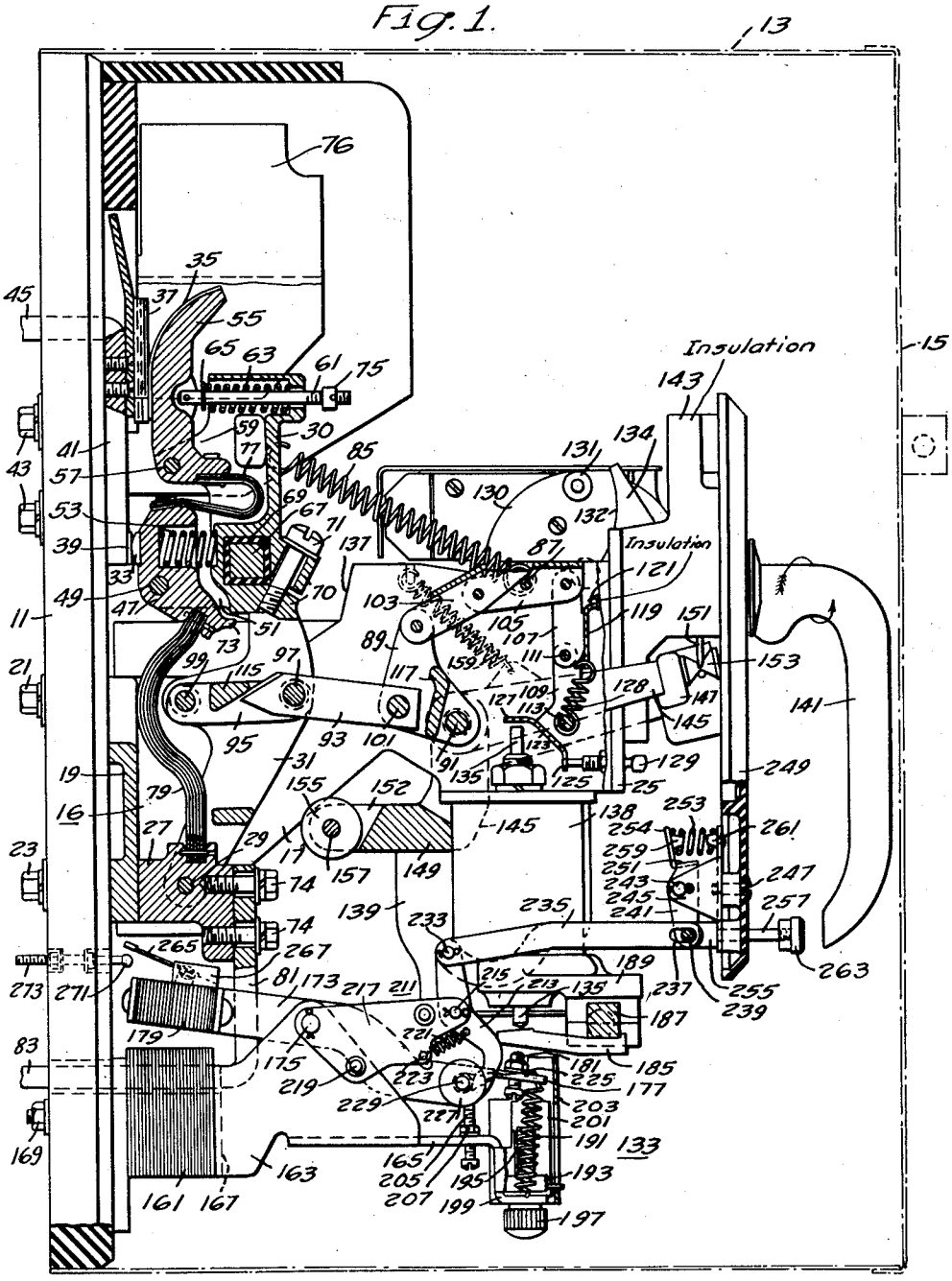
June 22, 1943. T. LINDSTROM ET AL 2,322,301

CIRCUIT BREAKER

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Fig. 1.



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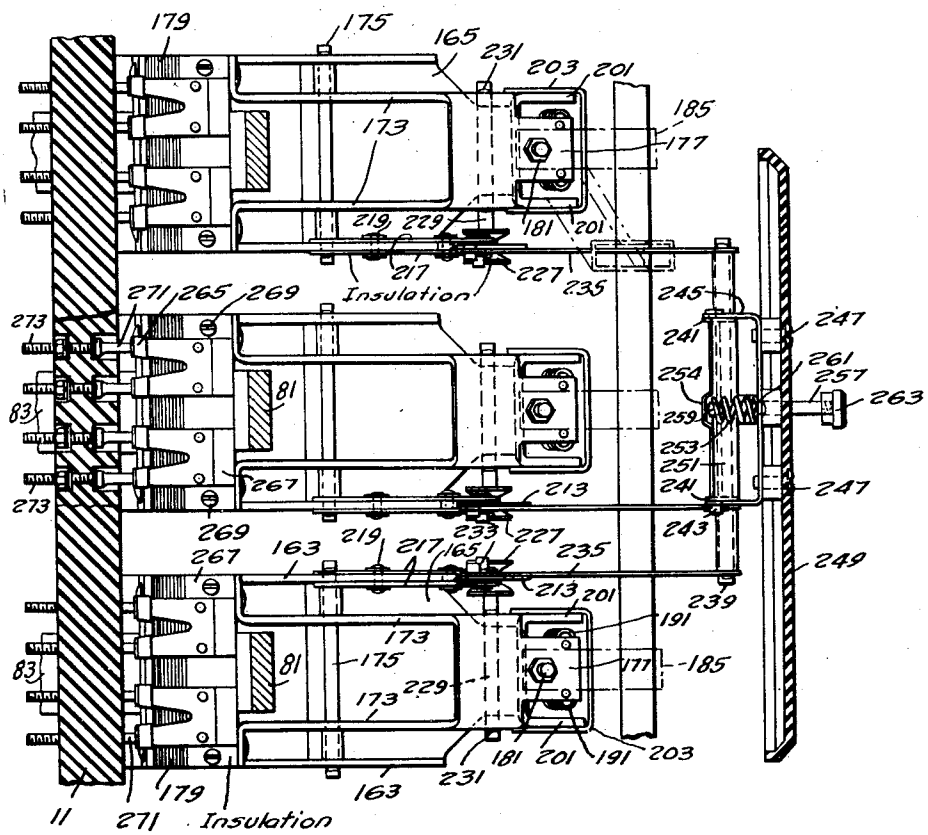
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CIRCUIT BREAKER

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Fig. 2.



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Patented June 22, 1943 2,322,301

UNITED STATES PATENT OFFICE

2,322,301

CIRCUIT BREAKER

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Application December 13, 1941, Serial No. 422,786

13 Claims. (Cl. 200—89)

This invention relates to circuit breakers in general and more particularly to circuit breakers of the trip-free type for controlling moderate power circuits.

An object of the present invention is the provision of a trip-free circuit breaker having a trip device operable in response to predetermined conditions, and a latch operated to automatically latch the trip device in operated position.

Another object of the invention is the provision of a circuit breaker in which a toggle is operated by a trip device to cause opening of the breaker and in which a latch is operated upon operation of the trip device to restrain said trip device and the toggle in operated position and thereby prevent closing of the breaker.

Another object of the invention is the provision of a circuit breaker having an electroresponsive trip device which is adapted to be automatically locked in operated position when it is operated in response to an overload current.

Another object of the invention is the provision of a circuit breaker having a trip device including a trip member operable in response to overload currents to cause opening of the breaker, and having a latch which is automatically effective to latch the trip member in operated position upon operation of the trip member, said latch being manually operable to release the trip member.

Another object of the invention is the provision of a circuit breaker in which the trip device is latched in operated position to prevent closing the breaker the trip device being manually releasable to permit closing the breaker.

Another object of the invention is the provision of a circuit breaker in which operation of a trip device causes operation of a latch member for latching the trip device in operated position to prevent closure of the breaker, the latch being manually operable to release the trip device and permit closing the breaker.

Another object of the invention is the provision of a circuit breaker having a closing means for closing the breaker, a member movable to cause opening of the breaker irrespective of the position of the closing means and which must be reset to permit closing of the breaker, a trip device operable in response to predetermined conditions to move the member, and latching means automatically effective to lock the trip device and member in operated position to thereby prevent closing of the breaker.

Another object of the invention is the provision of a circuit breaker having a means which is automatically effective to prevent closing of the breaker when the breaker is opened in response to predetermined conditions, said means being ineffective when the breaker is opened by other means.

Another object of the invention is the provision of a circuit breaker having a member movable to cause opening of the breaker and which must be reset to permit closing of the breaker, a plurality of trip devices each operable to cause movement of the member to cause opening of the breaker, and a latching means automatically effective upon operation of one of the trip devices to prevent resetting of the said member.

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 advantages and objects thereof, will be best understood from the following description of one embodiment thereof when read in conjunction with the accompanying drawings, in which:

Figure 1 is a vertical sectional view through the center pole of a multiple circuit breaker embodying the principles of the invention; and

Fig. 2 is a horizontal sectional view of the trip mechanism.

Referring to Figure 1 of the drawings, the circuit breaker is provided with an operating mechanism common to all of the poles which is mounted in a U-shaped main frame 16 comprising a pair of frame members 17 (only one being shown) rigidly connected by a cross member 19. The frame 16 is mounted on the central portion of a base 11 of insulating material and is secured thereto by means of bolts 21 and 23. The outer ends of the frame members 17 are rigidly connected by a cross member 25.

The bolt 23 extends through the base and the cross member 19 and serves to rigidly secure a connector 27 of conducting material to the cross member and to the base 11. A shaft 29 extending through an opening in the connector 27 and through openings in the frame members 17 pivotally supports a pair of arms 31 having their free ends integral with a contact arm 30 for the center pole. The contact arms 30 (Fig. 1) for the outer poles are identical with the arm 30 for the center pole but are not provided with arms 31. The contact arms for the outer poles are rigidly secured to a tie bar 67 which extends across all of the poles and which is clamped to the center pole contact arm 30 by means of a split clamp 70 and a screw 71. The three con-

tact arms 30 are thus mechanically connected for movement together. Rectangular tubes 69 of insulating material between the tie bar 67 and contact arms 30 for the several poles serve to insulate the three movable contact arms and their associated contacts from the tie bar 67.

The movable contact structures and the stationary contacts for the several poles are alike for which reason only the contacts for the center pole will be described. The contact arm 30 for the center pole pivotally carries a main movable contact member 47 and a movable arcing contact member 55. The main contact member 47 is pivoted on a pivot pin 49 supported in projections 51 of the contact arm 30, and the movable arcing contact member 55 is pivoted on a pivot pin 57 supported in projections 59 of the arm 30. The main movable contact member 47 carries a contact 33, and a contact 35 is secured to the arcing contact member 55. These contacts 33 and 35 are adapted to engage respectively fixed contacts 39 and 37 secured on a conductor 41 which is in turn secured to the base 11 by means of bolts 43. The conductor 41 extends upwardly and is bent at right angles, the bent portion extending through an opening in the base 11 to form a terminal connector 45.

A spring 53 compressed between a spring seat on the contact arm 30 and a spring seat on the main contact member 47 provides contact pressure for the main contacts 33—39 when the contact arm is in the closed position. Contact pressure for the arcing contacts 35—37 is provided by a spring 63 surrounding a rod 61 pivotally connected to the arcing contact member 55 and slidable through an opening in a spring seat on the contact arm 30. The spring 63 is compressed between a washer 65 seated on a shoulder on the rod 61 and the spring seat on the contact arm 30. The rod 61 has a nut 75 on the outer end thereof which acts to limit counterclockwise rotation of the arcing contact member 55 about its pivot when the contact arm 30 is moved to open the contacts. Counterclockwise movement of the main contact member 47 is limited by a projection 73 thereon striking the body of the contact arm 30. The adjustment of the nut 75 on the rod 61 is such that the arcing contacts 35—37 open after the main contacts 33—39 open during an opening operation of the circuit breaker, and close before the main contacts close during a closing operation.

When the contact arm 30 is operated to open the contacts, the arc across the arcing contacts 35—37 resulting from the rupture of the current is drawn into an arc extinguisher indicated generally at 76 where it is cooled and extinguished. Any suitable arc extinguisher may be employed, the one illustrated comprising, generally, a stack of slotted plates (not shown) of magnetic material disposed adjacent the paths of travel of each of the arcing contacts 35. The plates serve to draw the arc towards the ends of the slots where it is broken up into a plurality of short arcs which are quickly cooled and extinguished.

The movable arcing contact member 55 is connected by a flexible shunt conductor 77 to the main contact member 47 and another flexible shunt conductor 79 connects the main contact member 47 to the connector 27. The connector 27 for the center pole is secured to the cross member 19 of the frame 16 by the bolts 23, and the connectors 27 for the outer poles are bolted to the base 11 with a spacer (not shown) between the base and each of these connectors in order to align the members 27 of the outer poles with the corresponding member 27 for the center pole. A conductor 81, secured to the connector 27 by means of bolts 74 extends downwardly therefrom and is bent at right angles. The horizontally disposed portion of the conductor extends between the legs of a U-shaped tripping magnet core 161 and projects through an opening in the base 11 where it forms a terminal connector 83 which, together with the terminal connector 45, serves to connect the breaker in an electrical circuit.

The electrical circuits for the several poles of the breaker are essentially the same, therefore, only the circuit for the center pole will be traced. This circuit extends from the terminal connector 45 through the conductor 41, the main contacts 33—39, the main contact member 47, the flexible shunt conductor 79, the connector 27, the conductor 81 to the terminal connector 83. The circuit for the arcing contacts, 37—35 extends from the terminal connector 45, through the conductor 41, the arcing contacts 37—35, contact member 55, the flexible shunt conductor 77, the main contact members 47, and through the previously described circuit to the terminal connector 83.

The contact arms 30 are biased in a clockwise or opening direction by means of a pair of springs 85 (only one being shown). These springs are tensioned between the center pole contact arm 30 and a fixed pivot 87 supported in the main frame 16. In the closed position of the breaker, the center pole contact arm 30 and consequently all of the contact arms are releasably restrained in closed contact position (Fig. 1) by means of a toggle and linkage mechanism which is collapsible to cause opening of the contacts. The toggle and linkage forms a part of the common operating mechanism.

This collapsible linkage includes a lever 89 pivotally mounted on a fixed pivot 91 supported on the main frame 16. The lever 89 comprises a pair of levers rigidly connected by an integral cross bar 117, and is operatively connected to the support arms 31 of the center pole contact arm 30 by a main operating toggle comprising toggle links 93 and 95. The toggle link 93 has one end pivoted on a pin 101 supported on the lever 89 and the link 95 is pivoted on a pivot pin 99 on the arms 31. The links 93 and 95 are pivotally connected by a knee pivot pin 97. The toggle link 95 comprises a pair of links rigidly connected by means of an integral cross bar 115.

The free end of the lever 89 is pivotally connected by means of a link 103 to one arm of a lever 105 pivoted on the fixed pivot 87. The other arm of the lever 105 is pivotally connected to a toggle link 107 of a tripping toggle comprising the link 107 and a toggle link 109. The link 109 is pivoted on a fixed pivot 113 supported on the frame 16 and comprises a pair of links joined near the pivot 113 by a yoke 123 provided with projections 125 and 127. The toggle link 107 comprises a pair of links connected by a yoke 119 having a bent portion to which is secured an extension 121 of insulating material. The toggle links 107 and 109 are pivotally connected by a knee pivot pin 111. The purpose of the extension 121 is to cooperate with a part connected to a manually operable handle 141 to manually trip the breaker in a manner to be more fully described later. The lever 105 and the link 103

each comprise a pair of members rigidly connected by yokes substantially as illustrated.

The linkage just described serves to releasably hold the contact assemblage including the movable contacts for all of the poles of the breaker in closed contact position. In the closed position, the main operating toggle 93—95 is overcenter above a line through the center of the pins 99—101, and a second toggle, one link of which comprises the overcenter links 93—95 and the other link of which comprises the lever 89, is overcenter above a line through the center of the pins 99 and 91. The overcenter movement of the main operating toggle 93—95 is limited by the projecting end of the link 93 engaging the cross bar 115 of the link 95.

With the main operating toggle 93—95 and the toggle comprising the links 93—95 and the lever 89 in the overcenter position, as shown in Fig. 1, the springs 85 bias the lever 89 in a clockwise direction. Clockwise movement of the lever 89, however, is normally prevented by the tripping toggle 107—109 which is overcenter to the left of a line through the center of the fixed pivot 113 and the point of connection of the toggle link 107 with the lever 105. The toggle 107—109 is biased to its overcenter position by a spring 128 tensioned between the yoke 119 and the fixed pivot 113. The overcenter position of the tripping toggle 107—109 is adjustably determined by the projection 125 of the yoke 123 engaging an adjusting screw 129 in the cross member 25 of the frame. The tripping toggle 107—109 in its overcenter position, acting through the lever 105 and the link 103, prevents clockwise movement of the lever 89 and consequently holds the movable contact assemblage in the closed contact position against the biasing influence of the springs 85.

The tripping toggle 107—109 is adapted to be moved overcenter outwardly in a direction to cause its collapse to effect opening of the contacts by means of an overload trip device indicated generally at 133 (Fig. 1). The trip device is operable in response to overload currents in the circuits of the breaker to actuate a trip rod 135 and cause collapse of the tripping toggle 107—109. The trip rod 135 is slidable vertically through a shunt trip coil (not shown) enclosed in a casing 138 attached to the main frame 16. The shunt trip coil forms an additional tripping means for tripping the breaker. The shunt coil is adapted to be energized from a suitable source and in a manner well known in the art, to operate the trip rod and trip the breaker from a remote point.

When operated either by the shunt coil or by the overload trip device 133, the trip rod 135 is thrust upwardly and strikes the projection 127 of the yoke 123 and rocks the toggle link 109 clockwise about the fixed pivot 113. This movement of the link 109 causes collapse of the tripping toggle 107—109 permitting clockwise movement of the lever 89 which permits the springs 85 to rock the movable contact assemblage clockwise to open the contacts.

The main operating toggle 93—95 does not immediately collapse but the force of the springs 85 applied through the contact arm 30—31 and the main operating toggle causes collapse of the toggle comprising the links 93—95 and the lever 89 which results in a clockwise movement of the lever 89. This movement is transmitted through the link 103 and the lever 105 to complete the collapse of the tripping toggle 107—109.

The clockwise or opening movement of the contact arm 30 is arrested by projections (not shown) thereon striking portions 137 of the frame members 17 of the main frame 16. At this time the rebound of the inertia of the main operating toggle 93—95 and the parts of the linkage 89, 103 and 105 starts the main operating toggle overcenter in a direction to cause its collapse. By the time the knee pin 97 of the toggle has passed overcenter below the line 99—101 the weight of the parts act to complete the collapse of the toggle 93—95 and causes the linkage 89, 103, 105 and the tripping toggle 107—109 to be automatically reset to their normal position. The main operating toggle 93—95 remains in collapsed condition until the contacts are closed.

The contacts are closed manually by operation of the previously mentioned handle 141. The handle is rotatably mounted in a bracket 143 of insulating material secured to the outer end of the main frame 16. Operatively connected to the mechanism (not shown) operated by the handle is a link 151. The lower end of the link 151 is recessed and straddles a pulley-shaped projection 153 rigidly secured on a cross member 147 rigidly connecting the outer ends of a pair of spaced contact closing levers 145. These levers are disposed on the outside of the frame 16 and are pivotally supported on the ends of the fixed pivot 91 which project beyond the frame members 17. The inner ends of the lever 145 are rigidly connected by a cross member 149. Spaced projections 152 extending from the center portion of the cross member 149 support a pivot pin 157 upon which is rotatably mounted a roller 155.

The contacts are closed manually by clockwise rotation of the handle 141. This movement of the handle, through connections (not shown) thrusts the link 151 downwardly and due to its engagement with the projection 153, rotates the closing lever 145 in a clockwise direction. During this movement of the lever 145, the roller 155 engages the link 93 of the now collapsed main operating toggle 93—95 and moves this toggle to its overcenter position. Since at this time the tripping toggle 107—109 has been restored to its overcenter position, rotation of the lever 89 is prevented and consequently the force applied by the roller 155 to straighten the toggle 93—95 rotates the contact arm 30 counterclockwise to close the contacts and to tension the springs 85. The clockwise movement of the closing lever 145 moves the toggle 93—95 overcenter above the line 99—101 so that the contacts are held in the closed position until the breaker is again tripped.

Upon release of the handle 141 following a contact closing operation, a spring 159 tensioned between the closing lever 145 and the frame 16 restores the lever 145 in a counterclockwise direction. This movement of the lever 145 and the projection 153 thrusts the link 151 upwardly to restore the handle 141 to its neutral position.

The closing lever 145 may be operated to automatically close the contacts through the agency of a motor 139 (Fig. 1) mounted on a plate attached to the side of the frame 16. The motor 139 may be energized from any suitable source. When energized, the motor is adapted, through a suitable driving connection, to rotate a crank disc 130. This disc carries an anti-friction roller 131 which engages a cam face 132 on an arm 134 secured to one side of the closing lever 145 and rotates the arm and the closing lever 145 clockwise to effect closing of the contacts in the pre-

viously described manner. As soon as the roller 131 passes out of engagement with the arm 134, the spring 159 acts to restore the lever 145 to its normal position. The motor 139 is deenergized by a suitable limit switch (not shown).

The circuit breaker may be tripped manually by rotation of the handle 141 through a small angle in a counterclockwise direction from its neutral position. When the handle is rotated in tripping direction, a projection (not shown) on the link 151 engages the extension 121 on the yoke 119 of the toggle link 107 and rocks the link counterclockwise about its point of connection with the lever 105. This moves the tripping toggle 107—109 overcenter in a direction to cause its collapse and effects opening of the contacts in the previously described manner.

As previously stated, the trip rod 135 is operated to effect tripping of the breaker by means of a current responsive trip device 133. There is a trip device 133 provided for at least two of the poles of the breaker but since the trip devices are alike only the one for the center pole will be described.

The trip device includes the U-shaped magnet core 161 and a frame comprising substantially parallel side members 163 rigidly connected at their outer ends by a yoke 165. The members 163 are provided with mounting feet 167, and bolts 169 extend through openings in the feet 167 and in the magnet core 161 and in the base 11 to rigidly secure the core and frame to the base. A trip lever 173 is pivotally supported on a pivot 175 mounted in the frame 163. The trip lever 173 comprises a pair of spaced levers having an armature 179 secured to one end and being rigidly connected by a yoke 177 at the other end. The trip lever 173 is biased against operation by the magnet 161, by means of a pair of springs 191 (Figs. 1 and 2) having one end secured to the yoke 177 and the other end attached to a vertically movable plate 193. The plate 193 cooperates with an adjusting screw 195 which is provided with a knurled head 197 bearing against the bottom side of a formed projection 199 of the yoke 165. Rotation of the screw 195 moves the plate 193 and thereby adjusts the tension of the springs 191 to vary the tripping point of the breaker. A scale plate 203, supported on spaced projections 201 of the yoke 165, bears indicia indicating the adjustment of the springs 191 or the tripping point of the breaker. An adjustable stop screw 205 provided with a lock nut 207 determines the open air gap of the magnet.

A trip bar 187 is rotatably supported in a bracket 189 secured to the casing 138 for the shunt coil. The trip bar extends across all of the poles of the breaker and is provided with an arm 185 for each pole, the center one of the arms being in alignment with the lower end of the trip rod 135. An adjusting screw 181 is mounted in each of the yokes 177 in alignment with the corresponding arm 185.

Normal rated current flowing through the circuit of the breaker, including the conductor 81, causes slight energization of the magnet 161 but not sufficient to overcome the tension of the springs 191. Upon the occurrence of an overload current above a predetermined value in the circuit of any pole, the flow of current through the corresponding conductor 81 causes energization of the magnet sufficient to overcome the spring 191 and attract the armature 179 rocking the trip lever 173 counterclockwise. At this movement of the trip lever 173, the screw 181 rotates the arm 185 and the trip bar 187 in a clockwise direction and thrusts the trip rod 135 upwardly to trip the breaker in the previously described manner.

The construction of the circuit breaker as thus far described with the exception of the trip device 133 is essentially the same as that fully disclosed in the copending application of John W. May and Ture Lindstrom, Serial No. 391,625, filed May 3, 1941, and assigned to the assignee of this invention.

In accordance with the present invention, a locking mechanism 211 serves to automatically lock each trip device 133 in its actuated position when the trip device is operated in response to an overload condition occurring in any pole of the breaker. By locking the trip device in its actuated position the tripping toggle 107—109 is maintained in its collapsed condition. In this condition of the tripping toggle, it is impossible to close the contacts until the door 15 of the housing 13 is opened and the trip device released in a manner to be described later.

There is an independently operable locking device 211 provided for each pole of the breaker and since the locking devices are alike only the one for the center pole (Fig. 1) will be described. Each of the locking devices comprises a locking lever 213 pivotally supported intermediate its ends on a pivot pin 215 mounted in a support comprising a pair of plates 217 of insulating material. The plates 217 are disposed one on each side of one of the side members 163 of the trip device frame and are secured thereto by means of a rivet 219 and by the pivot 175 for the trip lever, the pivot 175 extending through openings in the plates 217. A tension spring 221 having one end hooked into an opening in the locking lever 213 and the other end anchored on a rod 223 supported in the plates 217 biases the hook-shaped lower end 225 of the lever 213 into contact with the center portion of a flanged roller 227 of insulating material. The roller 227 is rotatably mounted on a rod 229 mounted in openings in the members 173 comprising the trip lever. Cotter pins 231 are provided in the rod 229 to prevent axial movement thereof relative to the trip lever. Axial movement of the roller 227 is prevented by engagement of the flanges thereon with the end 225 of the lever 213.

The upper end of the locking lever 213 is pivotally connected by means of a pivot pin 233 to one end of a horizontally extending link 235. An elongated slot 237 in the other end of the link 235 engages a rod 239 common to all of the links 235 and carried in the lower ends of a pair of spaced levers 241 (Figs. 1 and 2). The levers 241 are pivotally supported on a pivot pin 243 mounted in a U-shaped bracket 245 rigidly secured by means of screws 247 to a plate 249 of insulating material which is mounted on the insulating bracket 143. The upper ends of the levers 241 are rigidly connected by means of a yoke 251 and a spring 253 compressed between a projection 254 and the yoke 251 and the base of the bracket 245 biases the levers 241 in a counterclockwise direction. The counterclockwise movement of the lever 241 is limited by the engagement of the rod 239 with the enlarged inner end 255 of a releasing rod 257 slidably mounted in an opening in the plate 249 and in the base of the bracket 245. Spring pilots 259 and 261 secured respectively to the projection 254 and to the base of the bracket 245 serve to retain the spring 253 in position.

As previously described, energization of the magnet 161 in response to an overload current in the circuit of any one of the poles of the breaker attracts the armature 179 and rocks the trip lever 173 in a counterclockwise direction to effect tripping of the breaker. This movement carries the roller 227 upwardly to a position opposite to the recess in the lower end of the lever 213, whereupon the spring 221 acts to rotate the lever 213 clockwise about the pivot 215 and engages the hook-shaped lower end of the lever beneath the roller 227. This restrains the trip lever 173 in its actuated position against the force exerted by the springs 191 which tends to restore the trip lever to its normal position.

It will be remembered that when the trip lever 173 is actuated the screw 181, acting through arm 185 on the trip bar 187, thrusts the trip rod 135 upwardly to move the tripping toggle 107—109 overcenter in a direction to cause its collapse and thereby cause opening of the breaker contacts. When the trip device is restrained in its actuated position by the locking lever 213, the trip rod 135 is held in its raised position, and due to the engagement of the upper end of the rod with the projection 127, holds the tripping toggle 107—109 in its operated position. Operation of the closing lever 145 in closing direction under this condition will straighten the operating toggle 93—95, but since the springs 85 are stronger than the spring 128 lever 89 will be rocked clockwise and through the connecting link 103 will rock the lever 105 clockwise to further the collapse of the tripping toggle. It will thus be seen that with the trip lever restrained in its actuated position, it is impossible to close the breaker contacts.

When the locking lever 213 was actuated by the spring 221 upon operation of the trip lever 173, the link 235 was thrust toward the right, moving the left hand end of the slot 237 close to the rod 239. In order to operate the locking mechanism to release the trip lever, the releasing rod 257 is thrust inwardly by means of a knob 263 secured to the outer end thereof. Due to the engagement of the inner end 255 of the releasing rod with the rod 239, the inward movement of the rod 257 rocks the arms 241 clockwise. This movement thrusts the link 235 inwardly rotating the locking lever 213 counterclockwise to free roller 227. The springs 191 immediately restore the trip lever to its unoperated position. This permits the spring 128 to move the tripping toggle 107—109 to its overcenter holding position and the breaker may then be closed either manually by manipulation of the handle 141 or automatically by means of the rotor 139 in the previously described manner.

When the trip lever 173 returns to its unoperated position, the center portion of the roller 227 is positioned in the path of the lower end of the lever 213 and restrains the lever and the link 235 in the positions in which they appear in Fig. 1. When the pressure is released from the knob 263 the spring 253 expands and rocks the lever 241 counterclockwise restoring the rod 239 to the right hand end of the slot 237 and moving the releasing rod 257 outwardly until it is arrested by engagement of the enlarged end 255 thereof with the base plate of the bracket 245.

The locking mechanism for each pole is independently operable whenever an overload occurs in the circuit for that pole to automatically prevent closing of the main contacts of the breaker following an opening operation in response to an overload condition in any one of the poles of the breaker.

The locking means 211 cooperates only with the overload trip devices 133 and is not effective to lock the breaker in open position when it is tripped open either manually or by operation of the shunt trip device 138.

Since, as previously described, the circuit breaker is completely enclosed and locked in a cubicle at a point remote from the central station, it is desirable to provide means to indicate the condition of the breaker at the central station. To this end there is provided a plurality of signaling circuits each of which is closed upon actuation of the trip device for any one of the poles of the breaker. One of the circuits may be utilized to sound an audible signal at the central station and another of which circuits may energize a visual signal indicating the particular circuit breaker in whose circuits an abnormal condition has occurred. Neither the signaling devices nor the circuits therefor is illustrated herein since any well known signaling devices may be used.

In order to close the circuits, a plurality of bridging contacts 265 are provided for each pole of the breaker. The bridging contacts for each pole are mounted on a block 267 of insulating material secured to the armature 179 of the corresponding trip device, by means of screws 269 (Fig. 2). Secured in the base 11 adjacent each of the bridging contacts 265 is a pair of projecting contact members 271 provided with terminal connections 273 projecting to the rear of the base. The terminal connectors serve to connect the contacts 271 in the signal circuits.

It is obvious that when the magnet 161 for any pole of the breaker is energized a predetermined amount in response to an overload condition, the armature 179 for that pole will be attracted and engage the corresponding bridging contact 265 with the contacts 271 and thus close the circuit to the signaling devices.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is to be understood that various changes and modifications may be made therein without departing from some of the essential features of the invention. It is, therefore, desired that the invention be interpreted as broadly as the prior art permits, and that it be limited only by what is expressly stated in the following claims.

We claim as our invention:

1. A circuit breaker comprising relatively movable contacts, operating mechanism for said contacts including an operating handle, a trip device including a trip member operable to cause opening of the contacts irrespective of the position of said handle, electrorespective means operable in response to predetermined overload circuit conditions to operate the trip member, and latch means operable to restrain the trip member in operated position upon operation of the trip member.

2. A circuit breaker comprising relatively movable contacts, operating mechanism for said contacts, a trip device including a trip lever operable to cause opening of the contacts, means biasing said trip lever against tripping operation, electroresponsive means operable in response to predetermined overload circuit conditions for operating said trip lever, and a pivoted latch biased to latching position and operable under the control of the trip lever to engage a part movable

with said trip lever for restraining the trip lever in operated position against the force of said biasing means.

3. A circuit breaker comprising relatively movable contacts, operating mechanism for said contacts, a trip device including a trip member operable to cause opening of the contacts, electroresponsive means operable in response to predetermined overload circuit conditions for operating said trip member, latching means biased to a latching position for latching the trip member in operated position, means on the trip member for normally restraining said latching means in unlatching position when said trip member is in an unoperated position, said restraining means being operable upon operation of the trip member to permit movement of the latching means to latching position.

4. A circuit breaker comprising relatively movable contacts, operating mechanism including a toggle operable to cause opening of said contacts, a trip device including a trip member for operating said toggle, electroresponsive means operable in response to predetermined circuit conditions for operating said trip member, and a latch operable upon operation of the trip member to restrain said trip member and said toggle in operated position to thereby prevent closing of said contacts.

5. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including a toggle operable to cause opening of said contacts, a trip device including a trip member for operating said toggle, an electromagnet operable in response to predetermined circuit conditions for operating said trip member, a latch member operable upon operation of the trip member to restrain said trip member and said toggle in operated position to thereby prevent closing of said contacts, and manually operable means for operating said latch member to release the trip member.

6. A circuit breaker comprising relatively movable contacts, operating mechanism therefor, a trip device including a trip member operable to cause opening of said contacts, electroresponsive means operable in response to overload currents to operate the trip member, a latch member supported on a fixed member and operable to a latching position upon operation of the trip member to restrain said trip member in operated position, and means apart from said operating mechanism for operating said latch member to unlatching position to release the trip member.

7. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating handle, a trip device including a trip member operable to cause opening of said contacts irrespective of the position of said handle, electroresponsive means operable in response to overload currents to operate said trip member, a latch member engageable with a part movable with the trip member for restraining said trip member in operated position, and manually operable means apart from said operating handle for disengaging said latch member from said part to permit resetting of the trip member.

8. A circuit breaker comprising relatively movable contacts, operating mechanism therefor, a trip device including a trip member operable to cause opening of said contacts, electroresponsive means operable in response to predetermined overload circuit conditions for operating said trip member, a latch member pivoted on a fixed pivot and biased to latching position, a roller mounted on the trip member, said roller normally cooperating with said latch member to restrain said latch member in unlatching position and said roller being operable upon operation of the trip member to cause said latch member to engage said roller and restrain the trip member in operated position thereby preventing closing of the contacts.

9. A circuit breaker comprising relatively movable contacts, operating mechanism therefor, a trip device including a trip member operable to cause opening of the contacts, electroresponsive means operable in response to predetermined overload circuit conditions for operating said trip member, a pivoted latch member biased to a latching position, a roller mounted on the trip member and movable therewith, said roller normally restraining said latch member in unlatching position and said roller being operable upon operation of the trip member to cause movement of the latch member to a latching position wherein it restrains the trip member in operated position, and a manually operable device for moving the latch member to unlatching position.

10. A circuit breaker comprising relatively movable contacts, closing means for closing the contacts, a member movable to cause opening of the contacts irrespective of the position of the closing means and which must be reset to permit closing of the contacts, a trip device operable in response to predetermined overload conditions to move the member, and latching means automatically effective to lock said trip device and the member in operated position to thereby prevent resetting of said movable member.

11. A circuit breaker comprising closing means for closing the breaker, a member movable to cause opening of the breaker which member must be reset to permit closing of the breaker, a plurality of trip devices each operable to cause movement of said member to cause opening of the breaker, and a latching means automatically effective upon operation of one of said trip devices to prevent resetting of said member, said latching means being ineffective to prevent resetting of said member when said member is moved by other of said trip devices.

12. A circuit breaker comprising closing means for closing the breaker, a member movable to cause opening of the breaker and which must be reset to permit closing the breaker, a plurality of trip devices each operable to move said member to cause opening of the breaker, latch means automatically engageable with one of said trip devices upon operation of said trip device to prevent resetting of said movable member, and means operable to disengage said latch means to permit resetting of the movable member.

13. A circuit breaker comprising separable contacts, closing mechanism for closing said contacts, a toggle operable to cause opening of said contacts irrespective of the position of the closing mechanism, said toggle being automatically resettable to permit closing of the contacts, a plurality of trip devices each operable to operate the toggle to cause opening of the contacts, and a latching means automatically effective upon operation of one of said trip devices to prevent resetting of the toggle.

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