June 30, 1942. H. D. DORFMAN ET AL 2,288,270

CIRCUIT BREAKER

Filed Aug. 22, 1941 2 Sheets-Sheet 1

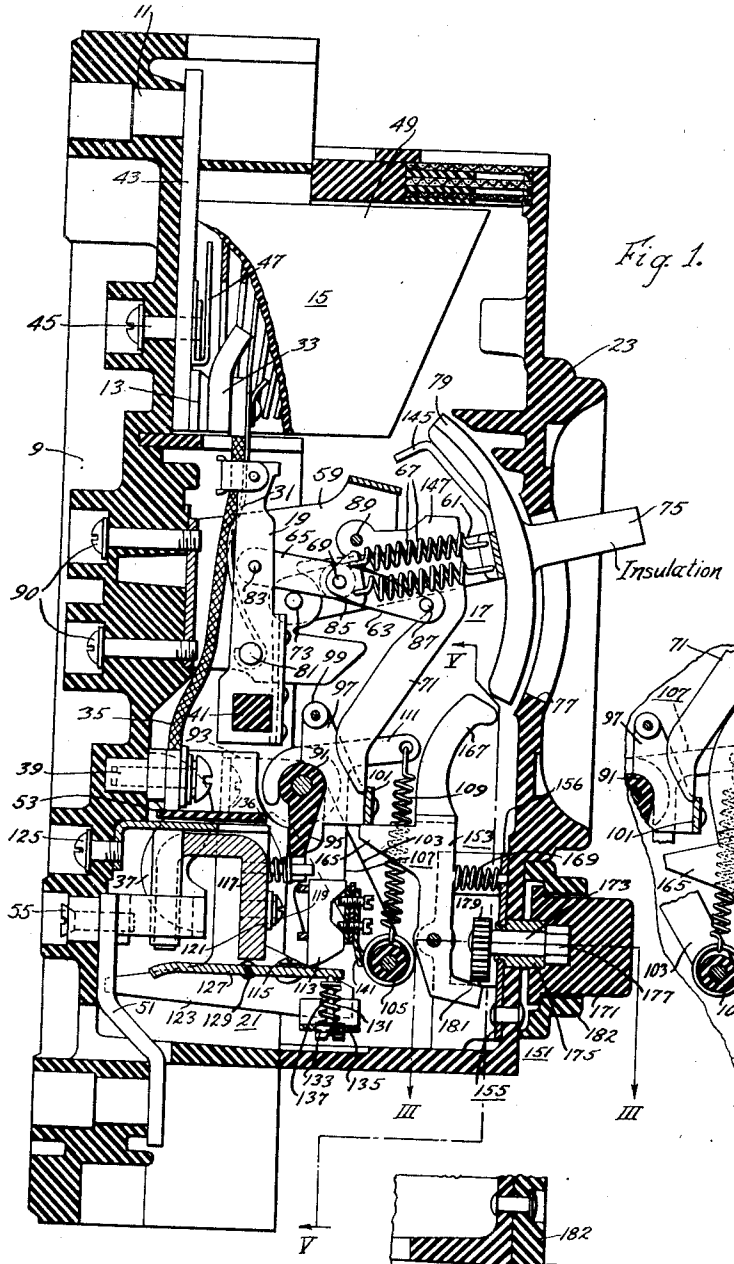


Fig. 1.

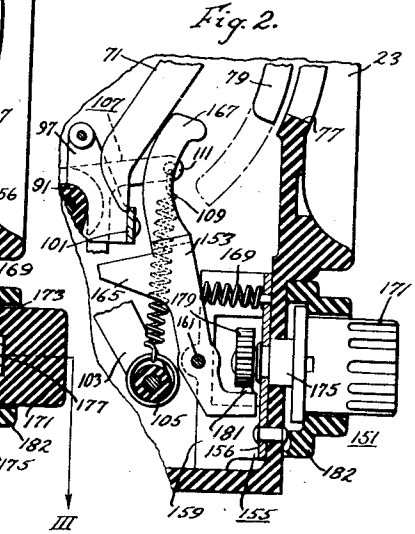


Fig. 2.

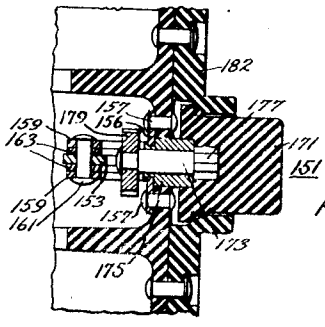


Fig. 3.

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CIRCUIT BREAKER

Filed Aug. 22, 1941 2 Sheets-Sheet 2

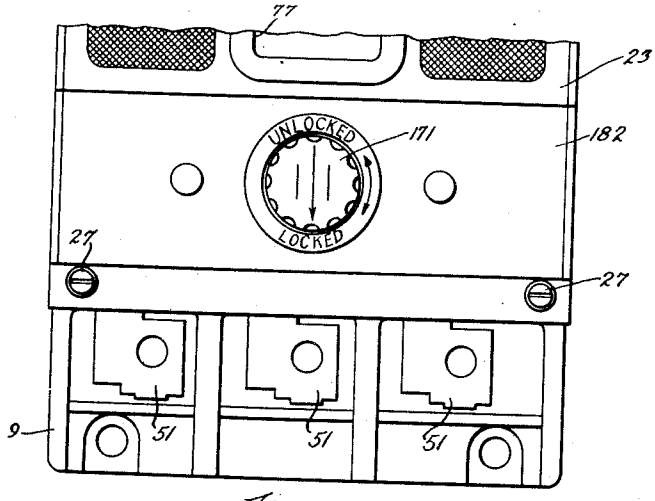
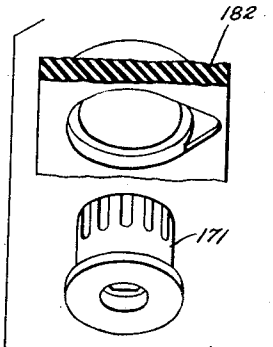


Fig. 4.



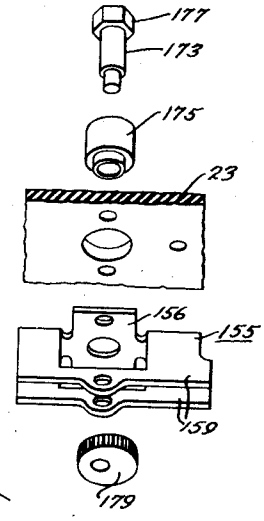


Fig. 6.

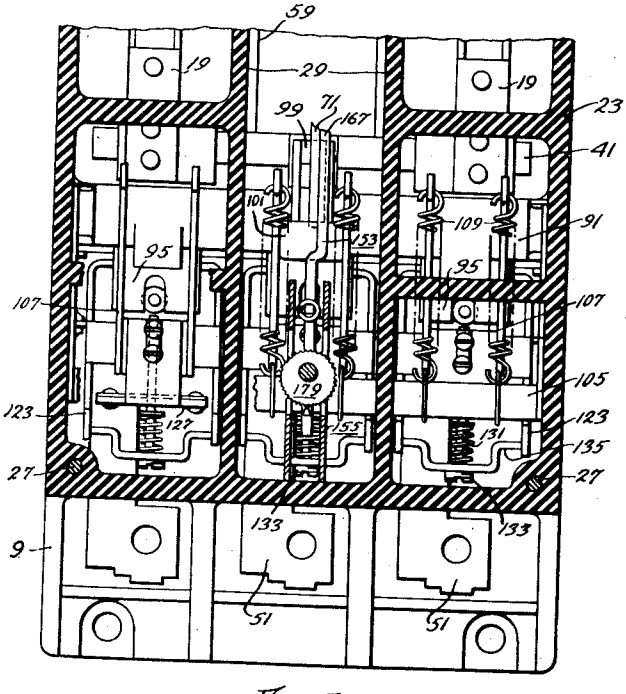


Fig. 5.

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2,288,270

UNITED STATES PATENT OFFICE

2,288,270

CIRCUIT BREAKER

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Application August 22, 1941, Serial No. 407,884

19 Claims. (Cl. 200—89)

The invention relates to circuit breakers of the trip free type having an operating mechanism which is manually operable to open and close the breaker contacts, and which is automatically tripped to cause opening of the contacts in response to predetermined abnormal conditions in the circuit.

Circuit breakers when installed in certain locations, are subjected to very severe jars and shocks which are often of such magnitude as to cause false opening or tripping of the circuit breakers in the vicinity, thus disrupting the electrical service when it is very essential. Under emergency conditions, it is desirable that the circuit breaker shall remain closed even though there be overloads on the circuit which would ordinarily open the breaker. In some cases, the shocks may be so severe as to cause the circuit breaker operating handle or other parts connected to the contacts to move to open position thereby falsely opening the breaker in this manner.

It has been proposed to use non-trip free circuit breakers and station an individual at each such breaker during an emergency to hold it closed. This is not satisfactory, however, because the very important and desired advantages of the modern trip free circuit breakers are lost under normal conditions. It has also been proposed to provide the circuit breaker with a manually operable locking member adapted to be moved to and manually held in locking position to lock the circuit breaker latch or trip bar against tripping movement. This latter proposal is not a satisfactory solution for two important reasons, the first being that it requires a man to be stationed at each individual breaker, and the second being that the locking of the breaker latch or trip bar is not alone sufficient to prevent false opening of the breaker in the case of severe shocks which will move the operating handle or other part connected to the contacts to open position thereby opening the breaker even if the latch is locked.

An object of the invention is the provision of a trip free circuit breaker embodying an improved construction whereby it can be locked to prevent opening thereof by jars or by abnormal circuit conditions.

Another object of the invention is the provision of a trip free circuit breaker embodying an improved locking device manually settable to locking position to lock the circuit breaker in closed position to prevent opening thereof by overloads, jars or any means as long as the locking device is in locking position.

Another object of the invention is the provision of a trip free circuit breaker embodying a locking device which can be manually set to locking position to prevent opening of the circuit breaker by forces acting to release the mechanism latch and also by forces acting to move the operating handle or other parts connected to the contacts to open position.

Another object of the invention is the provision of a trip free circuit breaker embodying a single locking element which is manually settable to a locking position in which it prevents release movement of the circuit breaker latch and also prevents opening movement of the breaker operating member or other parts connected to the contacts.

Another object of the invention is the provision of an improved locking device for trip free circuit breakers, which is simple, reliable and inexpensive to manufacture, and which can be applied to many existing circuit breakers without substantial alteration of the breakers.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof will be best understood from the following detailed description of one embodiment thereof when read in conjunction with the accompanying drawings, in which:

Figure 1 is a vertical sectional view of a multipole circuit breaker embodying the features of the invention, the breaker being shown in the closed position with the locking device set in locking position,

Fig. 2 is a fragmentary sectional view of the circuit breaker showing the locking device in non-locking position,

Fig. 3 is a fragmentary horizontal sectional view taken substantially on the line III—III of Fig. 1 to illustrate features of construction of the locking device,

Fig. 4 is a fragmentary front elevational view of the circuit breaker showing the lower portion of the circuit breaker and the operating knob of the locking device,

Fig. 5 is a fragmentary sectional view of the circuit breaker taken substantially along the line V—V of Fig. 1, and

Fig. 6 is an exploded view of the locking device.

Referring to the drawings, particularly Figs. 1

and 5 thereof, the three-pole circuit breaker illustrated comprises a base 9 of molded insulating material having mounted thereon six terminals 11, two for each of the three poles of the breaker, three stationary contacts 13, an arc extinguishing device 15 for each of the three poles, the circuit breaker operating mechanism 17 which has associated therewith the three movable switch members 19, and the trip device indicated generally at 21. A separate cover 23 also of molded insulating material is provided for cooperating with the base 9 to form an enclosing casing for the circuit breaker. The base 9 and cover 23 are secured together by four bolts 27 (Figs. 4 and 5, only two being shown) which extend through bolt holes located in the cover adjacent the four corners thereof and engage threaded nuts (not shown) embedded in the base 9. The base 9 and cover 23 are each provided with longitudinally extending partitions 29 (Fig. 5) formed integral therewith, which are aligned when the cover is on the base. These partitions serve to separate and insulate the three poles of the breaker from each other.

Each of the switch members 19 includes a resilient switch arm 31 preferably of spring steel secured at one end to the switch member 19 and which supports a movable contact 33 at the other end, each movable contact 33 being adapted to cooperate with a corresponding one of the stationary contacts.

A flexible shunt conductor 35 is provided for connecting each of the movable contacts 33 with a corresponding one of the conducting members 37 which serve to complete the circuit from the shunts 35 to the trip device 21. Each conducting member 37 is secured at its upper end to the base 9 by means of a screw 39, this screw also serving to fasten the lower terminal of the shunt 35 to the conducting member 37.

The three-switch member frames 19 which are substantially channel-shaped adjacent their lower ends are rigidly connected together by means of an insulating tie-bar 41 which extends through suitable openings provided therefor in the channel-shaped portions of the switch members 19, the tie-bar being rigidly fastened to each switch member. The three switch members are thus mechanically connected for simultaneous movement together but insulated from one another, by the insulating tie-bar 41.

Each stationary contact 13 is secured to the lower end of a corresponding terminal strip 43 which is, in turn, secured to the base by a screw 45. Each terminal strip 43 is suitably secured at its upper end to a corresponding one of the upper terminals 11. Both the upper and lower terminals 11 of the circuit breaker are embedded or molded in openings provided therefor in the base 9 and each has a passage therethrough for receiving a terminal screw, or a terminal stud of a switchboard. An arc runner 47 of arc resisting conducting material is secured to each terminal strip 43 adjacent the stationary contact 13, by means of the fastening screw 45.

The arc extinguishers 15 may be of any suitable type but are preferably of the space plate type and each comprises a stack of slotted plates of magnetic material which are insulated from each other and positioned adjacent the path of movement of the corresponding movable contact. The slotted plates are supported in spaced relation with each other in a stack by means of a U-shaped member 49 of insulating material disposed about the plates.

Three terminal strips 51 are provided for connecting the lower circuit breaker terminals 11 to the corresponding poles of the trip device 21, the lower end of the terminals 51 being secured to the terminals 11. Each conducting member 37 comprises a formed strip of conducting material which is shaped as shown in Fig. 1 and serves as the energizing winding of one of the electromagnetic tripping means of the trip device 21, there being three such electromagnetic tripping means, one for each pole of the breaker. The upper angularly bent end of the conducting member 37 is fastened to the base by the screw 39 as previously described. Each conducting member 37 passes through a slot provided therefor in an insulating plate 53 and is looped over one leg of the corresponding magnet core 117 of the trip device, and the lower end of the conducting member is bent angularly and secured to the lower terminal strip 51 by a screw 55. The screw 55 also serves to secure the terminal strip 51 to the circuit breaker base 9.

The electrical circuit for each of the poles is essentially the same. Beginning with the lower terminal 11 the current flows successively through the terminal strip 51, the conducting member 37, flexible shunt conductor 35, the movable contact member 33, the stationary contact 13, and thence through the upper terminal strip 43 to the upper terminal 11.

The operating mechanism 17 which is of the snap action type is supported on a U-shaped metal frame 59 and comprises a bifurcated operating lever 61, two pivotally connected toggle links 63 and 65 forming a toggle which is connected to the center pole switch member 19, two pairs of overcenter springs 67 for operatively connecting the operating lever 61 with the knee pivot pin 69 of the toggle, and the releasable lever 71 for supporting the outer end of the toggle so as to provide a means whereby actuation of the trip device 21 can cause the mechanism to automatically move all of the switch members 19 to open circuit position. The bifurcated operating lever 61 straddles the sides of the frame 59 and is pivotally supported on the sides of the frame by means of two pivot pins 73 (only one being shown). An operating handle 75 of molded insulating material is secured to the outer end of the operating lever 61 and extends through an elongated slot 77 in the circuit breaker cover 23 to provide for manual operation of the circuit breaker. The operating handle 75 is provided with an arcuate shield 79 formed integral therewith which is disposed beneath the opening 77 and serves to close the opening in all positions of the operating handle.

The mechanically connected switch members 19 are pivotally supported on the U-shaped main frame 59 by means of a pivot pin 81 which engages the channel-shaped portion of the central switch member 19. One end of the inner toggle link 65 is likewise pivoted to the center pole switch member 19 through the agency of a pivot pin 83 which provides the only mechanical connection between the operating mechanism and the three switch members. The knee pivot pin 69 of the operating toggle extends for some distance on either side of the joined toggle links and each of the projecting portions is pivotally connected to the inner ends of a pair of the overcenter springs 67 by a spring support 85. The two pairs of overcenter springs 67 lie on opposite sides of the toggle link 63 and releasable lever 71, and the outer ends of the springs are fastened

to the cross portion of the bifurcated operating lever 61. The outer end of the toggle link 63 is pivotally connected to the releasable lever 71 by a pin 87, and this releasable lever is in turn pivotally supported on the U-shaped frame 59 by means of a pivot pin 89. The U-shaped frame 59 is secured to the central portion of the base 9 by a plurality of screws 90.

The trip device 21 includes a rotatably supported trip bar 91 of molded insulating material which has a centrally disposed shaft molded therein by means of which the trip bar is rotatably supported on a pair of brackets 93. The brackets 93 are secured at their inner ends against the opposite side walls of the base 9 and are provided with bearing openings for engaging the ends of the shaft of the trip bar 91. The trip bar is provided with three spaced projections 95 formed integral therewith, one for each pole of the breaker and is also provided with a means for engaging the circuit breaker operating mechanism. This engaging means comprises a pair of substantially parallel plates 97 which are rigidly affixed to the trip bar, a pin 99 which connects the two plates 97 and provides a means for resetting the trip device, and a latch member 101 joining the outer ends of the plates 97 which latch member is adapted to engage the lower end of the releasable lever 71 and restrain this lever when the trip device is in the untripped position. The brackets 93 which support the trip bar are provided with extensions 103 which are connected at their ends by an insulating rod 105.

Three bifurcated trip members 107 are rotatably mounted in slots provided therefor on the trip bar 91 and each of these tripping members is biased in a clockwise direction, as viewed in Fig. 1, to tripping position by a pair of springs 109 connected at one end to extensions 111 of the trip member and connected at the other end to the insulating rod 105. Each tripping member 107 is provided with a latch portion 113 joining the bifurcated ends of the trip member and this latch portion is adapted to be normally engaged by a latch 115 on the armature of a corresponding one of the electromagnetic tripping means. Thus each trip member is normally restrained in non-tripping position by the latch of its corresponding electromagnetic tripping means.

Each of the electromagnetic tripping means of the trip device includes the U-shaped core 117 of magnetic material which is mounted by means of a screw 119 on a cross piece 121 of a supporting frame 123 which is of non-magnetic material, preferably brass. Each supporting frame 123 is secured to the base by means of a screw 125 which passes through the base and threads into an opening provided in a portion of the frame 123. The frame 123 has spaced sides between which the U-shaped magnet core is mounted, and a movable armature 127 is pivotally mounted intermediate its ends at 129 on the frame 123 between the side walls thereof. The armature 127 of each electromagnetic tripping means is biased to a normal unattracted position, as shown in Fig. 1, by means of a compression spring 131 which is interposed between the outer end of the armature lever and an adjusting screw 133 which threads into a cross piece 135 joining the sides of the frame 123. The adjusting screw 133 carries a pin 137 which engages in a notch in the outwardly extending end of the armature 127. The adjusting screw 133 thus provides a means for adjusting the force of the spring 131 of the electromagnetic tripping means to thereby adjust the value of overload current at which tripping will occur.

As has previously been explained, each conducting member 37 serves as an energizing winding for one of the electromagnetic tripping means and for this purpose each conductor member 37 has a portion which is looped over the inner leg of its corresponding magnet core 117, hence each electromagnet is responsive to the current flowing through the corresponding pole or circuit breaker. The trip bar 91 is biased counterclockwise to latching or non-tripping position by three light compression springs 136 each disposed between one of the magnet cores 117 and a corresponding one of the projections 95 of the trip bar. The combined strength of the three springs 136 is considerably less than that of the two trip member springs 109 for any one pole.

When the current flowing through any pole of the breaker is below the magnitude for which its corresponding electromagnetic tripping means is set to operate, the magnetic force developed thereby is insufficient to move the armature 127 to attracted position and consequently the electromagnetic trip means will not operate to trip the breaker. However, as soon as the value of overload current in any pole exceeds that for which the device is set, the magnetic force is then sufficient to move the armature 127 to attracted position against the force of the spring 131 and thereby effect release of the spring biased tripping member 107 of the corresponding pole. When any one of the tripping members 107 is thus released, it is moved to tripping position by the springs 109 and engages the corresponding projection 95 of the trip bar and moves the trip bar in a clockwise direction. This movement of the trip bar causes the latch member 101 to release the releasable lever 71 of the circuit breaker mechanism thereby causing automatic opening of the contacts of the circuit breaker. Clockwise movement of each trip member 107 when released is limited by a projection 141 carried thereby striking the outer end of the armature lever 127. It will thus be seen that when an overload above a predetermined value occurs in the circuit of any one of the poles of the circuit breaker, it will result in operation of the corresponding electromagnetic tripping means of that pole and cause rotation of the trip bar to trip the circuit breaker operating mechanism and thereby cause opening of all of the contacts of the circuit breaker.

The operation of the circuit breaker as thus far described is briefly as follows: The circuit breaker is shown in Fig. 1 in the closed circuit position, the trip device 21 being in the untripped position. Assuming the locking device is in non-locking position: To open the contacts manually, the operating handle 75 is moved in a clockwise direction, as viewed in Fig. 1, about its pivot 73. This movement moves the line of action of the operating springs 67 below the center of the pivot pin 87 which connects the outer toggle link to the releasable lever and in so doing produces a component of force which tends to move the knee pivot pin of the toggle away from the overcenter or closed circuit position toward the collapsed position. Shortly before the operating handle 75 reaches the full open position, this component becomes great enough to set the mechanism in motion and cause collapse of the operating toggle. The collapse of the toggle

causes the switch members 19 to be rotated in a clockwise direction about the common pivot axis 81 to open circuit position.

To close the contacts manually, the operating handle is moved from the open circuit position upwardly or in a counterclockwise direction toward the closed position. After the line of action of the overcenter spring 67 crosses the center line of the outer toggle link 63, that link is caused to move toward the overcenter or closed circuit position, thereby causing the three movable switch members 19 to be operated to the closed circuit position. The closing operation takes place as does the opening operation with a snap action shortly before the operating handle reaches its end position.

When the circuit breaker is in closed circuit position, the releasable lever 71 is biased in a counterclockwise direction, as viewed in Fig. 1, about its pivot 89 by the reaction forces of the springs 67 and is restrained in the normal position shown by the latch member 101 on the trip bar 91. Upon the occurrence of an overload in the circuit of any pole of the breaker which is of sufficient magnitude to cause operation of the corresponding electromagnetic tripping means, the armature of that tripping means is moved to attracted position thereby releasing the corresponding spring biased tripping member 107 which thereupon operates to rotate the trip bar 91 in a clockwise direction. This movement of the trip bar effects release of the lever 71 and the subsequent rotation of the lever 71 causes the pivot 87 to be shifted above the line of action of the overcenter springs 67 thereby resulting in collapse of the toggle and opening of the contacts regardless of the position of the operating handle 75, that is, even though the operating handle may be held in closed position. The breaker is, therefore, entirely trip free. Following each opening operation of the circuit breaker as a result of the operation of the trip device 21, it is necessary to restore the operating mechanism and the trip device 21 to an operative condition. This is done by rotating the operating handle 75 in a clockwise direction to the open position. This movement of the operating handle 75 is transmitted to the releasable lever 71 through the engagement of the projecting member 145 of the operating lever 61 with a portion 147 of the releasable lever 71. As the releasable lever 71 is thus rotated, by the handle 75, the end thereof engages the pin 99 which forms a part of the mechanism engaging means and since that pin is rigidly connected to the trip bar 91, causes the trip bar to rotate in a counterclockwise direction a sufficient distance to permit the latch member 101 to re-engage the end of the releasable lever 71. This re-engagement occurs somewhat before the operating handle 75 reaches the limit of its motion in an opening direction. The resetting movement of the trip bar 91 not only affects the re-engagement of the operating mechanism 17 and the trip device 21, but, in addition, causes a resetting of any or all of the trip members 107 to their latched position, shown in Fig. 1. This is accomplished by the engagement of the projections 95 of the trip bar with the underside of the tripping members 107. The resetting of the trip members 107 and the re-engaging of the operating mechanism by the latch of the trip device restores the circuit breaker to an operative condition in the open circuit position. The contacts may then be manually moved to the closed circuit position exactly as described above.

In order to lock the circuit breaker in closed circuit position and prevent opening thereof either by an overload or severe jars, there is provided in accordance with the invention a locking means indicated generally at 151. This locking means comprises a locking element or lever 153 which is pivotally mounted on a bracket 155 carried by the cover 23 of the circuit breaker. The bracket 155 is formed of a single piece of sheet metal and has a base portion 156 (Fig. 6) which is secured to the underside of the circuit breaker cover 23 by a pair of rivets 157 (Fig. 3). The bracket has two inwardly extending plates 159 which are slightly spaced from one another. The locking lever 153 extends between the plates 159 of the bracket 155 and is pivoted thereto by a pivot pin 161, the ends of which are riveted over against the plates. A pair of spacing washers 163 (Fig. 3) are disposed on the pivot pin 161 on the opposite sides of the locking lever 153 to take up any lateral play in the locking lever 153 and to provide for rotation thereof without binding against the plates 159.

The locking lever 153 is provided with a projection 165 which is adapted to engage or block movement of the lower edge of the latch member 101 when the locking lever 153 is in locking position, thereby preventing releasing or tripping movement of this latch member and the trip bar 91 to which it is secured. In the locking position of the locking lever, the projection 165 thereof thus prevents tripping of the circuit breaker either in response to an overload or by any jars or shocks which might otherwise move the trip bar and trip the breaker.

As has previously been pointed out, it is not sufficient merely to lock the latch or tripping means in order to prevent opening of the circuit breaker contacts, because shocks or jars may occur which are so severe as to cause opening of the circuit breaker by jarring the operating handle 75 and operating lever 61 to open position thereby jarring the circuit breaker open in this manner. In order to avoid this, the locking lever 153 is also provided with an upwardly projecting extension 167 which is adapted to occupy a blocking position under the lower end of the arcuate portion 79 of the handle 75, as shown in Fig. 1, when the locking lever 153 is in its locking position. In this position, the extension 167 prevents any substantial movement of the operating handle 75, the operating lever 61, and the springs 67 away from their closed position so that jars or shocks cannot cause the breaker to be jarred open by movement of any of these elements. The circuit breaker operating toggle 63—65 is itself locked in the overcenter position by the operating springs 67 and the reactive pressure of the resilient contact arms 31 so that this toggle cannot be caused to collapse by shocks or jars as long as the operating lever 61 is held in closed or substantially closed position.

The locking lever 153 is biased in a counterclockwise direction as viewed in Fig. 1 about its pivot 161 to a non-locking position as shown in Fig. 2 by means of a compression spring 169 disposed between the locking lever and the supporting bracket 155. In the non-locking position of the locking lever 153, the projections 165 and 167 thereof are disposed out of the path of movement of the latch member 101 and operating handle 75 respectively so that the locking means

does not interfere with either tripping or manual operation of the circuit breaker.

The locking lever 153 is adapted to be manually set to locking or non-locking position by means of an operating knob 171 of insulating material which is rotatably mounted on the front of the circuit breaker cover 23 in a position below the operating handle 75. The knob 171 has a shaft 173 secured thereto which extends through the cover 23 and is rotatable in a bearing or bushing 175 secured to the mounting bracket 155, the inner reduced end of the bushing being riveted over against the base portion 156 of the bracket 155. The shaft 173 has a non-circular portion 177 which fits tightly in a correspondingly non-circular recess in the knob 171. The inner end of the shaft 173 has a cam 179 rigidly secured thereon, and the edge of this cam engages a co-operating projection 181 on the lower end of the locking lever 153 whereby the cam controls movement of the locking lever. The cam 179 comprises a generally circular disk which is secured eccentrically to the shaft 173. The sides of the bracket 155 have openings, as shown in Fig. 6, to accommodate the cam 179. When the low part of the cam 179 is in contact with the projection 181 of the locking lever, the biasing spring 169 maintains the locking lever in non-locking position as shown in Fig. 2. However, when the knob 171 is rotated 180° in either direction from the non-locking position shown in Fig. 2 to the locking position shown in Fig. 1, the high portion of the cam moves the locking lever 153 to locking position and maintains it in locking position to lock the circuit breaker closed. The edge of the cam 179 is provided with a series of notches as shown in Figs. 5 and 6 and the projection 181 which engages the cam has a beveled engaging edge so that the cam and lever will be held firmly by the spring 169 in any position to which the locking means are manually set. The teeth formed by the notches are rounded to permit manual rotation of the knob and cam. Since the projection 181 of the locking lever 153 bears against the cam in a direction radial to the axis of the shaft 173, shocks or jars will not cause the cam to be rotated away from the position to which it is set.

A trim plate 182 is secured to the front side of the circuit breaker cover by rivets and this plate has a circular flange portion surrounding the base of the knob 171. This flange of the trim is marked with the words "locked" and "unlocked" and the front of the knob is provided with an arrow to cooperate with the markings to indicate the position of the locking means.

The locking means under normal conditions is always set in unlocked position as shown in Fig. 2. In this position, the circuit breaker may be operated manually, or automatically on overload, without interference by the locking lever. If it is desired to lock the circuit breaker closed, the knob 171 is rotated 180° from the unlocked position shown in Fig. 2 to the locked position shown in Fig. 1. This movement of the knob causes the cam 179 to move the locking lever to the locking position shown in Fig. 1, thereby locking the circuit breaker closed to prevent opening thereof. In this position, the circuit breaker cannot be tripped open because the latch member 101 is locked in latching position, nor can the contacts be opened by jarring the handle or operating member because the projection 167 locks the operating handle against substantial movement away from the closed position.

It may sometimes be desired to close the circuit breaker against an overload. This can be accomplished by first rotating the knob 171 toward locking position as far as it will go, its movement being limited by the projection 167 engaging the under surface of the arcuate handle shield 79. In this position, however, projection 165 is close enough to the latch member 101 to positively prevent unlatching of the releasable lever 71. The operating handle 75 may now be moved to closed position closing the breaker even though an overload exists which would ordinarily be sufficient to trip the breaker. After the handle has been moved to closed position, the locking knob 171 may be turned on to its completely locked position, thus completing the locking of the circuit breaker in the closed position. The same result may also be accomplished by moving the operating handle far enough toward closed position to allow movement of the locking lever to locking position, and turning the knob 171 of the locking device to the full locking position.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details thereof and arrangement of parts may be made without departing from some of the essential features of the invention. It is desired, therefore, that the language of the appended claims be given the broadest interpretation permissible in the light of the prior art.

We claim as our invention:

1. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means operable to cause opening of said contacts irrespective of the position of said operating member, and locking means movable to a locking position in which it is effective to prevent tripping of the breaker and in which it is also effective to prevent opening of said contacts by other than a tripping operation.

2. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means including a tripping member movable to cause opening of said contacts irrespective of the position of said operating member, and locking means movable to a locking position in which it is effective to prevent tripping movement of the trip member and in which it is also effective to prevent opening of said contacts by other than a tripping operation.

3. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means operable to cause opening of said contacts irrespective of the position of said operating member, and locking means movable to a locking position in which it is effective to prevent tripping of the breaker and in which it is also effective to prevent opening of the breaker by a part of the mechanism connected to said contacts.

4. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means operable to cause opening of said contacts irrespective of the position of said operating member, and locking means settable to a locking position to lock said

circuit breaker closed and prevent opening of the breaker either by said tripping means or by parts of the mechanism connected to said contacts.

5. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means operable to cause opening of said contacts irrespective of the position of said operating member, and locking means including a single locking member movable to a locking position in which it is effective to prevent tripping of the breaker and in which it is also effective to prevent opening of the contacts by the operating mechanism.

6. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to open and to close said contacts, tripping means operable to cause opening of said contacts irrespective of the position of said operating member, and locking means settable to a locking position in which it is effective to prevent tripping of the breaker and in which it is also effective to prevent opening of said contacts by said operaing mechanism.

7. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means operable to cause opening of said contacts irrespective of the position of said operating member, and locking means settable to a locking position in which it is effective to prevent tripping of the breaker and in which it is also effective to hold said operating member in closed position thereby preventing opening of said contacts.

8. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to a closed position to close said contacts, tripping means operable to cause opening of the contacts irrespective of the position of said operating member, and locking means comprising a locking member movable to a locking position in which a portion thereof locks the tripping means to prevent tripping of the breaker and another portion thereof locks said operating member in closed position thereby preventing opening of said contacts.

9. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to a closed position to close said contacts, a member movable from one position to a second position to cause opening of said contacts irrespective of the position of said operating member, said last-mentioned member being biased to said second posiion at least when said contacts are closed, holding means for holding said member in said one position, electroresponsive means operable to cause said holding means to permit movement of said member to said second position, and locking means movable to a locking position in which a portion thereof prevents movement of said member from said one position and in which another portion thereof prevents opening movement of a part of the mechanism connected to the movable contact.

10. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, a spring biased member releasable to cause opening of said contacts irrespective of the position of said operating member, a latch for normally restraining said releasable member, electroresponsive means operable to cause said latch to release said releasable member, and locking means settable to a locking position in which a portion thereof prevents release of said releasable member and in which another portion thereof prevents opening movement of a part connected to said movable contact thereby preventing opening of said contacts.

11. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to closed position to close said contacts, a member movable from one position to a second position to cause opening of the contacts irrespective of the position of said operating member, holding means for normally restraining said member in said one position, electroresponsive means operable to cause said holding means to permit movement of said member to said second position, and locking means comprising a single locking element movable to a locking position in which a portion thereof is effective to prevent movement of said member from said one position and in which another portion thereof locks said operating member in closed position.

12. A circuit breaker comprising relatively movable contacts, operating mechanism therefor comprising an operating member movable to open and to close said contacts, a spring biased member releasable to cause opening of said contacts irrespective of the position of said operating member, a latch for normally restraining said releasable member, electroresponsive means operable to cause said latch to release said releasable member, and locking means comprising a locking element movable from a non-locking position to a locking position in which a portion thereof prevents release of said releasable member and in which another portion thereof locks said operating member in closed position.

13. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means operable to cause opening of said contacts irrespective of the position of said operating member, and locking means comprising a locking element movable from a non-locking position to a locking position in which a portion thereof prevents tripping of the breaker and another portion thereof prevents opening of said contacts, and a knob rotatably mounted on the front of the breaker and operable to cause movement of said locking element to locking or non-locking position.

14. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to open and to close said contacts, a spring biased member releasable to cause opening of said contacts irrespective of the position of said operating member, a latch for normally restraining said releasable member, electroresponsive means operable to cause said latch to effect release of said releasable member, and locking means comprising a pivoted locking element movable from a non-locking position to a locking position in which it prevents release of said releasable member, and a knob rotatably mounted on the front of said breaker manually operable to cause movement of said locking element to non-locking or locking position.

15. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to open

and to close said contacts, a spring biased member releasable to cause opening of said contacts irrespective of the position of said operating member, a latch for normally restraining said releasable member, electroresponsive means operable to cause said latch to release said member, and a locking means comprising a locking element movable from a non-locking position to a locking position in which a portion thereon prevents release of said releasable member and in which another portion thereof locks said operating member in closed position, and a knob rotatably mounted on the front of the breaker for moving said locking element to locking or non-locking position.

16. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to open and to close said contacts, a spring biased member releasable to cause opening of said contacts irrespective of the position of said operating member, a latch for normally restraining said releasable member, electroresponsive means operable to cause said latch to release said member, and a locking means comprising a pivoted locking element movable from a non-locking position to a locking position in which a portion thereon prevents release of said releasable member and in which another portion thereof locks said operating member in closed position, and a knob rotatably mounted on the front of the breaker for moving said locking element to locking or non-locking position.

17. A multipole circuit breaker comprising a plurality of movable contact members mechanically connected for movement together, an operating mechanism for actuating said contact members including an operating member movable to operate said contact members to closed circuit position, a member releasable to cause said contact members to be moved to open circuit position irrespective of the position of said operating member, a trip bar having a latch for normally restraining said releasable member, a plurality of electro-responsive tripping means one for at least two of the poles of said breaker each operable in response to predetermined abnormal conditions in the circuit of its pole to cause movement of said trip bar and latch to release said releasable member, and locking means movable from a non-locking to a locking position in which it is effective to prevent release of said releasable member and also to prevent opening of said contact members by said operating mechanism.

18. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating member movable to close said contacts, tripping means operable in response to predetermined conditions to cause opening of said contacts irrespective of the position of said operating member, and locking means movable from a non-locking position to a locking position in which it is effective to prevent tripping of the breaker and in which it is also effective to prevent opening of said contacts by said operating mechanism, said locking means also being settable to prevent tripping of the breaker so as to permit said breaker to be closed against an overload condition.

19. A circuit breaker comprising relatively movable contacts, operating mechanism therefor comprising an operating member movable to open and to close said contacts, a spring biased member releasable to cause opening of said contacts irrespective of the position of said operating member, a latch for normally restraining said releasable member, electroresponsive means operable in response to predetermined overload conditions to cause said latch to release said releasable member, and locking means comprising a locking element movable from a non-locking position to a locking position in which a portion thereof prevents release of said releasable member and in which another portion thereof locks said operating member in closed position, said locking element also being settable to a position in which the first mentioned portion thereof prevents release of said releasable member and allows the circuit breaker to be closed and maintained closed against said predetermined overload conditions.

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