Feb. 3, 1948. G. G. GRISSINGER ET AL 2,435,305

CIRCUIT BREAKER

Filed Oct. 18, 1941 6 Sheets-Sheet 1

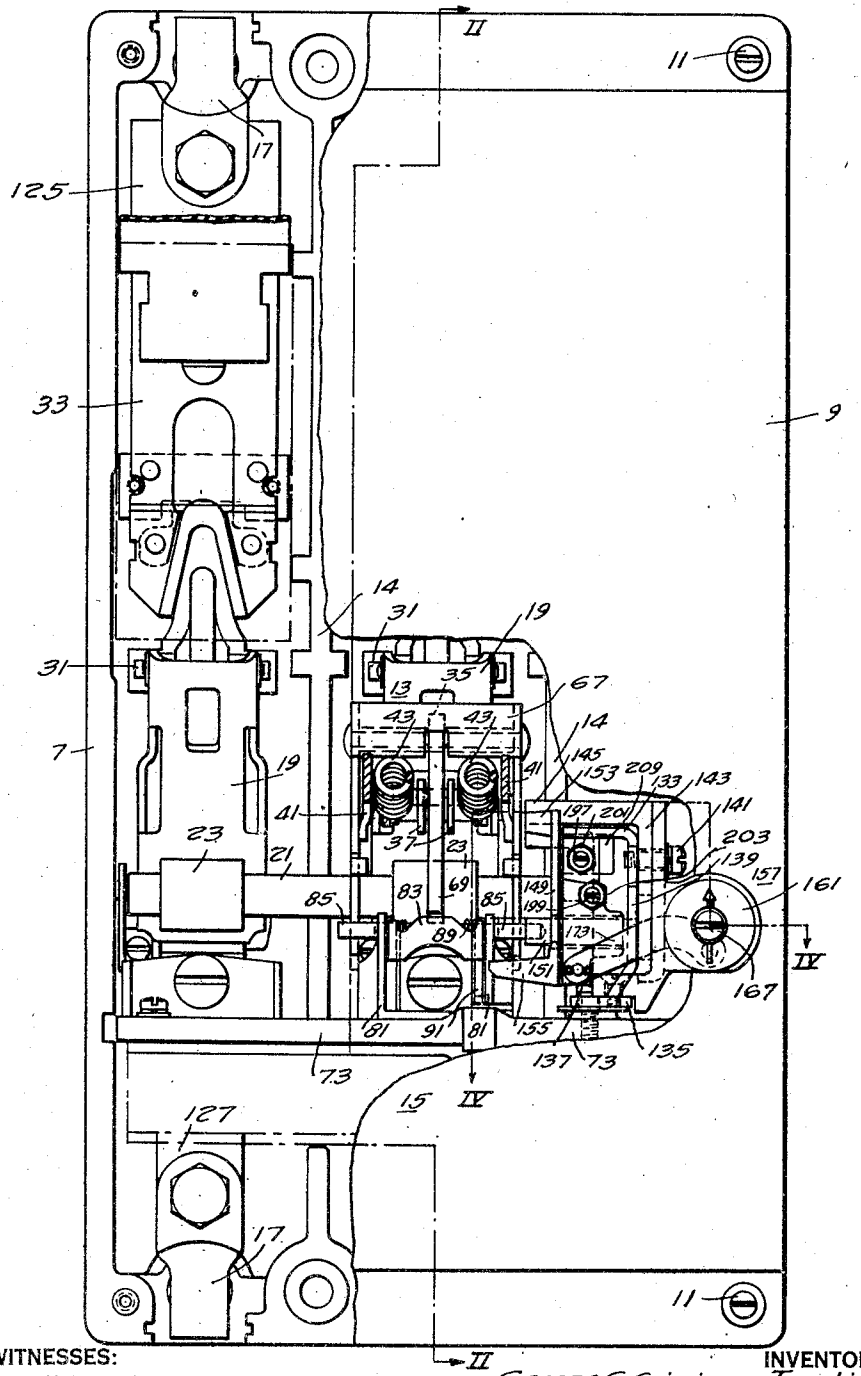


Fig. 1.

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CIRCUIT BREAKER

Filed Oct. 18, 1941 6 Sheets-Sheet 2

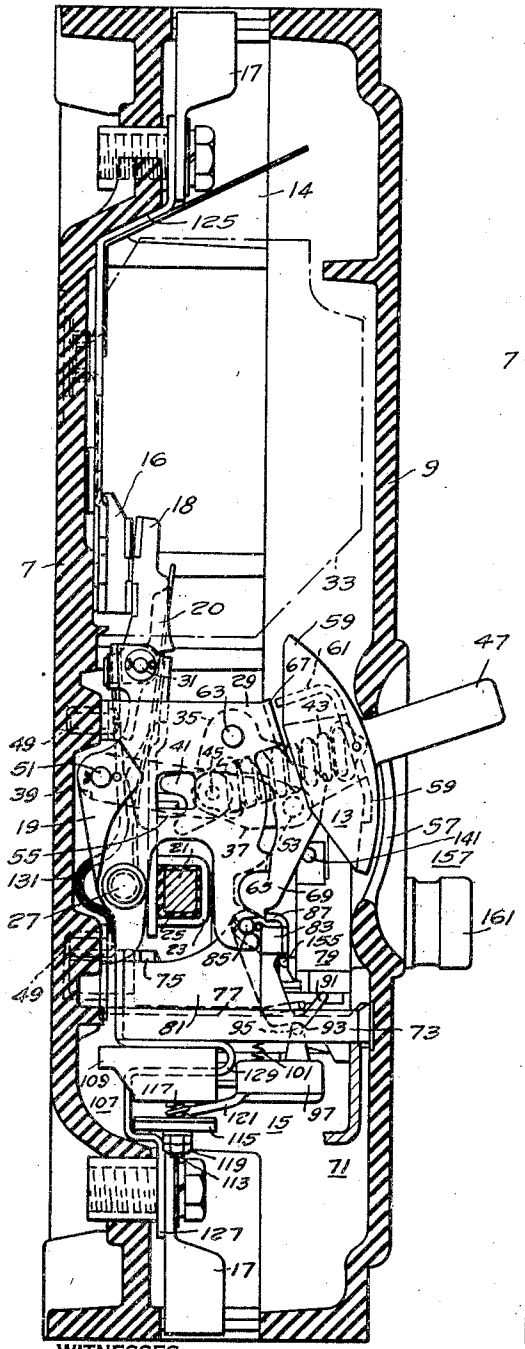


Fig. 2.

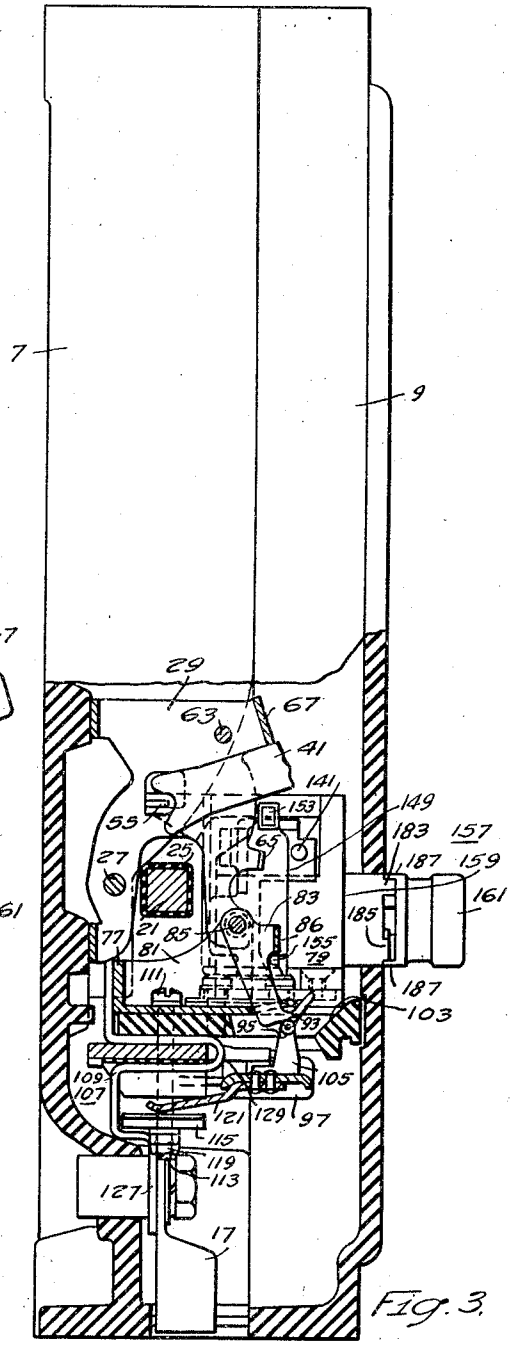


Fig. 3.

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CIRCUIT BREAKER

Filed Oct. 18, 1941 6 Sheets-Sheet 3

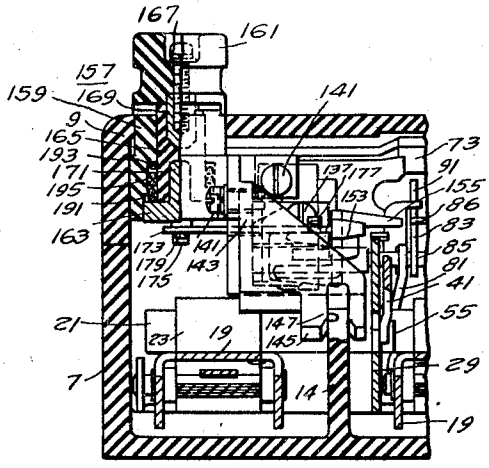


Fig. 4.

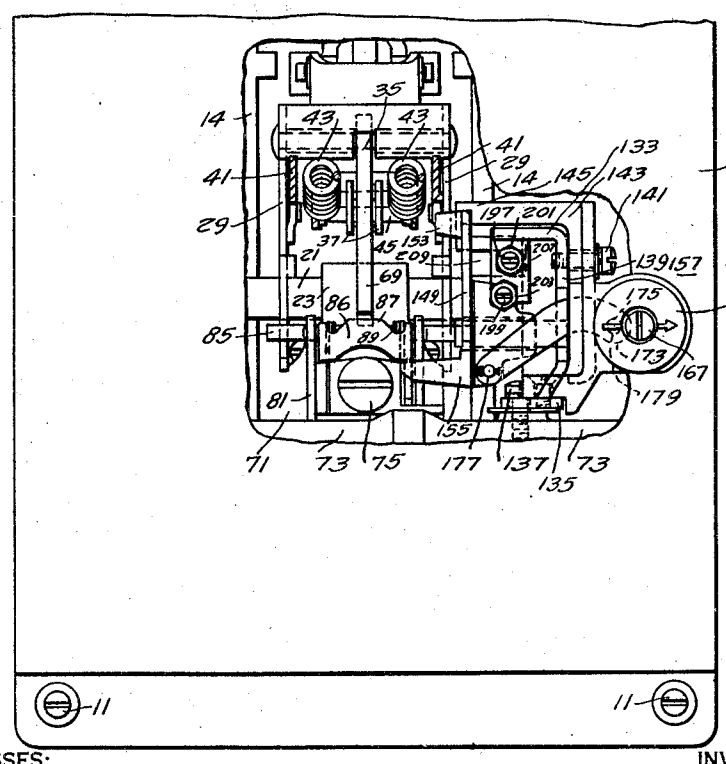


Fig. 5.

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CIRCUIT BREAKER

Filed Oct. 18, 1941 6 Sheets-Sheet 4

Fig. 6.

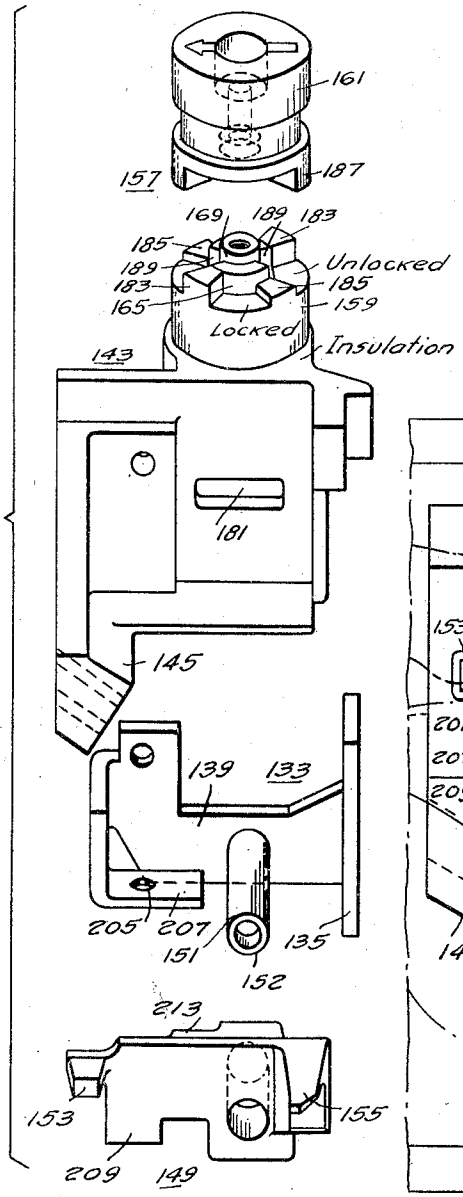


Fig. 7.

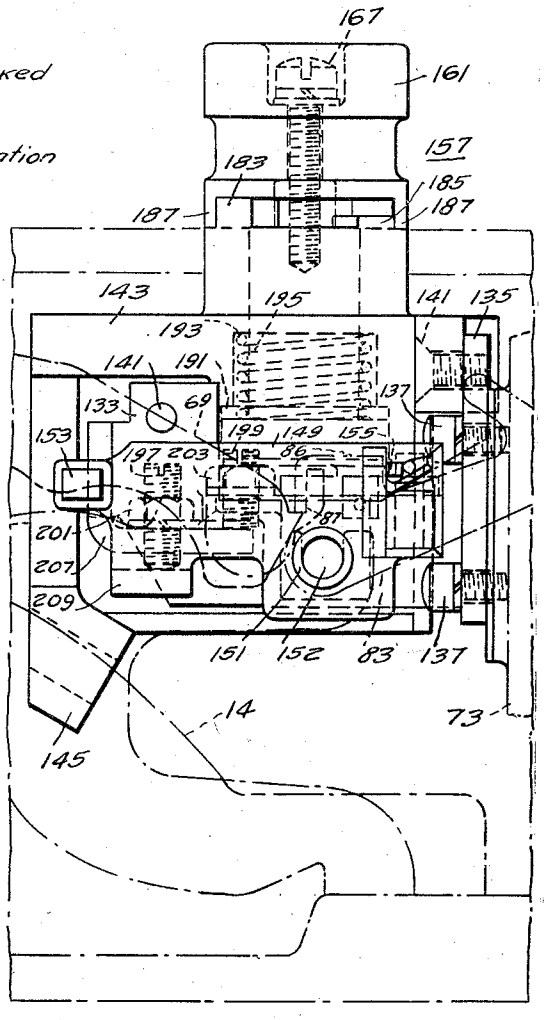
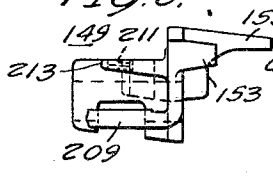


Fig. 8.



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CIRCUIT BREAKER

Filed Oct. 18, 1941 6 Sheets-Sheet 5

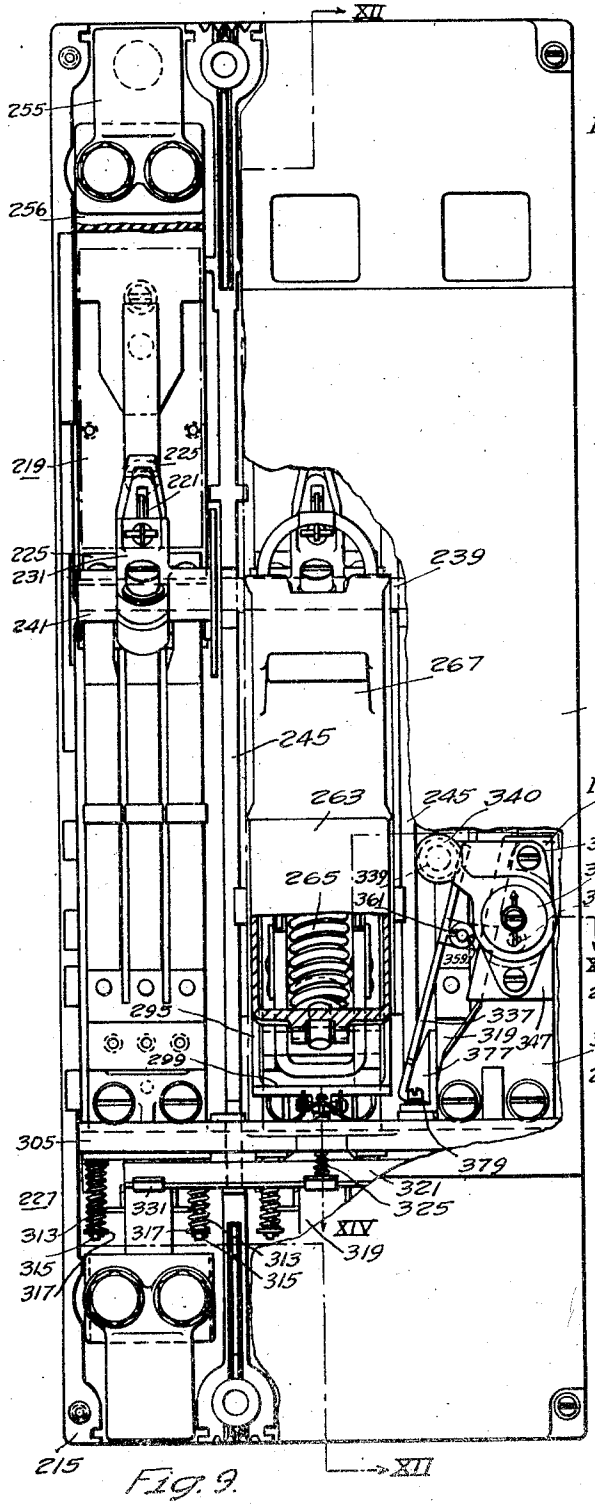


Fig. 9.

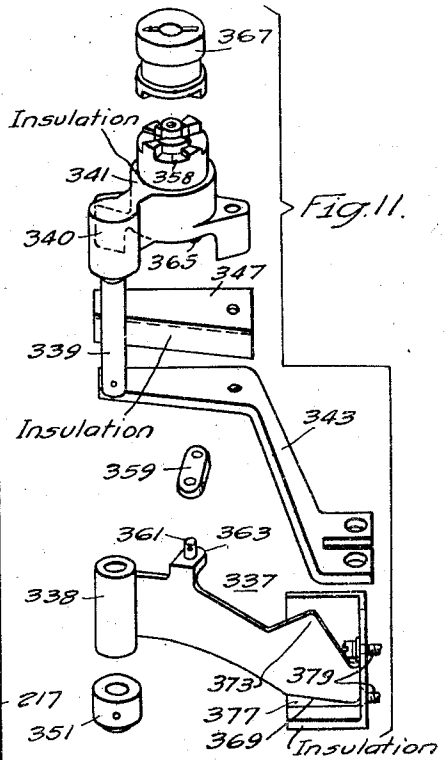


Fig. 11.

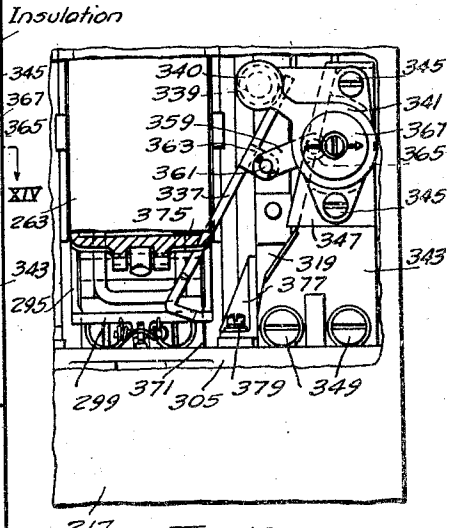


Fig. 10.

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Feb. 3, 1948. G. G. GRISSINGER ET AL 2,435,305

CIRCUIT BREAKER

Filed Oct. 18, 1941 6 Sheets-Sheet 6

Fig. 12.

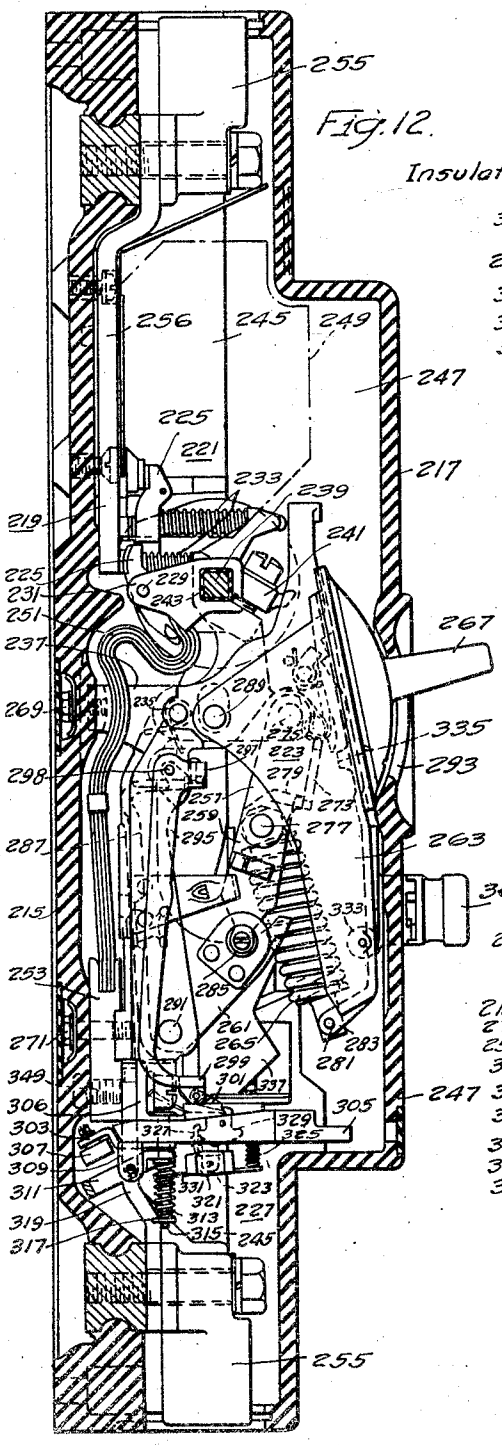


Fig. 14.

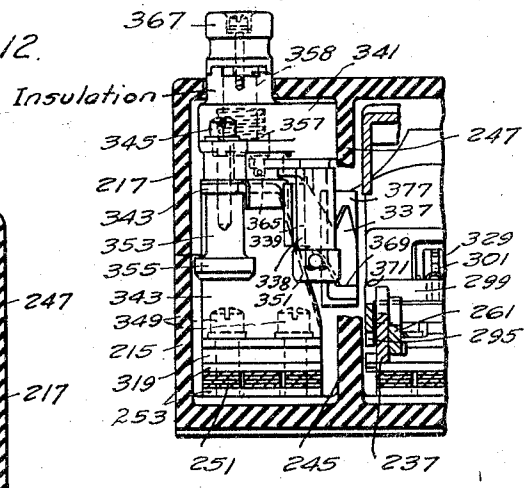
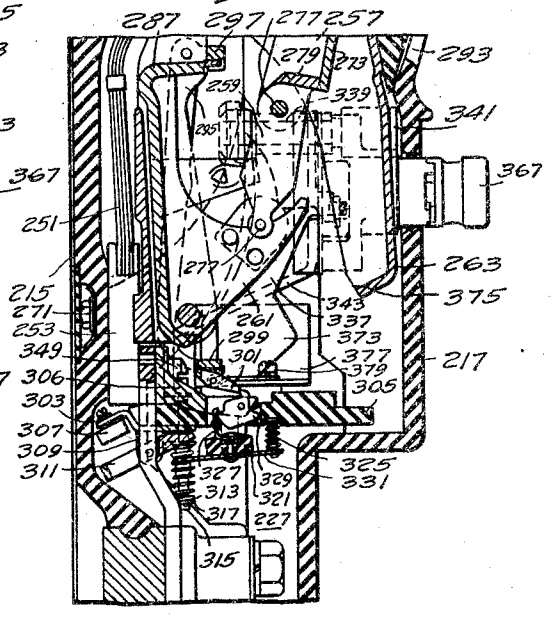


Fig. 13.



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Patented Feb. 3, 1948

2,435,305

UNITED STATES PATENT OFFICE

2,435,305

CIRCUIT BREAKER

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Application October 18, 1941, Serial No. 415,616

25 Claims. (Cl. 200—109)

1

This invention relates to circuit breakers, and more particularly to circuit breakers of the type wherein the contacts are trip free of the operating handle and are operable by the operating handle and also automatically operable in response to abnormal circuit conditions.

Trip free circuit breakers cannot be closed or held in closed circuit position by the manual operating handle during the existence of predetermined abnormal circuit conditions, due to the trip free construction of the mechanism of such breakers. Under certain conditions however it may be desired to effect closing of a circuit breaker against an abnormal circuit condition, and it may be important to maintain a circuit breaker in closed circuit position and prevent opening thereof by any means either by predetermined abnormal circuit conditions or by severe shocks or jars which otherwise would cause opening of the breaker.

An object of the invention is the provision of a trip free circuit breaker embodying an improved locking means which is settable to a locking position in which it is effective to prevent opening of the circuit breaker either in response to abnormal circuit conditions or by jars or shocks which would otherwise cause opening of the breaker.

Another object of the invention is the provision of a trip free circuit breaker embodying an improved locking device which is operable to permit the circuit breaker to be closed against an abnormal circuit condition, and which is also operable to a position in which it locks the circuit breaker closed to prevent opening thereof either by abnormal circuit conditions or by jars or shocks which would otherwise cause opening of the breaker.

Another object of the invention is the provision of a circuit breaker having a manually operable unitary means which is operable to a locking position to simultaneously lock the trip device against tripping movement and to lock the operating handle against opening movement.

Another object of the invention is to provide a circuit breaker embodying a slidable interposer which is settable to a locking position for locking the trip device and the operating handle of the breaker against operation to open the breaker.

Another object of the invention is to provide

2

a circuit breaker with an interposer which is operable to prevent opening of the breaker, the interposer being operated to locking position by means of an overcenter toggle to prevent accidental movement of the interposer to unlocking position.

Another object of the invention is the provision of a circuit breaker embodying an improved locking device comprising a unitary locking member which is movable to a locking position by a rotatable handle knob and toggle in which position the locking member is effective to lock the trip device and also to lock the operating handle against opening movement, the handle knob having locking means associated therewith to lock the locking device in locking position.

Another object of the invention is to provide a circuit breaker with a single member which is movable to a position in the paths of travel of a trip member and the breaker operating mechanism to prevent operation of the breaker to open circuit position.

Another object of the invention is the provision of an improved locking device which may be readily installed in existing circuit breakers and by the operation of which the tripping device is rendered ineffective to trip the breaker, and which also maintains the operating mechanism of the breaker in closed position.

The novel features that are considered characteristic of the inventions 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 description of several embodiments thereof when read in conjunction with the accompanying drawing in which:

Figure 1 is a front elevational view of a three-pole circuit breaker with the cover partly broken away to show one pole of the breaker, the operating mechanism and the locking mechanism embodying the principles of the invention.

Fig. 2 is a vertical sectional view taken substantially on line II—II of Fig. 1 showing the operating mechanism and the center pole contact structure.

Fig. 3 is a side elevational view, partly in section, illustrating the locking mechanism in side

elevation and showing a vertical section through the trip device of the breaker.

Fig. 4 is a fragmentary horizontal sectional view taken substantially on line IV—IV of Fig. 1 and showing the locking mechanism.

Fig. 5 is a fragmentary view in front elevation with the cover partly broken away showing a part of the operating mechanism and showing the locking mechanism in operated or locking position.

Fig. 6 is an enlarged exploded view in perspective showing the detail construction and shapes of the several parts of the locking device,

Fig. 7 is an enlarged fragmentary view in side elevation of the locking mechanism,

Fig. 8 is a detail view of the locking member shown in Fig. 4,

Fig. 9 is a front elevational view of a three-pole circuit breaker having the cover partly broken away to show the breaker structure and to show a modified form of the locking mechanism as applied to a different type breaker,

Fig. 10 is a fragmentary front elevational view of the modification of the locking mechanism and showing the locking mechanism in locking position,

Fig. 11 is an enlarged exploded view in perspective of the modified form of the locking mechanism.

Fig. 12 is a vertical sectional view taken substantially on line XII—XII of Fig. 9 showing the trip device and operating mechanism of the circuit breaker to which the modified form of the locking device is applied.

Fig. 13 is a fragmentary vertical sectional view through the trip device and showing the modified locking mechanism in side elevation, and

Fig. 14 is a fragmentary horizontal sectional view taken substantially on line XIV—XIV of Fig. 9, showing the modified locking mechanism.

The three-pole circuit breaker illustrated in Fig. 1 comprises in general, a base 7 of molded insulating material, a cover 9 of similar material secured to the base by means of bolts 11, contact actuating means indicated generally at 13 and a trip unit indicated generally at 15. The casing formed by the base and cover is divided into three longitudinal compartments at the upper end thereof by partitions 14 formed integral with the base. Each compartment is adapted to receive a stationary contact 16 (Fig. 2) and a cooperating movable contact 18 which with their corresponding terminals 17 collectively form the three poles of the breaker.

The partitions 14 form insulating barriers between the contact means of each pole of the breaker and align with similar partitions formed in the cover 9.

Three terminals 17, only two of which are shown, are secured in openings formed in the base at each end thereof; one terminal at each end being provided for each pole of the breaker. The respective movable contacts 18 one for each pole of the breaker, are each carried by a pivoted channel-shaped frame 19. The channel-shaped frames are rigidly fastened for movement together by means of a steel tie bar 21 which extends across all of the poles of the breaker. The tie bar is affixed to the frames adjacent the pivoted ends thereof by means of iron straps 23 which loop about the bar and have projecting ends extending through openings in the frames and which are clinched thereagainst. An insulating tube 25 is disposed about the tie bar 21 in order to prevent the short circuiting of the poles

of the breaker. The bar serves to mechanically interconnect all of the channel-shaped contact supporting frames 19 and thereby makes it possible to operate all three of the frames from a single actuating mechanism to be hereinafter described. The channel-shaped frame 19 of the center pole of the breaker is pivotally supported on a pin 27 carried by a U-shaped main frame 29 of the common actuating mechanism. The other channel-shaped frames may be pivotally supported on other pins, not shown, which are mounted on supports extending from the base.

The movable contacts 18 are each carried by an arm 20 pivoted to its corresponding channel-shaped frame 19 by means of a pin connection 31. The particular contact means do not form an important part of my invention and hence, will not be described or shown in detail. Suitable arc extinguishing means 33 of the spaced plate type may be provided for the contact means of each pole of the breaker.

The single actuating means 13 comprises in general the U-shaped main frame 29, a carrier or support member 35 pivoted to said frame, a pair of toggle links 37 and 39 interconnecting the carrier member and the channel-shaped contact supporting frame 19 of the center pole of the breaker, a U-shaped operating lever 41, overcenter springs 43 for connecting the operating lever to the knee pivot pin 45 of the toggle links, and an operating handle 47 for the lever.

The U-shaped main frame 29 is secured to the base 7 by means of bolts 49 which extend through the frame and base and engage inserts disposed in recesses in the base. The lower toggle links are pivoted to the channel-shaped frame 19 of the center pole by means of a pin 51, while the upper toggle links are pivotally connected to the carrier by means of a pin 53. The legs of the operating lever are pivotally supported on members 55 projecting from the sides of the main frame 29. The operating handle projects through a slot 57 provided in the cover 9 and has a curved protective portion 59 for closing the slot. The operating lever is provided with a hook 61 for engaging and moving the carrier member 35 to reset the member 35 when the operating handle is moved to its open position after a tripping operation. The carrier member is pivoted to the main frame by a pin 63 and is adapted to be moved by the hook 61 to its latched position, in which its nose or latch engaging portion 69 is releasably held by a latch of the trip unit to be hereinafter described. Movement of the operating lever is limited by stop lugs 65 struck in from the main frame and by a transverse portion 67 of said frame.

The operation of the circuit breaker actuating means is as follows. With the parts in the position shown in Fig. 2, in which all of the contact means are closed and in which the carrier member is held in the latched position; if the operating handle 47 is moved from the position shown to the opposite end of the slot 57 to rotate the lever 41 in a clockwise direction, the overcenter springs 43 will snap over and cause the toggle links 37—39 to collapse. The collapse of the toggle links causes a simultaneous movement of all of the channel-shaped frames 19 and movable contacts 18 to the open circuit position with a snap action. To close the breaker the operating handle is moved in the opposite direction back to the position shown in Fig. 2. This movement of the handle will cause the overcenter springs to snap over in the opposite direction and move the toggle links to their operative position to

simultaneously close all of the contact means with a snap action.

The mechanism of the current responsive trip unit is mounted in a compartment 71 in the casing and is supported by a panel 73 which extends across all the poles of the breaker. The panel is removably mounted in the compartment 71 by means of bolts 75 (Fig. 2), which pass through openings provided in angle brackets 77 secured to the panel and which are threadedly engaged in openings formed in the base of the breaker. Referring to Fig. 3, a common latch mechanism 79 is mounted on the upper side of the panel 73 by means of a frame 81. The latch mechanism comprises a pivoted latch member 83 mounted on a pin 85 carried by the frame 81. The latch member has a latched portion 87 (Fig. 2) for engaging and holding the latch engaging portion 69 of the carrier member 35. The latch member is biased in a counterclockwise direction by means of a spring 89 (Fig. 5) coiled about the pin 85 and which engages under the latch member at one end thereof and which has its other end secured against the face of the panel 73. The latch member has a hook shaped extension 91 which is provided at its outer edge with a detent 93 adapted to be engaged by a roller 95 which is carried by a trip bar 97. The trip bar is pivotally mounted by means of brackets (not shown) extending downwardly from the panel 73, and the bar extends across all of the poles of the breaker. The trip bar is biased in a counterclockwise direction, as viewed in Fig. 2, by means of a coiled spring 101 (Fig. 2) which has one end engaged in a socket provided in the panel 73 and the other end engaging a similar socket provided in the trip bar 97. An opening 103 is formed in the panel to accommodate the end of the hook shaped portion 91 of the latch member 83, and a bracket 105 is secured to the trip bar to support the roller 95. The trip bar is biased by the spring 101 to engage the roller 95 in the detent 93 in the end of the latch member. The trip bar thus holds the latch member in latching position by the means described above.

A plurality of electromagnetic trip means 107 (Fig. 2) are provided, one for each pole of the breaker. Each trip means 107 consists of a U-shaped core 109 of magnetic material secured to the panel 73 by means of bolts 111. The ends of the legs of the U-shaped cores 109 form pole faces. Each pole face has a bolt 113 extending therefrom for supporting an armature 115. The armature consists of a flat plate of magnetic material having two openings provided therein for receiving the bolts 113. A coiled spring 117 surrounds each bolt and engages the pole face at one end thereof, and the armature at its other end. These springs serve to bias the armature away from the pole faces. Lock nuts 119 are threaded on the outer end of the bolts in order to adjustably position the armature and to limit movement of the same away from the pole faces. The trip bar 97 carries a plurality of strips 121, one for each pole of the breaker. The strips 121 extend at right angles to the trip bar and are adapted to be engaged by an adjustable projecting bolt (not shown) carried by each of the armatures of the trip means whereby the trip bar is adapted to be moved to tripping position when any one of the armatures is operated.

The electrical connections for each pole of the breaker are the same and are as follows: One terminal 17 of each pole of the breaker is connected to the stationary contact 16 by a conductor 125. The other terminal 17 of each pole is connected, by a conductor-bar 127, which has a looped portion 129 extending around the bight of the U-shaped core 109 of its trip element, to a flexible conductor 131 which is connected, in turn, to the movable contact 18. The looped shaped portion 129 of the conductor 127 forms a one-turn coil for the core of the trip means. Current passes from one terminal 17 of the breaker through the conductor member 127, around the loop 129 to the flexible conductor 131, thence to the movable contact 18, the stationary contact 16 and the conductor 125 to the other terminal 17. The connections for each pole of the breaker are the same, hence each trip means is responsive to the current flowing through its corresponding pole and is operative when an overload of predetermined magnitude occurs therethrough to move the trip bar 97 to its tripped position.

The operation of the trip unit is as follows: With the parts of the circuit breaker in the position shown in Fig. 2, i. e., with the contact means in the closed circuit position and the carrier member in its latched position; if an overload occurs in any of the circuits extending through the poles of the breaker, the corresponding electromagnet formed by the U-shaped core 109 and looped conductor 129 is energized, its armature 115 is attracted and engages the strip 121 rotating the trip bar 97 in a clockwise direction as viewed in Fig. 2. Rotation of the trip bar 97 in the clockwise direction moves the roller 95 out of engagement with the detent 93 in the latch member 83, thus releasing the same. The carrier member 35 being biased in a counterclockwise direction by the overcenter springs 43 partially rotates the latch member in a clockwise direction, thus freeing its latch engaging portion 87 from engagement with the latch portion 69 of the carrier member. When the carrier member is thus released, the toggle links 37—39 are collapsed by means of the overcenter springs 43 and cause the channel shaped frames 19 to move the movable contacts 18 to an open circuit position. The breaker cannot be reclosed until the operating handle has been moved to full open position in order to reset and latch the carrier member. After the carrier member has been reset, the operating handle may then be moved to its closed circuit position to effect closing of the contact means.

The locking device 12 appears in the drawings in Figs. 1 to 8, inclusive. Referring to Figs. 1 and 6, the locking device is supported on a mounting bracket 133 having a horizontally extending portion 135 secured by screws 137 to the panel 73 which supports the trip device 15. The main body 139 of the bracket 133 extends vertically and has secured thereto, by means of a screw 141, a member 143 of molded insulating material. As an additional support for the locking device, a portion 145 of the member 143 extends to the left (Figs. 1 and 5) and toward the rear of the breaker (Fig. 4). A slot 147 (Fig. 4) in the portion 145 fits snugly over the right-hand one of the partitions 14 (Fig. 1). The cooperation of the portion 145 and the partition 14 can best be seen in Figs. 4, 5 and 7.

In order to lock the breaker in a manner to render the trip device 15 ineffective to trip the operating mechanism and to lock the operating mechanism against circuit opening operation, there is provided a locking member 149. This member is of irregular shape (Figs. 6 and 8) and is slidably mounted on a cylindrical projection 151 extending toward the center pole of the break-

er from the mounting bracket 133. The end of the cylindrical member 151 is provided with an opening 152 (Fig. 6) into which projects one end of the pin 85 upon which the latch member 83 is mounted as best seen in Figs. 1 and 5. The locking member 149 is disposed vertically in the breaker (Fig. 1) and is provided with a locking projection 153 at its upper end and a locking projection 155 at its lower end.

The locking member 149 is adapted to be moved to locking position (Fig. 5) and to unlocking position (Fig. 1) by rotation of an operating device 157, the details of construction of which may best be seen in Figs. 4 and 6. The operating device 157 is rotatably mounted in a cylindrical portion 159 of the molded member 143 which projects horizontally through an opening in the cover 9 (Figs. 2 and 3). The operating device 157 comprises an operating knob 161 of insulating material, a crank disc 163 (Fig. 4) and a connecting shaft 165 of molded insulating material. The knob 161 is rigidly secured to the shaft 165 by means of a screw 167 which extends axially through the knob and is secured in a metal insert 169 molded into the outer end of the shaft 165. An insert 171 integral with the crank disc 163 is molded into the inner end of the shaft 165 and thereby rigidly secures the crank disc to the shaft.

The crank disc 163 is connected to the locking member 149 by means of a link 173 which is pivotally connected to a pin 175 on the crank disc and to a pin 177 on the locking member. Cotter pins 179 or other suitable retaining means may be used to retain the link 173 in cooperative relation with the pins 175 and 177. The link 173 passes through an opening 181 in the member 143 (Fig. 6) provided therefor.

Referring now to Fig. 1, rotation of the knob 161 of the operating device 157 through an angle of approximately 90° in a clockwise direction thrusts the link 173 and the locking member 149 toward the left to the locking position in which it appears in Fig. 5. In the locking position of the member 149 the locking projection 155 occupies a position in the path of travel in unlatching direction of the yoke 86 of the latch member 83 (Figs. 2, 3, 5 and 7). A positive lock is formed by the projection 155 which prevents movement of the latch member 83 to free the carrier 35. Thus, with the locking member 149 in locking position, the trip device 15 is rendered ineffective to trip the breaker.

The movement of the locking member 149 in locking direction also interposes the projection 153 in the path of travel of the operating lever 41, thereby preventing movement of the operating mechanism in contact opening direction. Rotation of the knob 161 from the locking position (Fig. 5) in a counterclockwise direction to the unlocking position (Fig. 1) moves the locking member 149 toward the right withdrawing the projection 155 and 153, respectively, from the paths of the trip member 83 and the operating lever 41, as shown in Fig. 1.

Before the knob 161 can be rotated in either direction, it is necessary to pull it outwardly toward the front of the breaker (Fig. 1) which is toward the right (Figs. 2 and 3). Referring to Fig. 6, the outer end of the cylindrical portion 159 of the member 143 is provided with two pairs of projections 183 and 185. The inner end of the knob 161 is provided with a pair of diametrically opposed projections 187 adapted to fit in the spaced recesses between the projections 183 and 185 and the portions 159. The projections 185 are shorter than the projections 183 which serve as limit stops to limit the rotation of the knob 161 in either direction. The radially inner ends of projections 187 on the knob 161 extend into notches 189 in the shaft 165 in order to communicate the rotary movement of the knob 161 to the shaft 165 and to the crank disc 163. Since the knob 161 is rigidly secured to the shaft 165 by means of the screw 167, and since the inner ends of the projections 187 are permanently engaged with the notches 189 in the shaft 165, the knob 161, shaft 165 and crank disc 163 move as a unit both axially and rotatively. It will be noted that the crank disc 163 (Fig. 4) fits within an opening in the inner end of the molded member 143 which is provided with a shoulder 191 (Fig. 4). When the knob 161, shaft 165 and crank disc 163 are drawn outwardly in order that the projections 187 may clear the projections 185, the crank disc 163 strikes the shoulder 191 limiting the outward movement of the knob beyond that necessary for the projections 187 to clear the projections 185. The member 143 is provided with a shoulder 193 (Fig. 4), and a coil spring 195 compressed between this shoulder and the crank disc 163 biases the knob assembly 157 comprising the crank disc 163, the shaft 165 and the knob 161 inwardly to engage the projections 187 with the selected recesses formed by the projections 183 and 185.

It can be seen, therefore, that in order to move the locking member 149 from the unlocked to the locked position, or vice versa, the knob 161 is first drawn outwardly, then rotated approximately 90° to the selected position, or until the projections 187 strike the projections 183 and then released. The knob lock prevents any jarring force from causing undesired rotation of the knob and crank disc 163.

Referring to Fig. 5, when the knob 161 is rotated to move the member 149 to the locking position, the pin 179 is moved over center above a line drawn through the center of the pin 177 and the center of the knob assembly. The toggle thus formed acts as an additional means for preventing accidental movement of the locking member 149 to unlocking position.

The side of the projection 155 which engages the latch member 83 is slightly tapered so that as the member 149 is moved to locking position and the projection 155 engages the latch 83, the latch is rocked slightly counterclockwise (Figs. 2 and 3) to remove the load from the latch roller 95.

Adjusting screws 197 and 199 (Fig. 7) are provided whereby the position of the projection 155 may be adjusted relatively to the latch member 83. This adjustment is effected by slightly rotating the locking member 149 in either direction about the projection 151 on which the member 149 slides. The screws 197 and 199, respectively, are provided with lock nuts 201 and 203. The adjusting screw 197 is mounted in a threaded opening 205 in a formed projection 207 integral with the mounting bracket 133 (see also Fig. 6). The lower end of the screw 197 is rounded and bears against a projection 209 formed integral with the locking member 149 (Figs. 7 and 8). The adjusting screw 199 is mounted in a threaded opening 211 (Fig. 8) in a portion 213 of the member 149 and bears against the upper face of the projection 207.

Obviously, rotation of the screw 197 in a direction to move it farther into the opening 205 and

at the same time backing the screw 199 out will result in rotating the member 149 in a counterclockwise direction (Fig. 7) which will move the projection 155 toward the left as viewed in Fig. 7 or closer to the yoke 86 of the latch member 83 (see also Figs. 2 and 3). Reversal of the rotation of the member 149 is obtained by moving the screws 197 and 199 in the opposite directions.

If the breaker is standing in the open position with the operating handle 47 in the opposite end of the slot 57 from which it appears in Fig. 2, the operating lever 41 will occupy a position in the path of travel of the projection 153. Inspection of Fig. 1, however, discloses that the locking member 149 may move toward the left a sufficient distance to engage the projection 155 with the latch member 83 before the projection 153 strikes the lever 41. This permits locking the trip member against tripping if an overload circuit condition is present when it is desired to close the circuit. After moving the locking member 149 until the projection 153 strikes the lever 41, the operating handle 47 is moved to the closed position (Fig. 2) closing the contacts. The handle 47 is held in the closed position while knob 161 is rotated the remainder of the distance to locking position which moves the projection 153 under the lever 41, i. e., into the path of opening movement of the lever 41 and thus locks the breaker closed even though an overload condition which would normally trip the breaker open exists in the circuit controlled by the breaker and against shock which would tend to cause the handle to move to open position.

Figs. 9 to 14, inclusive, illustrate a modified form of the invention applied to a circuit breaker of the same general type as that previously described but having a somewhat different form of operating mechanism. Referring to Figs. 9 and 12 of the drawings, the breaker shown therein is also of the three-pole type and is of the same general construction as the circuit breaker fully described in U. S. Patent No. 2,083,304, issued June 8, 1937, to Ture Lindstrom and assigned to the assignee of the present invention. For a more detailed description of the main breaker construction and its operation, reference may be had to the above-mentioned patent.

The circuit breaker comprises, in general, a casing 215 of molded insulating material having a removable cover 217 secured thereon, stationary contact means 219, cooperating movable contact means 221, an operating mechanism 223 and a unitary trip device 227.

Three sets of stationary and movable contact means 219 and 221 are provided forming the three poles of the breaker. The movable contact members 225 of the movable contact means 221 for the center pole are pivotally mounted at 229 on a movable switch member 231, and are biased toward the stationary contact means 219 relative to the switch member 231 by means of springs 233 carried by the switch member. Suitable stops are provided on the switch member for limiting the counterclockwise movement of the contacts 225 relative to the switch member when the contacts are separated.

The switch member 231 is pivotally mounted by means of a pivot pin 235 on a U-shaped main frame 237 which also supports the circuit breaker operating mechanism 223. The movable contact members for the two outer poles (only the left-hand one being shown in Fig. 9) are also carried by switch members which are mechanically connected for simultaneous movement with the center pole switch member 231 by means of a rigid tie bar 239 which extends transversely across the three poles of the breaker. Each switch member is clamped to the tie bar 239 by a clamp 241, and the switch members are insulated from each other by means of insulating sleeves 243 surrounding the tie bar 239.

The several poles of the breaker are insulated from each other by means of insulating barriers 245 molded in the casing 215, which are in alignment with similar barriers 247 molded in the cover 217. Each pole of the circuit breaker is provided with an arc extinguisher 249 for extinguishing arcs drawn between the arcing contacts during rupture of the circuit. The arc extinguishers 249 may be of any suitable type but are preferably of the type fully disclosed in U. S. Patent No. 1, 896,764, issued February 7, 1933, to M. W. Brainard, and assigned to the assignee of the present invention.

The electrical circuit for each of the poles of the breaker is the same, the circuit extending from an upper terminal 255 (Fig. 12) through a conductor 256 to the stationary contact means 219, through the movable contacts 225, flexible shunt conductors 251, a conducting bar 253, and a conductor 319 through the electro-responsive means of the trip device 227 to the lower terminal 255.

The operating mechanism 223 (Fig. 12) includes the U-shaped frame 237, a toggle comprising a pair of toggle links 257 and 259 having one end pivotally connected to the center pole switch member 231, a carrier lever 261 for releasably restraining the other end of the toggle 257—259 in operative position, a channel-shaped operating member 263, an overcenter spring unit 265 for connecting the operating member 263 to the knee 277 of the toggle, and an operating handle 267.

The U-shaped frame 237 is positioned below the contact means of the center pole and is rigidly secured to the base by means of screws 269 and 271. The screw 271 extends through the conductor bar 253, hence the entire operating mechanism 223 and the frame 237 are at the same electrical potential as that of the center pole.

The toggle link 257 comprises a pair of parallel links which are rigidly joined by a yoke 273. One end of the toggle link 257 is pivotally connected to the center pole switch member 231 by a pivot pin 275 and the other end of said toggle link is pivotally connected to one end of the toggle link 259 by the knee pin 277.

The toggle link 259 also comprises a pair of parallel links which are rigidly joined at their upper ends by a yoke 279 which is adapted to engage the yoke 273 of the toggle link 257 when the breaker is in fully closed position (Fig. 12) to provide a stop for limiting the outward motion of the knee of the toggle.

The overcenter spring unit 265 operatively connects the lower end of the operating member 263 with the knee pin 277 of the toggle and exerts a strong tension force therebetween. The lower end of the overcenter spring unit is pivotally connected to the lower end of the operating member 263 by means of a pivot pin 281 and a pair of supporting ears 283 projecting from the operating member 263. The lower end of the toggle link 259 is pivotally connected to the carrier lever 261 by a pivot connection 285. The sides of the channel-shaped operating member 263 are

pivotally connected to the frame 237 by means of a pivot pin 289.

The carrier lever 261 comprises parallel bell crank levers which are joined by a yoke 287 extending parallel to the base of the casing. The carrier 261 is pivoted to the frame at the apex of the bell crank levers by means of a pivot pin 291. The overcenter spring unit 265 at all times exerts a force on the carrier 261 transmitted through the toggle link 259, biasing the carrier lever in a clockwise direction. A latching lever 295 is provided for restraining the carrier lever 261 in operative position. The latching lever 295 also comprises a pair of parallel members which are joined by yokes 297 and 299. One end of the latching lever 295 is pivoted to the frame 237 by a pivot pin 298. The yoke 297 (Fig. 13) of the latching lever 295 normally rests in the path of the yoke 287 of the carrier lever 261 and thus holds the carrier lever in an operative position by preventing it from moving in a clockwise direction under the biasing influence of the overcenter spring 265. The free lower end of the latching lever 295 carries a pivoted latch engaging pawl 301 supported on the yoke 299 of the latching lever 295, the pawl 301 and the latch lever 295 being normally restrained by the trip device 227.

The trip device 227 is preferably of the type fully disclosed in U. S. Patent No. 2,178,083, issued October 31, 1939, to Jerome Sandin, and assigned to the assignee of the present invention.

The trip device includes an electro-magnetically responsive element for each of the poles of the breaker. Each of these elements includes a metallic yoke 303 of non-magnetic material suitably mounted by a panel 305 of insulating material. The panel 305 extends across all of the poles of the breaker and is suitably secured to the base thereof by means of a bracket 306. The yoke 303 is U-shaped and the legs thereof support a stationary core member 307 which is suitably secured thereto by means of screws. A pair of ears 309 on the yoke 303 pivotally support a U-shaped armature 311. Each of the armatures 311 is biased away from its stationary core member 307 by a pair of springs 313 surrounding studs 315 which are secured to the panel 305. The springs 313 are compressed between the armature 311 and washers 317 which may be held in place on the ends of the studs 315 by any suitable means, for instance, cotter pins.

An energizing conductor 319 having one end electrically connected to the conductor bar 253 and the other end connected to the lower terminal 255 passages between the legs of the yoke 303 and the legs of the armature 311 and over the stationary core 307. Current flowing through the conductor 319 energizes magnetic circuit including the core member 307 and causes it to attract the armature 311. Under normal current conditions, however, the springs 313 prevent movement of the armature. Upon the occurrence of an overload current or a short circuit, the attracting force is sufficient to overcome the biasing influence of the springs 313 and move the armature 311 to its attracted position.

Operation of the armature 311 is adapted to actuate a trip bar 321 to cause tripping of the breaker. The trip bar 321 is of molded insulating material and extends across all of the poles of the breaker. It is pivotally supported by means of a pair of lugs 323 (only one being shown) projecting downwardly from the bracket 306.

A compression spring 325 biases the trip bar in a clockwise direction and maintains the latch end of an angular bracket 327 secured thereto, in engagement with a trip lever or main latch 329 pivotally supported in the bracket 306. The latch 329 engages the trip pawl 301 to normally restrain the latch lever 295 in latching position. Spaced plates 331, one for each pole of the breaker, are secured to the trip bar 321 by means of rivets. Each of the plates 331 extends downwardly and is adapted to be engaged by the corresponding armature 311 when the armature is operated as previously described in response to an overload current.

When any armature 311 is operated in response to abnormal circuit conditions, the trip bar 321 is rocked counterclockwise causing the angular bracket 327 to release the main latch 329 which in turn releases the latching lever 295 thereby permitting counterclockwise movement of the latching lever 295 under the biasing influence of the operating spring unit 265. The counterclockwise movement of the latching lever 295 causes its yoke 297 to release the carrier lever 261 which is thus moved clockwise about its pivot 291 under the biasing influence of the overcenter spring unit 265 and the force exerted by the contact springs 233. This causes collapse of the toggle 257–259 toward the base and simultaneously opening of all of the contacts of the breaker.

To reset the breaker following an automatic tripping operation, the operating handle 267 is moved in a clockwise direction to the "off" position. This operation of the handle causes a pair of rollers 333 on the operating member 263 to engage and reset the carrier lever 261 and the latching lever 295 to their latched positions. The breaker may then be reclosed by moving the operating handle 267 in a counterclockwise direction to the "on" position.

In order to open the circuit breaker manually, the operating handle 267 is moved in a clockwise direction from the position in which it appears in Fig. 12 to the opposite end of the slot 293. When the handle has been moved a short distance, a projection 335 on the operating member 263 engages the yoke 273 of the toggle link 257 and positively starts the knee 277 of the toggle 257–259 toward the base of the breaker. At the same time, the operating spring unit 265 has been moved across the center line of the toggle link 259 and now exerts a force in a direction to move the knee of the toggle toward the base. The movement of the several parts of the operating mechanism is now automatic and all of the contacts are opened simultaneously with a snap action.

To close the contacts after they have been opened manually the operating handle 267 is moved in a counter-clockwise direction carrying the line of action of the operating spring unit 265 over the center line of the toggle link 259. The operating spring unit then exerts a force biasing the knee of the toggle 257–259 outwardly from the base, causing straightening of the toggle and closing the contacts for all of the poles with a snap action.

It can be seen that operating member 41 and the latch member 83 of the circuit breaker shown in Fig. 3 move in the same direction to effect opening of the breaker. It can also be seen that the operating member 263 and the latching lever 295 (Fig. 12) of the breaker described in connection with the modified form of the locking mech-

anism move in opposite directions. This fact and the shapes of the moving parts imposes a different problem in effecting the positive locking of the breaker in the closed contact position.

In order to effect locking of the operating member **263** and the latch lever **295** against movement to cause opening of the contacts a pivoted lock member **337** (Figs. 12 to 14, inclusive) is provided. The locking member **337** is provided with a hub **338** (Fig. 11) and is pivotally mounted on a horizontally disposed stud **339** molded into and projecting from a portion **340** of a member **341** of molded insulating material. The member **341** is secured to a metal bracket **343** by means of screws **345** with an angular plate **347** of insulating material therebetween. The bracket **343** is bent inwardly toward the base of the breaker and has a mounting foot formed on the inner end which is secured to the conductor **319** for the right-hand pole (Fig. 9) by means of screws **349** with which the conductor **319** is secured to the bar **253** for that pole and to the base **215**.

A retaining collar **351** (Fig. 14) secured to the end of the stud **339** bears against the barrier **245**, and a member **353** (Fig. 14) secured to the bracket **343** by the screw **345** is provided with an enlarged portion **355** which bears against the side of the casing **215** to provide a snug fit for the locking device between the right-hand barrier **245** (Fig. 9) and the wall of the casing **215** (Fig. 14).

The locking member **337** is operatively connected to a crank disc **357** (Fig. 14) by means of a link **359**, one end of which cooperates with a pin **361** projecting from an ear **363** on the locking member **337** (Fig. 11) and the other end of which link cooperates with a pin **365** (Figs. 9 and 10) on the crank disc **357**. The crank disc is secured to the inner end of a shaft **358** of insulating material having a knob **367** secured to its outer end. The construction of the knob **367** and its associated parts for operating the locking member **337** is identical with that described previously and illustrated in Fig. 4 of the drawings for which reason it is not believed necessary to repeat the description here.

When the knob **367** is drawn outwardly and rotated in a clockwise direction from the position in Fig. 9 to its Fig. 10 position, the crank disc **357** is rotated therewith and thrusts the link **359** toward the center pole of the breaker rotating the locking member **337** to the locking position in which it appears in Fig. 10. Referring to Fig. 14, as the locking member **337** is moved toward locking position, the edge **369** thereof engages the rounded corner **371** of the yoke **299** of the latching member **295** and rocks this member slightly in a clockwise direction (Fig. 13) to move the latch pawl **301** slightly away from the trip lever **329**. The engagement of the member **337** with the latching member **295** prevents unlatching of the carrier lever **261**, thus rendering the trip device **227** ineffective to trip the breaker in response to overload conditions, and also prevents shocks or jars from tripping the breaker.

Movement of the locking member **337** to locking position also positions the flattened apex of a projection **373** thereon into the patch of travel of a portion **375** (Figs. 10 and 13) of the operating member **263**. Should the operating member **263** be moved clockwise toward opening position, the portion **375** thereof will strike the projection **373** of the locking member which arrests the opening movement of the operating member before the projection **335** thereon strikes the yoke **273** of the toggle link **257** (Fig. 12) and before the operating member has travelled a sufficient distance to move the operating spring unit **265** over the center line of the toggle link **259**. Thus the tension of the powerful spring unit **265** is maintained in a position to hold the toggle **257—259** in straightened condition which holds the contacts closed regardless of the condition of the circuit, and also against any shock or jarring force.

It was stated previously that the entire operating mechanism **223** including the operating member **263** and the latching lever **295** are at the same electrical potential as that of the center pole of the breaker. Since the metal support bracket **343** for the locking device is secured to the conductor **319**, the bracket will have the electrical potential of the right-hand pole (Fig. 9). In order to more completely insulate the two poles concerned, there is provided an angular insulating member **377** secured to the panel **305** by means of screws **379**. The insulating member **377** is disposed between the bracket **343** and the adjacent center pole parts and the end of the locking member **337**. When the locking member **337** is in locking position and, therefore, in contact with the latching member **295**, the member **337** is also at center pole potential. The member **341** which is of insulating material, and the angular insulating plate **347** effectively insulate the locking member **337** and the metal parts connected thereto from the bracket **343** and hence from the right hand pole (Fig. 9).

It may be desirable to close the breaker and lock it in closed position against an overload circuit condition. In this case the knob **367** is drawn outwardly and rotated in a clockwise direction toward locking position. During this movement of the knob, the locking member **337** will be moved to a position in the path of unlatching movement of the latching lever **295** thus preventing tripping of the breaker. However, the movement of **337** will be arrested before full locking position is reached by striking the operating member **263**, which at this time is in the "off" position in which it is in the path of the locking member. While holding the knob **367** in its partially rotated position, the operating handle **267** is moved in a counterclockwise direction (Fig. 12) to its "on" position which closes the breaker as previously described. The locking knob **367** may now be rotated the remainder of the distance to locking position.

Referring to Fig. 10, it will be observed that with the knob **367** in the locking position the toggle comprising the link **359** and the crank disc **357** is over center above a line drawn through the center of the pin **361** and the center of the crank disc which is in axial alignment with the knob **367**. This overcenter condition assists in maintaining the locking member **337** in locking position against the effects of shocks or jars.

It is obvious that rotation of the knob **367** to its unlocking position withdraws the locking member **337** from its locking position (Fig. 10) to its unlocking position (Fig. 9).

The invention provides an improved locking mechanism for locking the circuit breaker in closed position and for preventing tripping of the breaker in response to overload conditions in the circuit controlled by the breaker. The locking devices described in the foregoing specification are of simple construction, inexpensive to manufacture and are adapted to be readily installed in circuit breakers of the type disclosed

which are already in use. The operation of the locking device is simple and positive, the locking of both the operating mechanism and the trip member being effected in both forms of the invention by a single locking member. The manually operable locking knob is arranged to be locked in both its locking and unlocking position. This, together with the toggle connection between the locking knob and the locking member insures that the mechanism will not be displaced from its adjusted position as a result of shock or jar.

Having described several embodiments of the invention in accordance with the patent statutes, it is to be understood that various changes and modifications may be made in the structural details disclosed without departing from some of the essential features of the invention. It is, therefore, desired that the language of the appended claims be given as reasonably broad interpretation as the prior art permits.

We claim as our invention:

1. In a circuit breaker, a base, relatively movable contacts, an operating member movable to an open and to a closed position for opening and closing said contacts, a member releasable to cause opening of said contacts irrespective of the position of the operating member, said elements being mounted on said base, and a locking element mounted on said base and movable transversely of the direction of movement of the operating member and the releasable member and into the path of opening movement of said operating member and said releasable member to prevent opening movement of said operating member and to prevent release of the releasable member.

2. In a circuit breaker, a base, relatively movable contacts, operating mechanism including an operating member movable to an open position and to a closed position for opening and closing said contacts, releasable means operable in response to predetermined conditions in the circuit controlled by the breaker for causing opening of said contacts irrespective of the position of said operating member, said operating mechanism and said releasable means being mounted on said base, a locking member mounted on said base to one side of said operating mechanism for movement transversely of the direction of movement of the operating member, said locking member being movable from a non-locking position to a locking position in which portions thereof are interposed in the path of opening movement of said operating member and said releasable means to prevent opening movement of said operating member and to prevent operation of the releasable means in response to shocks or jars.

3. In a circuit breaker including a supporting base, relatively movable contacts, operating means therefor including an operating member movable to open and to close said contacts, a member releasable to cause opening of said contacts irrespective of the position of said operating member, a latch member operable to release said releasable member, a slidable locking member mounted on said base and movable from one position to a second position to prevent movement of the operating member to open position and to prevent release of the releasable member, and means to lock said slidable member in either of its positions.

4. A circuit breaker comprising a base, a removable cover, relatively movable contacts, an operating member movable to an open position and to a closed position to open and close the contacts, releasable means operable to cause opening of the contacts irrespective of the position of the operating member, a locking member mounted for movement in a path perpendicular to the path of movement of the operating member, a member mounted on said base for supporting said locking member independently of said cover, said locking member being movable from a non-locking position to a locking position in which portions thereof are interposed in the path of opening movement of said operating member and said releasable means to prevent opening movement of the operating member and to prevent release of the releasable means, and means operatively connected to said locking member and operable upon movement of said locking member to locking position for locking said movable locking member in locking position.

5. In a circuit breaker, relatively movable contacts, an operating member having a closed position and movable to an open position to cause opening of said contacts, releasable means operable to cause opening of the contacts regardless of the position of the operating member, a member slidable transversely of the operating member and operable from one position to a second position to prevent movement of said operating member to open position and to prevent operation of the releasable means, a plurality of bearings for slidably supporting said slidable member, and means to lock said slidable member in either of its positions.

6. In a circuit breaker, a base, a cover removably mounted thereon, relatively movable contacts and operating mechanism therefor mounted on said base, said operating mechanism including an operating member movable to an open position and to a closed position for opening and closing said contacts, means releasable to cause opening of the contacts irrespective of the position of said operating member, a locking member mounted on said base and movable from one position to second position to prevent movement of the operating member to open position and to prevent operation of the releasable means, manually operable means mounted on said base for positively actuating said locking member to both positions, and a toggle operatively connecting said manual means to the locking member, said toggle and said manual means cooperating to lock said locking member in either of its positions.

7. In a circuit breaker, relatively movable contacts, operating mechanism for said contacts including an operating member movable to open and to close said contacts, a releasable means operable to cause opening of the contacts, irrespective of the position of said operating member, a pivoted locking member movable from one position to one side of the operating member and said releasable means to a position between said operating member and said releasable means to prevent operation of said releasable means and also to prevent opening of said contacts, manually rotatable means for positively moving said locking member to both positions, and means comprising at least one projection movable with said rotatable means and engageable with a support member provided with a plurality of locking recesses to retain said rotatable means and said locking member in locking position against the effects of shock or jar.

8. In a circuit breaker, relatively movable contacts, an operating member operable to cause

opening and closing of said contacts, a means releasable to cause opening of the contacts, a slidable member, movable transversely into the paths of movement of the operating member and the releasable means to render said operating member and said releasable means ineffective to cause opening of the contacts, manual operating means for positively moving said slidable member, and restraining means for preventing accidental movement of said manual operating means in response to shocks or jars.

9. In a circuit breaker, relatively movable contacts, an operating member operable to cause opening and closing of said contacts, a releasable latch member movable to cause opening of the contacts, a slidable member having a projection movable from one position to a position in the path of travel of the operating member and having a second projection engageable with the latch member to prevent opening movement of said operating member and said latch member, manual means operatively connected to the slidable member for positively operating said slidable member to both positions, and locking means for said manual means.

10. In a circuit breaker, relatively movable contacts, an operating member movable to open and close said contacts, means releasable to cause opening of the contacts, a locking member movable transversely of the movement of the operating member to a locking position in which it blocks movement of said operating member to open position and prevents release of the releasable means, rotatable operating means for said locking member including a knob which is rotatable to operate said locking member and which is also movable in the direction of its axis of rotation independently of said locking member, support means for said knob, retaining means for said operating means comprising at least one projection on said knob engageable with locking recesses on said support means to positively retain said operating means in operative position, and means effective upon movement of said rotatable operating means to locking position to lock the locking member in locking position.

11. In a circuit breaker, relatively movable contacts, an operating member movable to an open and to a closed position for opening and closing said contacts, a pivoted latch member operable to cause opening of said contacts, a locking member slidable transversely of the movement of the operating member from one position to a second position, said locking member having a projection thereon for preventing movement of the operating member and a second projection for preventing movement of the latch member, rotatable operating means for said locking member including a rotatable pullout knob, a support member for said rotatable means, and retaining means for positively retaining the rotatable means in either position, said retaining means comprising at least one projection on said knob selectively engageable with a plurality of recesses in the support member.

12. In a circuit breaker, relatively movable contacts, an operating member movable to an open position and to a closed position for opening and closing said contacts, a releasable member operable to cause opening of the contacts irrespective of the position of the operating member, a locking member movable from one position to a second position between said operating member and said releasable member to prevent movement of the operating member and of the releasable member, operating means for positively moving said locking member to both positions including a rotatable knob which is also movable in the direction of its axis of rotation, a support for said operating means, and means comprising a part movable with said knob and engageable with recesses in the support for positively retaining the movable locking member in either one of its positions.

13. In a circuit breaker, relatively movable contacts, an operating member for opening and closing said contacts, a releasable latch for causing opening of the contacts, a slidable member for cooperating with the operating member and said latch to prevent movement thereof, operating means operatively connected to said slidable member for positively operating said slidable member, and adjusting means for rotatably adjusting the slidable member relative to the operating member and the latch.

14. In a circuit breaker, relatively movable contacts, an operating member for opening and closing said contacts, a latch member operable to cause opening of the contacts, a locking member movable transversely of the plane of movement of the operating member to a position to prevent contact opening movement of said operating member and the latch member, and adjusting means for adjusting the locking member in a direction substantially parallel to the plane of movement of the operating member for adjusting the position of the locking member relative to the operating member and the latch member.

15. In a circuit breaker, relatively movable contacts, an operating member movable to cause opening and closing of said contacts, a latch member operable to cause opening of the contacts, a pivoted locking member movable transversely of the direction of movement of the operating member from a non-locking position to a locking position to prevent contact opening movement of said operating member and the latch member, manual actuating means for positively moving said locking member to both positions including a rotatable pull-out knob, said knob being movable in the direction of its axis of rotation independently of said locking member, support means for said actuating means, and retaining means for said actuating means comprising a part on the knob engageable with recesses in the support member for positively retaining said locking member in either position.

16. A circuit breaker comprising a base, relatively movable contacts, an operating member movable to an open position and to a closed position for opening and closing said contacts, releasable means operable in response to predetermined conditions in the circuit controlled by the breaker for causing opening by said contacts irrespective of the position of said operating member, said elements being mounted on said base, a slidable locking member movable in a path perpendicular to the path of movement of the operating member, a support for said locking member rigidly mounted on said base, said locking member being movable from a non-locking position to a locking position in which portions thereof are interposed in the path of opening movement of said operating member and said releasable means to prevent opening movement of said operating member and to prevent operation of the releasable means.

17. A circuit breaker comprising a base, relatively movable contacts, an operating member movable to an open position and to a closed posi-

tion for opening and closing said contacts, releasable means operable in response to predetermined conditions in the circuit controlled by the breaker for causing opening of the contacts irrespective of the position of the operating member, said elements being mounted on said base, a pivoted locking member mounted on said base and movable transversely of the direction of movement of the operating member, said locking member being movable from a non-locking position to a locking position between said operating member and said releasable means in which portions thereof are interposed in the path of opening movement of said operating member and said releasable means to prevent opening movement of said operating means and to prevent operation of the releasable means, and manually operable means for positively moving said locking member to both positions.

18. A circuit breaker comprising a supporting base, relatively movable contacts, an operating member movable to an open position and to a closed position for opening and closing said contacts, releasable means operable in response to predetermined conditions in the circuit controlled by the breaker for causing opening of the contacts irrespective of the position of the operating member, said elements being mounted on said base a locking member mounted on said base and movable in a path perpendicular to the path of movement of the operating member, means for positively moving said locking member in both directions, said locking member being movable from a non-locking position to an intermediate position in which a portion thereof is interposed in the path of movement of the releasable means to prevent operation of said releasable means, and said locking member being movable to a locking position in which said portion thereof and another portion thereof are interposed in the path of opening movement of said releasable means and said operating member to prevent operation of said releasable member and to prevent opening movement of said operating member.

19. A circuit breaker comprising relatively movable contacts, an operating member movable to open and close said contacts, means releasable to cause opening of said contacts irrespective of the position of said operating member, a locking member movable to a locking position wherein it blocks movement of said operating member in contact opening direction and prevents release of said releasable means, operating means for said locking member including a manual member which is rotatable, said manual member being also movable in the direction of its axis of rotation independently of said locking member, support means for said manual member, and retaining means for said manual member comprising at least one projection on said manual member engageable with locking recesses on said support means.

20. In a circuit breaker having movable contacts, an operating mechanism for effecting the engagement of said contacts with each other, means responsive to circuit conditions for effecting the disengagement of said contacts, a locking device for rendering said circuit responsive means ineffective to disengage said contacts, operating means for operating said locking device having a plurality of positions in one of which it operates said locking device to render said circuit responsive means ineffective and another position in which it positions said locking device to be ineffective on said circuit responsive means; and means whereby said last mentioned operating means is operable from any one position to another position only by a composite of two different motions.

21. In a circuit breaker having movable contacts, an operating mechanism for effecting the engagement of said contacts with each other, means responsive to circuit conditions for effecting the disengagement of said contacts, a locking device for rendering said circuit responsive means ineffective to disengage said contacts, operating means for operating said locking device having a plurality of positions in one of which it operates said locking device to render said circuit responsive means ineffective and another position in which it positions said locking device to be ineffective on said circuit responsive means; and means whereby said last mentioned operating means is operable from any one position to another position only by a composite of an axial and rotary motion.

22. In a circuit interrupter having engageable and disengageable contacts, a locking device for locking said contacts against disengagement, a handle operable on movement thereof in one direction to move the locking device into a plurality of selected positions; locking means engageable with said handle to prevent the movement thereof in said direction; said last mentioned locking means being disengageable on movement of said handle in another direction.

23. In a circuit breaker having contacts which engage and disengage, means responsive to circuit conditions for operating said contacts to disengaged position, a locking device having a plurality of positions, in one of which it is effective for locking said contacts in engagement, an operating means having a plurality of positions, in one of which it operates said locking device to its first position and in another of said positions it operates said locking device to its second position, said operating means being rotated from one position to another of said positions, said operating means being movable axially at each of its positions for locking said member in its operated position.

24. In a circuit breaker having a pair of cooperating contacts which engage and disengage, means responsive to circuit conditions for operating said contacts to disengaged positions, means for manually engaging and disengaging said contacts, a locking mechanism having a linear movement to a plurality of predetermined positions in one of which it is effective for locking said contacts in engagement, an operating member having a plurality of movements for passing between a plurality of set positions for operating said locking mechanism to each of said positions, means for translating one of said motions of said operating member into linear movement for selectively operating said locking mechanism to one of its positions, and spring means for operating said operating member through the other of said movements for locking said operating member in positions, said spring means being effective to move said operating member through said other movement only at said predetermined positions.

25. A circuit interrupter having an operating arm and tripping mechanism; a locking device operable on longitudinal movement for engaging said tripping mechanism in one position to prevent operation of said tripping mechanism and for engaging said operating arm in a second po-

sition to prevent operation of said operating arm; an operating handle for said locking device; said operating handle being rotatable; a connection between said handle and said locking device for translating rotational movement of said handle into longitudinal movement of said locking device.

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