constituting parallel current paths and its opposite end free and deflectable in response to current flowing through the strip, and means for selectively connecting the said portions in an electric circuit, whereby current is caused to flow through the selected portions of the strip.

5. A current-responsive device comprising a thermal strip having two or more slots extending inwardly from one end for dividing the strip into a plurality of portions constituting parallel current paths and having the opposite end free and deflectable in response to current flowing through the strip, a terminal of U-shape for supporting the ends of at least two of said portions, and a detachable connector for conductively connecting the ends of said two portions to the ends of other said portions, whereby the circuit through the strip may be divided into a plurality of parallel paths.

In testimony whereof, I have hereunto subscribed my name this 21st day of November, 1930.

TURE LINDSTROM.