Jan. 7, 1936. T. LINDSTROM 2,027,238

CIRCUIT BREAKER

Filed Nov. 26, 1930

Fig. 1.

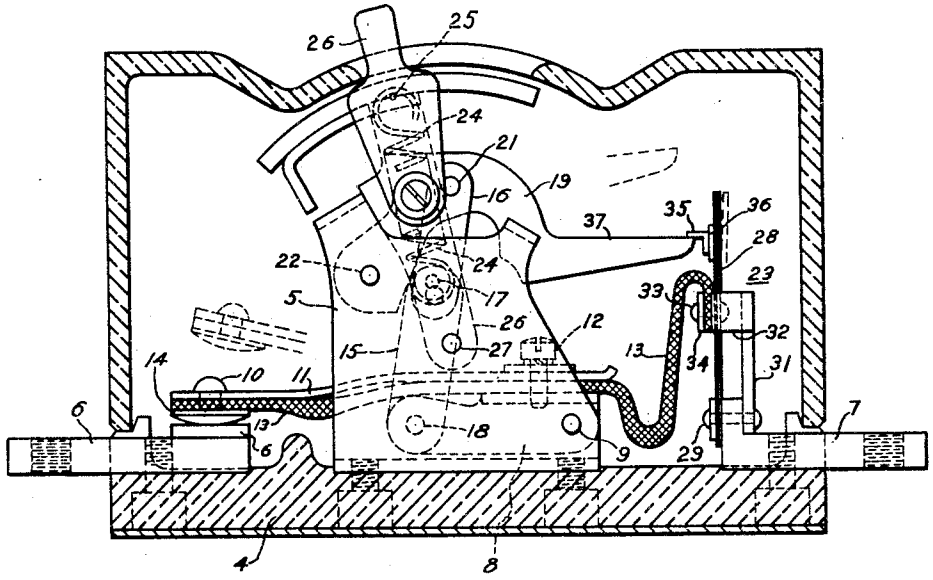


Fig. 2.

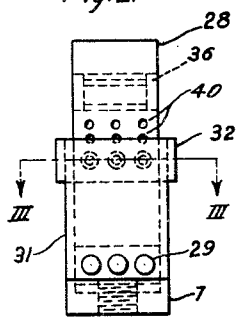
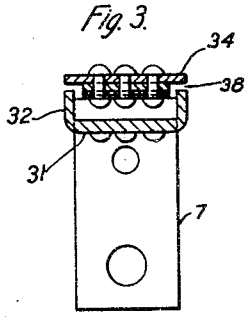


Fig. 3.



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CIRCUIT BREAKER

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3 Claims. (Cl. 200—88)

My invention relates to circuit breakers and particularly to circuit breakers and 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 wherein a bimetal thermal element serves to releasably retain a circuit breaker in operative closed position and wherein a magnetic device, energized by the current passing through the thermal element, serves to deflect or move the thermal element to releasing position in response to predetermined current conditions, such as are caused by a short circuit.

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

These, and other objects that will hereinafter appear are attained by means of the apparatus hereinafter described, and illustrated in the accompanying drawing; wherein,

Figure 1 is an elevational view, partially in section, of a circuit breaker and trip mechanism therefor embodying features of my invention,

Fig. 2 is an end elevational view of the trip mechanism shown in Fig. 1, and

Fig. 3 is a transverse section through the trip mechanism, taken on line III—III of Fig. 2.

Referring to the drawing, 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 also serves to connect a flexible conductor 13 to the contact arm 8. The outer end of the spring member 11 is provided with a contact 14 that is secured to its free end by means of a rivet 10 which serves to clamp one end of the flexible conductor 13 between the 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 together 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 of the pivot shafts 18 and 21, which results in moving the knee pivot 17 laterally. This movement, by reason of the contraction of the spring 24, causes the toggle links to collapse and move the contact 14 to the open position shown in dotted lines in Fig. 1, with a snap action. Upward movement of the operating handle 26 causes closing of the contact 14, when the center of the pin 25 has again moved about the said center line of the toggle pivots 18 and 21.

When the cradle 19 is released, in response to an overload or a short-circuit condition, the contraction of the spring 24 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 pivots of the toggle and the pin 25. Manual operation of the contact 14 to open and to closed positions 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 trip device 23 for releasably retaining the circuit breaker in closed position comprises a flat strip 28 of bimetal that is connected to the terminal 7 by means of rivets 29, which also serve to secure a bracket 31 thereto that supports an iron strap 32 to constitute a portion of a magnetic band surrounding the bimetal, in the manner indicated in Fig. 3. One end of the flexible conductor 13 is conductively connected to the bimetal element at a point between the free end thereof and its point of attachment to the terminal 7, the conductor 13 being attached to the bimetal element by screws or rivets 33 that also serve to attach a metal strap 34, which constitutes a portion of the iron band previously referred to.

By attaching the conductor 13 to the bimetal

strip 28, at a point intermediate its ends, all of the current may be made to pass through the bimetal element at any desired point between the point of attachment of the conductor 13 and the fixed end of the strip, thus causing the heating effect of the current to be concentrated between the point of attachment of the metal strip 28 to the terminal 7 and the flexible conductor 13. The maximum bending of the bimetal element, at that point, will, therefore, cause a relatively wide range of movement of the free end of the bimetal which carries a latch clip 35 that is insulated from the bimetal strip by an insulating plate 36, and releasably engages the latch arm 37 of the cradle 19. The strip is provided with a plurality of perforations 40 for permitting attachment of the conductor to the strip at any desired point.

Under normal operating conditions, the bimetal strip will remain in the latch-retaining position shown in Fig. 1 and will releasably retain the circuit breaker in closed position. Under an overload condition, the bimetal element will be heated by the excessive current passing therethrough and cause it to deflect to the broken-line position shown in Fig. 1, wherein the latch 35 is disengaged from the latch 37, thereby causing the circuit breaker to be released or tripped to open position, wherein the latch and cradle will occupy the positions shown in broken lines in Fig. 1.

The iron strap 32, which is of U-shape, partially surrounds the bimetal element 28, and, in conjunction with the iron strap 34, constitutes a magnetic ring or band which completely surrounds the bimetal element, with the exception of the air gaps 38 which exist in the iron circuit when the bimetal element is in latched position. In the event of a short-circuit condition, the sudden surge of current through the bimetal element energizes the magnet ring and sets up a magnetic circuit in it to cause the strap 34, which constitutes an armature, to be moved into engagement with the ends of the iron strip 32, by reason of the magnetic flux which tends to close the air gaps. Since the strap 32 is stationary, the strap or armature 34 causes deflection of the bimetal element instantly upon the occurrence of a short-circuit condition and thereby causes instantaneous opening movement of the circuit breaker.

The trip mechanism, therefore, provides a time interval before opening the circuit breaker under overload conditions, and an instantaneous trip under short-circuit conditions, and, by connecting the flexible conductor 13 at any one of the various points between its fixed and its free ends, the time lag or the current rating of the bimetal element may be varied without altering its shape. The bimetal current-responsive element, therefore, may be calibrated by simply shifting the position of the flexible conductor with reference to it.

While I have illustrated but one embodiment 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. In a trip device for a circuit breaker, a conducting means having a pair of electrical terminal members connected in circuit with said circuit breaker and including a portion heated by the flow of current therethrough, and movable means of bimetallic material joined to the heated portion of said conducting means to permit flow of heat by conduction from said heated portion to said bimetallic means to cause deflection thereof to trip the circuit breaker, and means including a member of magnetic material affixed to said movable means and energized by the flux set up by the current flow in said heated portion to deflect said means of bimetallic material to trip the circuit breaker.

2. An electro-responsive means for electrical apparatus comprising a conducting means having a pair of electrical terminal members and a heater portion therebetween, a bimetallic member having a portion conductively joined to the heater portion of said means to permit flow of heat by conduction from said heater thereto, said bimetallic means having a freely movable portion, and a magnetically responsive means including a member of magnetic material affixed to said freely movable portion.

3. In an electro-responsive trip mechanism for electrical apparatus, conducting means having a pair of electrical terminal members and a heater portion of bimetallic material electrically connected therebetween, said heater portion of bimetallic material being fixedly mounted at one end and having a portion freely movable laterally for actuating the electrical apparatus, and a pair of members of magnetic material forming a magnetic circuit about said heater portion of bimetallic material, one of said members of magnetic material being fixedly mounted and the other of said members of magnetic material being movable toward said fixedly mounted member of magnetic material and thereby causing lateral movement of said freely movable portion of said heater portion of bimetallic material to actuate the electrical apparatus.

TURE LINDSTROM.