

Aug. 2, 1932.

O. S. JENNINGS

1,869,563

CIRCUIT BREAKER

Filed Oct. 20, 1930

2 Sheets-Sheet 1

Fig. 1.

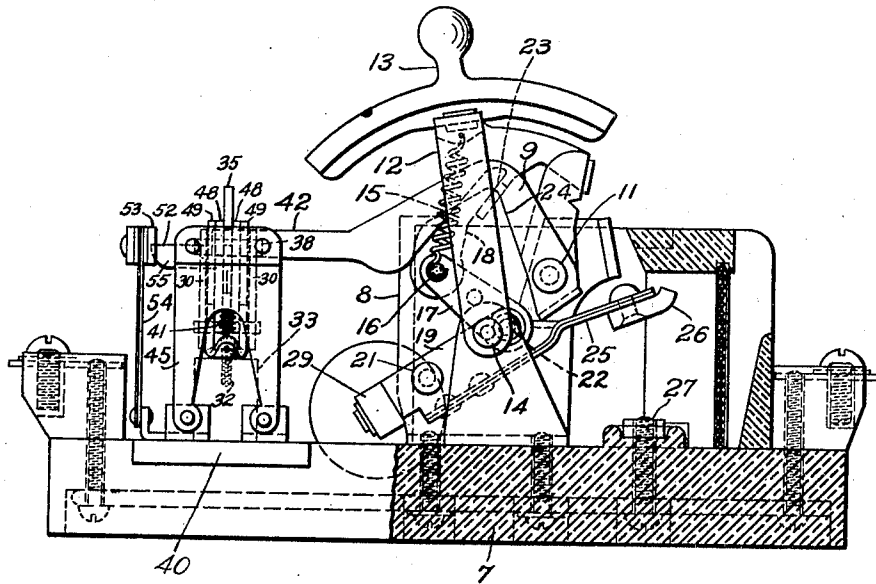


Fig. 2.

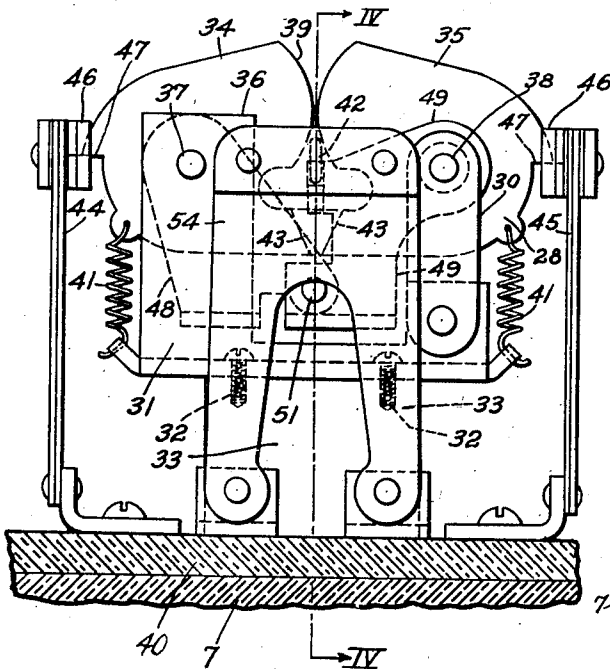
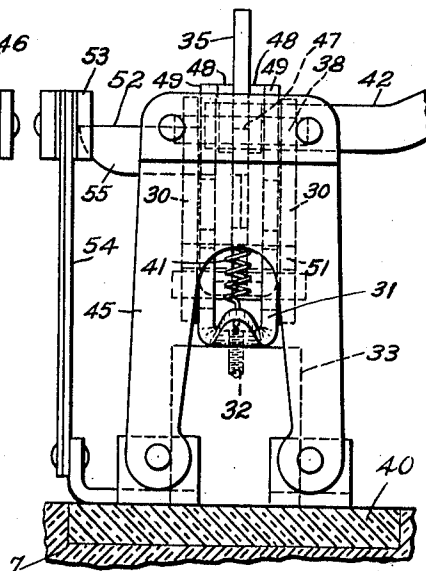


Fig. 3.



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Fig. 4.

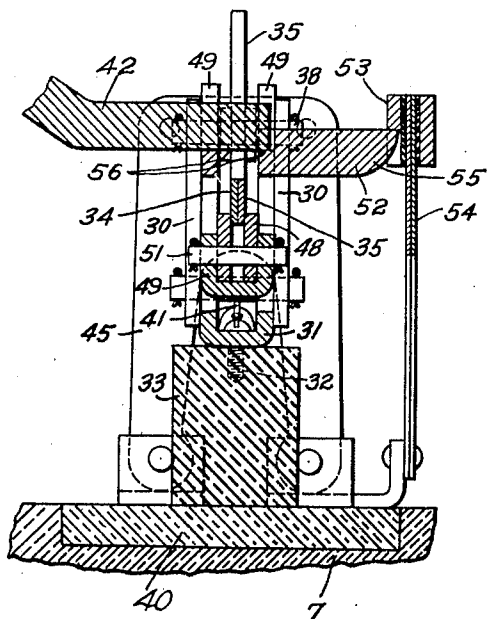


Fig. 5.

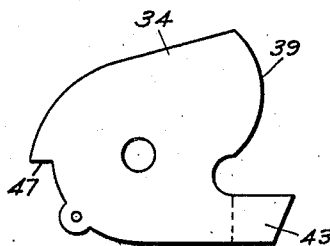


Fig. 6.

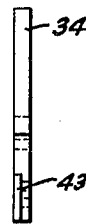


Fig. 7.

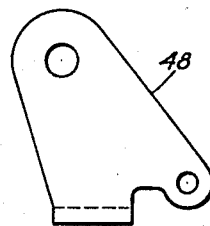


Fig. 8.

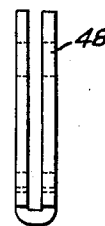


Fig. 9.

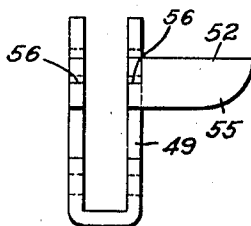


Fig. 10.

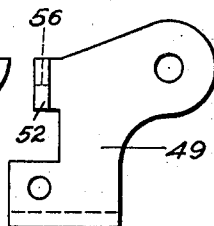


Fig. 11.

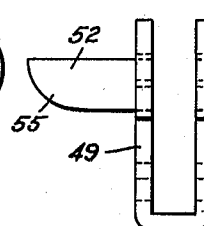


Fig. 12.

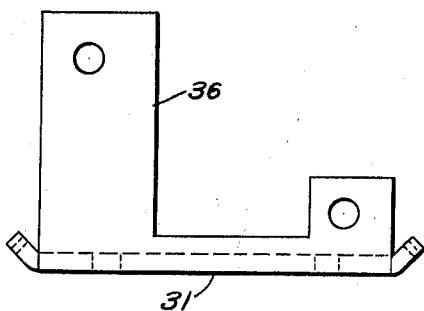
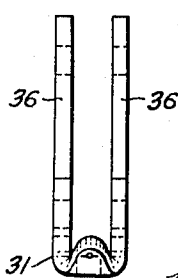


Fig. 13.



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UNITED STATES PATENT OFFICE

OLIVER S. JENNINGS, OF MANSFIELD, OHIO, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

CIRCUIT BREAKER

Application filed October 20, 1930. Serial No. 489,804.

My invention relates to circuit breakers and particularly to circuit breakers for controlling lighting and motor circuits and which may be mounted in sheet-metal enclosures.

An object of my invention is to provide a multi-pole circuit breaker wherein current-responsive trip mechanism is associated with at least three of the poles of the circuit, and wherein the trip mechanism releasably retains a single latch element of the circuit breaker in closed position, thereby rendering the circuit breaker responsive to current conditions in either of the three poles of the circuit.

A further object of my invention is to provide a simple current-responsive tripping element that may be applied to multi-pole circuit breakers of standard construction, and which may be detachably mounted upon the circuit breaker base, in order to permit of interchange of current-responsive elements having different operating characteristics.

A further object of my invention is to provide a trip mechanism for a circuit breaker wherein a plurality of cooperating cam elements serve to jointly retain the circuit breaker releasably in closed position, and wherein the cam members are retained in latching position by separate independently operable current-responsive elements.

A further object of my invention is to provide a trip mechanism for a circuit breaker that comprises a minimum number of parts which are assembled in compact arrangement.

In the copending application, Serial No. 480,096, filed by H. D. Dorfman, on September 6, 1930 and assigned to the assignee of this application, a trip mechanism for a circuit breaker is disclosed wherein a pair of cams serve to releasably retain the circuit breaker in closed position and are controlled by thermal elements that are responsive to current in the circuit controlled by two poles of a three-pole circuit breaker.

It is a further object of my invention to provide a cam-controlled trip mechanism wherein a separate cam is provided for two of the three poles of the circuit breaker which

are held in operative position by a current-responsive member in the third pole of the circuit in order that the circuit breaker may be rendered responsive to current conditions in each of the three poles of the circuit controlled by the circuit breaker.

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

Figure 1 is an elevational view, partially in section, of a circuit breaker embodying features of my invention;

Fig. 2 is an enlarged front elevational view of the current-responsive trip mechanism shown in Fig. 1,

Fig. 3 is an end elevation of the trip mechanism shown in Fig. 2,

Fig. 4 is a transverse sectional view through the trip mechanism shown in Fig. 2, taken on the line IV—IV thereof,

Figs. 5 and 6 are side and end elevational views, respectively, of a cam,

Figs. 7 and 8 are side and end elevational views, respectively, of a resetting lever,

Figs. 9, 10 and 11 are side, end and opposite side elevational views of a second of resetting lever, and

Figs. 12 and 13 are side and end elevational views, respectively, of a frame for the circuit-breaker trip mechanism.

Referring to the drawings, the circuit breaker comprises an insulating base 7 upon which is mounted a sheet-metal-frame structure 8 which serves to support the circuit breaker unit the construction of which is similar to that fully described in my copending application now Patent 1,794,901, issued March 3, 1931, and assigned to the assignee of this application.

Briefly, the circuit-breaker unit comprises the frame 8 upon which a cradle 9 is pivoted for rotative movement about the pivot pin 11. An operating arm 12, having a handle 13, is pivoted for rotative movement about the pivot pin 14, and a pair of tension springs 15 (one of which is shown) are attached, at their outer ends, to the arm 12 and,

at their inner ends, to the knee pivot 16 of a pair of toggle links 17 and 18 which serve to operate a pivoted switch arm 19 that is mounted to oscillate about a pivot shaft 21 mounted on the frame 8, the link 17 being pivoted to the arm 19 by the pivot shaft 22, and the toggle link 18 being pivotally connected to the cradle 9 at the point 23 in the apex of a notch 24 of V-shape in the cradle 9.

The contact arm 19 carries a flexible leaf spring 25, upon the free end of which is mounted a movable contact 26 that is adapted to engage a stationary contact 27.

The cradle 9 is releasably retained in the closed position shown in Fig. 2 by means of a latch that will be hereinafter described. The circuit-breaker apparatus may be designated as of the tumbler type wherein an over-center spring serves to move the contact to open and to closed positions. As shown in Fig. 1, the contact 26 is in open position and is moved to closed position with a snap action when the operating handle 13 has been moved clockwise a sufficient distance to move the outer end of the spring 15 past a center line traversing the pivot shaft 16 and the point 23 referred to above. When this movement of the operating handle has been completed, the spring 15 will snap the lower pivot shaft 16 toward the right and straighten the toggle links for forcing the contact 26 into the closed position.

When it is desired to move the switch to open position manually, the operating handle 13 is moved to the left or in a counter-clockwise direction, and, when the spring 15 again passes over the above-mentioned center line, the toggle will be broken with a snap action to cause the contact 26 to be quickly separated from the contact 27.

In the event of an overload or a short-circuit condition, the latch arm 42 is released, in a manner to be hereinafter described, and the springs 15, which are in extended stressed condition when the circuit breaker contact is closed, cause the cradle 9 to turn in a clockwise direction, which movement causes breaking of the toggle and the subsequent rapid separation of the contact 26 from the contact 27.

Since this form of circuit-breaker apparatus is completely described in the above-mentioned copending application, it is believed that no further explanation of its construction and operation is necessary for the purpose of this application, which is concerned more with the particular form of current-responsive releasing apparatus suitable for a multi-pole circuit breaker.

However, it is to be understood that the present form of circuit breaker, as disclosed in Fig. 1, is of the three-pole type in which the operating mechanism above described is employed for operating three contact arms 19

that are connected, at their inner ends, by means of an insulating cross bar 29.

Referring particularly to Figs. 2 and 3, the current-responsive tripping or releasing device comprises a metal frame 31 of U-shape that is secured, by means of screws 32, upon an insulating block or standard 33 that is detachably secured to the insulating base 7. A pair of rotatably movable cams 34 and 35 are mounted on the frame 31, the former being disposed between the side flanges 36 of the frame 31 to be turned about pivot pin 37, and the latter being mounted between a pair of pivotally mounted links 30 for movement about the pivot shaft 38 thereon. The adjacent faces of the cams are provided with two arcuate portions 39, as indicated in Fig. 2.

The cams 34 and 35 are normally biased in counter-clockwise and clockwise directions respectively, by helical springs 41 that serve to normally retain the cams yieldingly in their open, latch-receiving positions.

The cradle 9 of the circuit breaker is provided with a latch arm 42 that is moved into the space between the cam faces when the circuit breaker is moved to closed and to operative position, the inner edge of the latch arm 42 being adapted to engage overlapping resetting arms 43 on the cams 34 and 35, which move the cams, against the tension of the springs 41, into the locking positions, as indicated in Fig. 2, where they are releasably retained by bimetal elements 44 and 45, respectively, that are of the usual U-shape construction well known in the art and supported on the insulating block 40 inserted in base 7. The movable outer ends of the bimetal elements 44 and 45 are provided with insulating latch members 46 that engage shoulders 47 on the cams.

It will be noted that the space between the closest cam surfaces of the cams 34 and 35, when the cams are in locking position, is of less width than the thickness of the latch arm 42, and, consequently, the latch arm is retained in closed position so long as the cams are prevented from turning, or from separating in opposite directions. However, should either of the cams be released by the outward movement of either of the bimetal elements 44 and 45, its respective spring 41 immediately causes rotation of the cam, which results in widening of the space between the cam faces 39 and consequent release of the latch arm 42 which is of such yielding construction that it may be deflected laterally a sufficient distance to clear the cam which remains stationary.

It will be understood that the bimetal elements 44 and 45 are connected in series with their respective contact arms and are heated by current flowing in the circuit controlled by the contact arm and are, therefore, responsive to current conditions in that circuit. In the event of an overload or short-

circuit condition, the bimetal element deflects laterally and releases its respective cam, thus causing opening movement of the circuit breaker in a well known manner.

Resetting movement of the circuit breaker causes resetting of the cams, by reason of the engagement of the resetting arms 43 by the latch arm 42 which moves the cams to their original latching position shown in Fig. 2.

In order to render all three poles of a three-pole circuit breaker responsive to current in each individual pole of the circuit, a third current-responsive tripping device is provided for preventing lateral or bodily displacement of the cam 35 that is pivotally mounted on the links 30. This device comprises a pair of toggle links 48 and 49 that are pivotally connected by a knee pivot shaft 51, the link 48 being mounted for oscillation about the pivot shaft 37, and the link 49 being pivotally mounted for oscillation about the pivot shaft 38. The links 48 and 49, as indicated in Figs. 2, 4 and 7, to 12, are of U-shape and are so disposed that a portion of the link 48 fits between the side members of the link 49. The link 48 is disposed between the side plates 36 of the support 31, and the cam 34 is mounted between the side members of the link 48. The cam 35 is mounted between the side members of the link 49 which are disposed between the links 30. This arrangement of the links and cams provides a compact construction which requires but little space.

The link 49 is provided with a tongue 52 that projects laterally from one of the side members of the link, and is adapted to engage a latch seat 53 that is mounted upon, and insulated from, the free end of a bimetal element 54 of U-shape that is mounted on the insulating block 33, the tongue 52 being provided with a rounded end edge 55 that forces the bimetal element 54 outwardly when the link 49 is moved to its operative latch-retaining position, as shown in Figs. 1, 3 and 4.

The latch member or arm 42 of the circuit-breaker cradle 9 extends over the link 49 at a point in line with the tongue 52 thereof and engages the link 49 at the points 56 (see Figs. 4, 9 and 10) to move the link 49 to its latch-retaining position shown in Figs. 1, 3 and 4 when the latch member 42 is moved to its operative position, shown in the same figures.

The bimetal element 54 is connected in series with the contacts of the pole of the circuit breaker with which it is associated, and is deflected outwardly when an overload or short-circuit condition occurs in the pole of the circuit in which it is connected. When the latch seat 53 clears the extreme end of the tongue 52, the toggle links are moved toward their straightened position by the spring 41 that is attached to the cam 35, and

by the upward force of the cradle 42 thereby forcing the cam 35 in a lateral direction by reason of its pivotal mounting upon the links 30, and thereupon separating the arcuate cam surfaces 39 a sufficient distance to permit the latch member 42 to move to its released position, it being understood that there is sufficient flexibility in the member 42 and sufficient lost motion in its mounting to permit of the necessary lateral displacement to clear the then non-rotatable cam 34.

In the event that the circuit breaker is opened as a result of operation of the bimetal element 54, the cam 35 will be returned to its latch-retaining position by reason of the engagement of the latch member 42 with the arm 43 of the cam 35 and the link 49 of the toggle. When the cam 35 is returned to its original latch-retaining position, it will be retained in that position by the bimetal elements 45 and 54, from which it has not been freed in the above operation, and which serve to releasably retain the cam 35 and the tongue 52 in operative latch-retaining position.

It is apparent from the foregoing that, when an overload or short-circuit condition occurs in a circuit connected to any one of the three-poles of the circuit breaker, the latter will be tripped or released to open position and that, regardless of which current-responsive thermal element functions to cause opening of the circuit breaker, those elements are reset automatically when the circuit-breaker latch member 42 is moved to its operative position.

The various elements constituting the tripping mechanism, including the bimetal elements and the frame 31 that are mounted on the block 40, may be removed from the supporting base 7 of the circuit breaker without necessitating removal of the circuit breaker from its support, because of the manner in which the cradle 42 is associated with the cams 34 and 35.

Current-responsive calibrated trip elements having different responsive characteristics may be interchanged for changing the operating characteristics of the circuit breaker to meet the requirements of the circuits being controlled.

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. The combination with a trip member for a multi-pole circuit breaker and a pair of cooperating current-responsive cams for releasably retaining the trip member in operative position, of a third current-respon-

sive means for releasably retaining said cams in cooperating retaining position and means for resetting all of said current responsive members to retain said trip member.

2. The combination with a trip member for a multi-pole circuit breaker and a pair of cooperating current-responsive members for releasably retaining the trip member in operative position, of a third current-responsive means for releasably retaining the second said members in cooperating retaining position and means operated by movement of the circuit breaker for resetting said current responsive members to retain said trip member.

3. The combination with a trip member for a multi-pole circuit breaker and a pair of cooperating members each responsive to current controlled by a separate pole of the circuit breaker, of means responsive to current controlled by another pole of the circuit breaker for releasably retaining the second said members in cooperating retaining position.

4. The combination with a trip member for a circuit breaker and a pair of cooperating independently rotatable current-responsive members for releasably retaining the trip member in operative position and adapted to permit releasing movement of the said member when either of the second said members is rotated and when one of the second said members is moved bodily, of current-responsive means for releasably preventing bodily movement of the last said member.

5. The combination with a trip member for a circuit breaker and a pair of cooperating independently rotatable members for releasably retaining the trip member in operative position and adapted to permit releasing movement of the said member when either of the second said members is rotated and when one of the second said members is moved bodily, of independently operable current-responsive means for releasably preventing rotary movement of the second said members, and an independently operable current-responsive means for releasably preventing bodily separation of the second said members.

6. A trip device for a multi-pole circuit breaker, comprising a latch member for the circuit breaker, a pair of cooperating rotatable cams having proximate faces for engaging and releasably retaining the latch member in operative position when the cam members are moved to latching position, and for releasing the said latch member upon rotation of either of the cams, the said cams being movable to latching position by the said latch member, independent current-responsive means for releasably retaining the cams in latching position, a support for one of the cams permitting bodily movement thereof for also causing release of the said latch member, and current-responsive means for releas-

ably preventing bodily movement of the last said cam.

7. A trip device for a multi-pole circuit breaker comprising a latch member for the circuit breaker, a support, a cam pivotally mounted thereon, a second cam mounted thereon for rotary and bodily movement for cooperation with the first cam for releasably retaining the latch member in operative position and for releasing the circuit breaker by rotary or bodily movement of the cams, the said cams being operable by the said latch member, means for biasing the cams toward unlatching position, independently operable current-responsive means for releasably preventing rotary movement of the said cams, and a current-responsive means operable independently of the last-said means for releasably preventing bodily movement of the second said cam.

8. A trip device for a multi-pole circuit breaker comprising a latch member for the circuit breaker, a cam pivotally mounted thereon, a link pivotally mounted on the support, a second cam pivotally mounted on the link for cooperating with the first cam for releasably retaining the latch member in operative position and for releasing the latch member when either cam is rotated and when the second cam is moved bodily away from the first cam, means tending to rotate the cams to releasing position and to bodily move the second cam, means on the cams engageable by the latch member for moving the cams to latch-retaining position, means connected to the said link for releasably preventing bodily movement of the second cam and operable by the latch for bodily moving the second cam to latch-retaining position, and separate current-responsive means for releasably preventing rotary and bodily movement of the cams.

In testimony whereof, I have hereunto subscribed my name this 3 day of Oct., 1930.

OLIVER S. JENNINGS.