

Feb. 23, 1937.

T. LINDSTROM

2,071,848

CIRCUIT BREAKER

Original Filed Nov. 26, 1930

Fig. 1

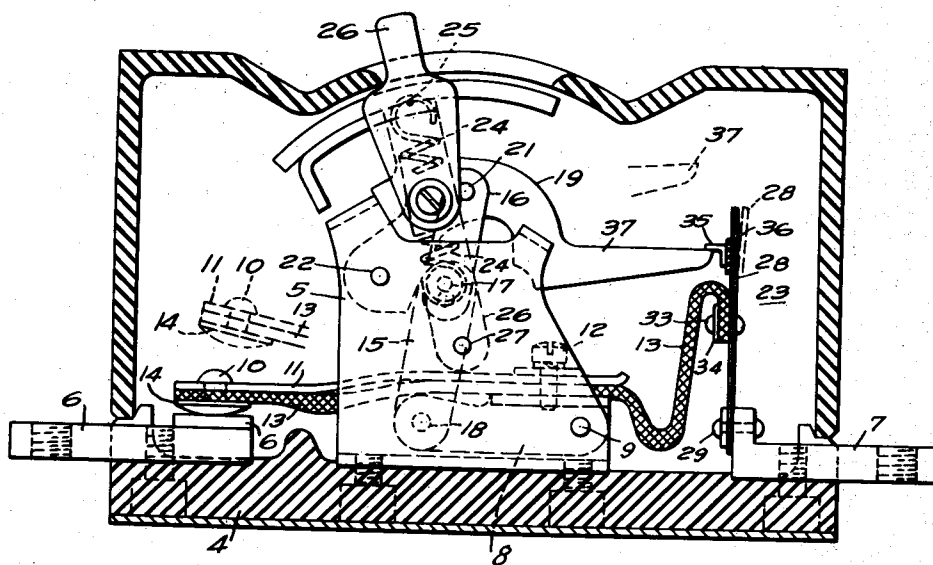


Fig. 2

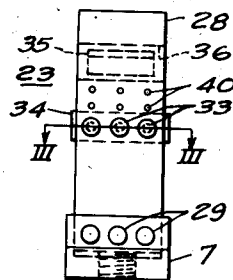
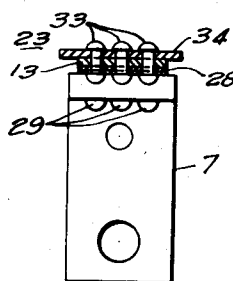


Fig. 3



WITNESSES:

*E. A. McLeskey*  
*Ralph H. Swingle*

INVENTOR

*Ture Lindstrom*

BY

*F. W. Syle*  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,071,848

## CIRCUIT BREAKER

Ture Lindstrom, Edgewood, Pa., assignor to  
Westinghouse Electric & Manufacturing Com-  
pany, a corporation of Pennsylvania

Original application November 26, 1930, Serial  
No. 498,408, now Patent No. 2,027,238, dated  
January 7, 1936. Divided and this applica-  
tion December 24, 1935, Serial No. 55,991

9 Claims. (Cl. 200—116)

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.

This application is a division of my copending application, Serial No. 498,408, filed Nov. 26, 1930 now Patent 2,027,238, issued January 7, 1936.

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 deflects to releasing position in response to predetermined current conditions, such as are caused by an overload or 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. 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.

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 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 clip 35 is disengaged from the latch arm 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 fact that the flexible conductor 13 is attached to the bimetal strip 28 adjacent the mid-portion thereof means that only the lower portion of the bimetal strip is directly heated by the current flow therein. The upper portion of the bimetal is heated only by the flow of heat from the lower portion. This requires considerable time with the result that on small overloads where the bending of the lower portion alone is not sufficient to release latch arm 37 from latch clip 35, the breaker will not trip until there has been time for heat to flow to the upper portion of the bimetal strip and cause it to bend also, but on heavy overloads or short circuits the breaker will trip more quickly due to the rapid heating and bending of the lower portion of the bimetal strip without the time required for heat to flow to the upper portion of the bimetal strip.

The trip mechanism, therefore, provides a time interval before opening the circuit breaker under overload conditions and by connecting the flexible conductor 13 at any one of 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. A trip device for electrical apparatus comprising a bimetal thermal strip fixed at one end and having the opposite end free for releasably retaining the apparatus in a predetermined position, and a flexible conductor adjustably connecting the strip in an electric circuit, whereby current will flow through the strip only between a point intermediate its ends and its fixed end.

2. In a circuit breaker, a pair of relatively

movable contacts, biasing means for moving one of said contacts to open the circuit, means normally opposing said movement, said means including a member of bimetallic material mounted at one end and movable at its other end, a flexible conductor for connecting said member of bimetallic material in the circuit through the circuit breaker, and means for connecting said flexible conductor to said member of bimetallic material at any one of a plurality of points along its length.

3. In combination in an automatic circuit breaker, a contact biased for movement to break the circuit, releasable mechanism normally holding the contact in closed-circuit position and including a bimetallic strip supported at one end and capable of deflection to cause the other end to relatively move and thereby effect the release of the mechanism, and means including a flexible conductor for connecting the bimetallic strip into the circuit to enable it to be deflected upon the passage of excess current and thereby release the mechanism, the said flexible conductor being connectible with the strip at different longitudinally spaced positions so as to change the rate of deflection thereof.

4. In a circuit breaker, a pair of relatively movable contacts, biasing means for moving one of said contacts to open position, means normally opposing said movement, said means including a bimetallic member, an electrical connection to one end of said bimetallic member and a flexible conductor connected to said bimetallic member adjacent the mid-portion thereof for connecting a portion of the bimetallic member in the circuit through the circuit breaker, and said bimetallic member being heated substantially entirely by the heat generated therein due to the current flow therethrough.

5. In a circuit breaker, a base having mounted thereon a pair of line terminal members, a portion of one of said terminal members forming a fixed contact, a strip of bimetallic material having one end fixedly mounted on the other said terminal member, said strip of bimetallic material having at its other end a straight portion which is freely movable laterally, a switch arm movable to make and break connection with said fixed contact, a flexible conductor connected at one end to the movable switch arm and at its other end to the movable portion of the strip of bimetallic material, said strip of bimetallic material being heated substantially entirely by the current flow therein, means biasing said switch arm to move to break connection with said fixed contact, and said strip of bimetallic material normally opposing said movement with a reaction force substantially longitudinally of the straight portion thereof.

6. In a circuit breaker, a movable contact member biased in the circuit-opening direction, a stationary electric contact engageable by the movable contact, an actuator movable when released to cause circuit-opening movement of the contact member, a thermostatic bimetallic strip rigidly mounted at one end and engaging the actuator at the other end so as to serve as a connecting latch adapted to release the actuator upon electro-thermal deflection, a flexible conductor electrically connected with the strip at a point substantially spaced from the point of engagement with the actuator and serving to complete the circuit through a part of the strip, whereby the said strip is automatically deflected rapidly upon the attainment of an excessive overload condition

therein and is automatically deflected very slowly upon the attainment of a moderate overload condition therein.

7. In a circuit breaker, a movable contact member biased in the circuit-opening direction, a stationary electric contact engageable by the movable contact, an actuator movable when released to cause circuit-opening movement of the contact member, a thermostatic bimetallic strip rigidly mounted at one end and engaging the actuator at the other end so as to serve as a connecting latch adapted to release the actuator upon electro-thermal deflection, a flexible conductor electrically connected with the strip at a point substantially spaced from the point of engagement with the actuator and serving to complete the circuit through a part of the strip, whereby the said strip is automatically deflected rapidly upon the attainment of an excessive overload condition therein and is automatically deflected very slowly upon the attainment of a moderate overload condition therein, and means for changing the position of the connection of the flexible conductor to the strip to change the rates of deflection under excessive and moderate overload conditions.

8. In a circuit breaker, a base having mounted thereon a pair of line terminal members, a portion of one of said terminal members forming a fixed contact, a strip of bimetallic material having one end fixedly mounted on the other said terminal member, said strip of bimetallic material having only a single leg with a latch portion at its other end which is freely movable laterally of the length of the strip, a switch arm movable to make and break connection with said fixed contact, a flexible conductor connected at one end to the movable switch arm and at its other end to the movable portion of the strip of bimetallic material, said strip of bimetallic material being traversed by all of the current through the circuit

breaker and being heated substantially entirely by the current flow through the strip, means biasing said switch arm to move to break connection with said fixed contact, and said strip of bimetallic material normally opposing said movement with a reaction force substantially longitudinally of the strip.

9. In a circuit breaker, a base having mounted thereon a pair of line terminal members, a portion of one of said terminal members forming a fixed contact, a strip of bimetallic material having one end fixedly mounted on the other said terminal member, said strip of bimetallic material having only a single leg with a latch portion at its other end which is freely movable laterally of the length of the strip, a switch arm movable to make and break connection with said fixed contact, a flexible conductor connected at one end to the movable switch arm and at its other end to the movable portion of the strip of bimetallic material, said strip of bimetallic material being traversed by all of the current through the circuit breaker and being heated substantially entirely by the current flow through the strip, an operating mechanism for the circuit breaker including means biasing said switch arm to move to break connection with said fixed contact, a latch portion for controlling the switch arm normally engaging said latch portion on the strip of bimetallic material and said strip of bimetallic material normally opposing said movement with a reaction force substantially longitudinally of the strip, a handle member operable to both open and close the circuit breaker without breaking the engagement of said latch portions, and said strip when heated by the current flow therethrough disengaging said latch portions and causing opening of the circuit breaker irrespective of the position in which said handle member may be held.

TURE LINDSTROM.