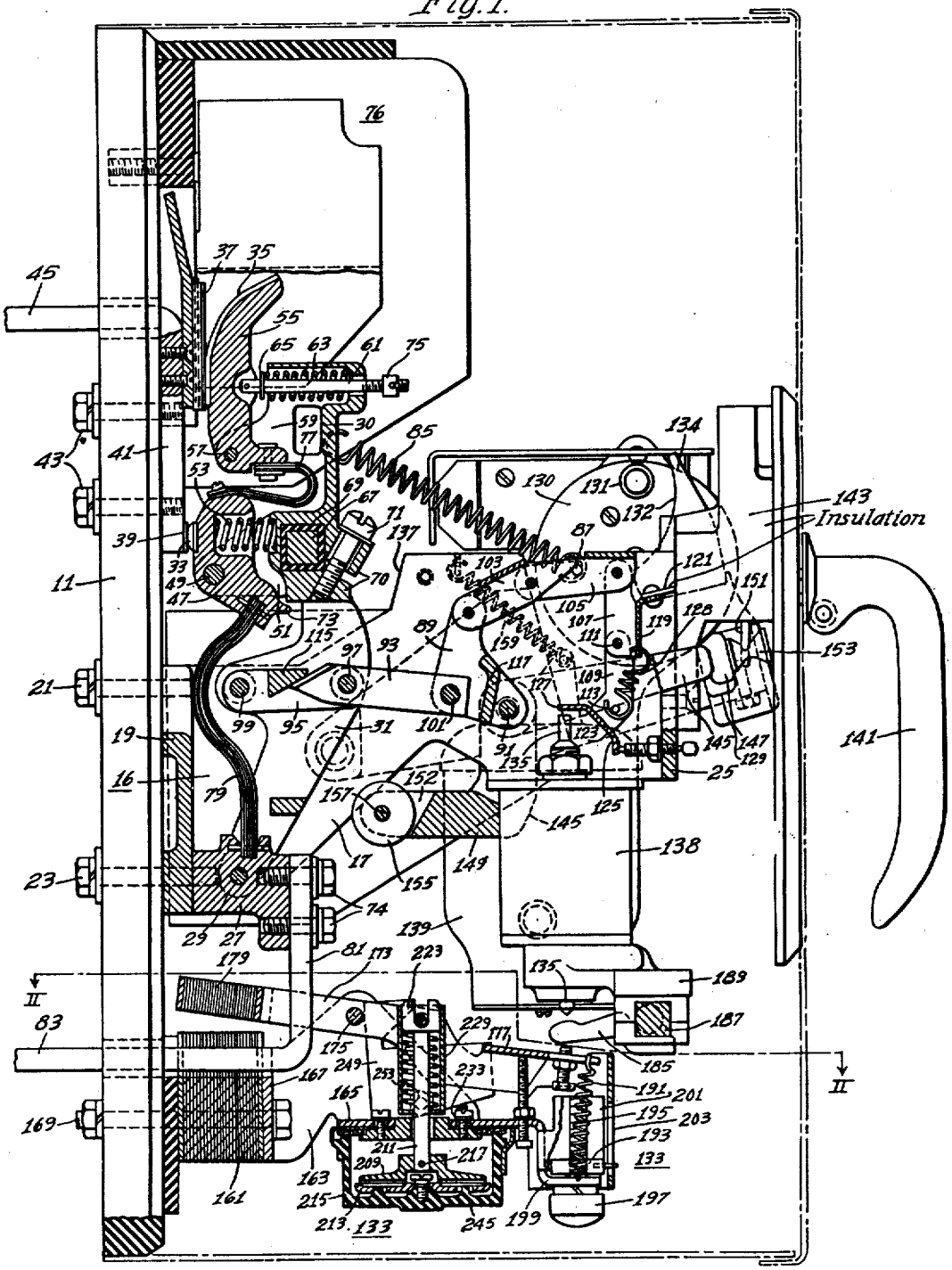
Dec. 28, 1943. J. W. MAY 2,337,565

CIRCUIT BREAKER

Filed April 4, 1942 2 Sheets-Sheet 1

Fig. 1.



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CIRCUIT BREAKER

Filed April 4, 1942 2 Sheets-Sheet 2

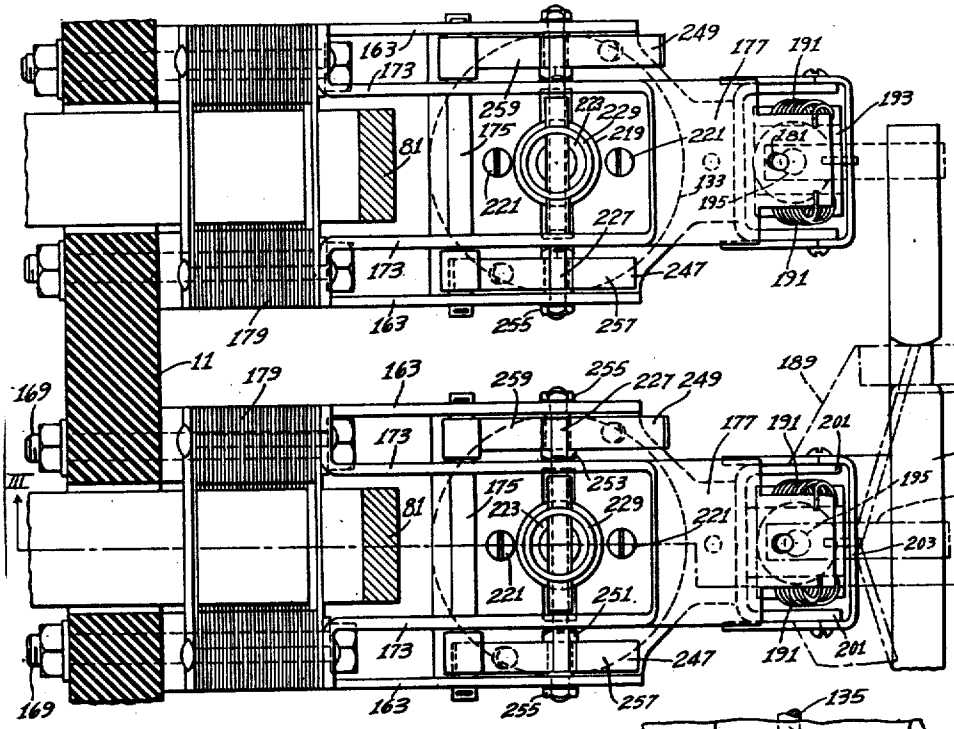


Fig. 2.

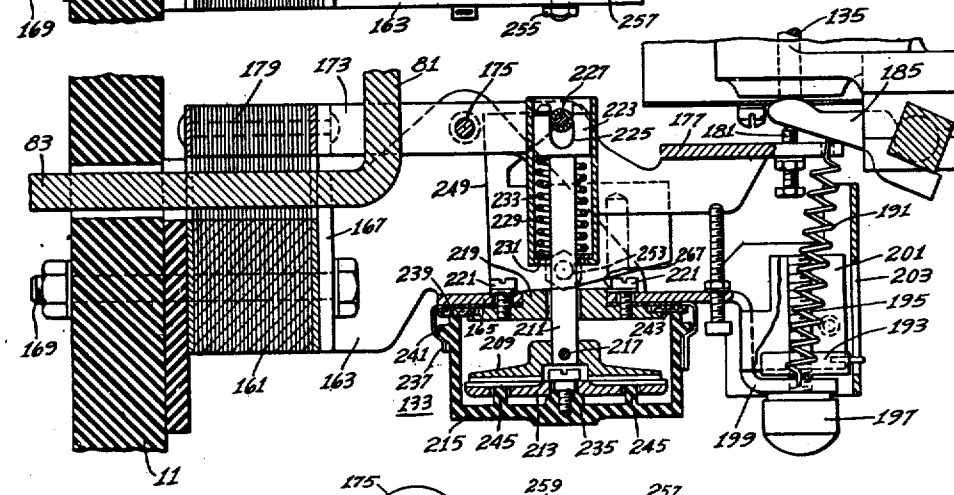


Fig. 3.

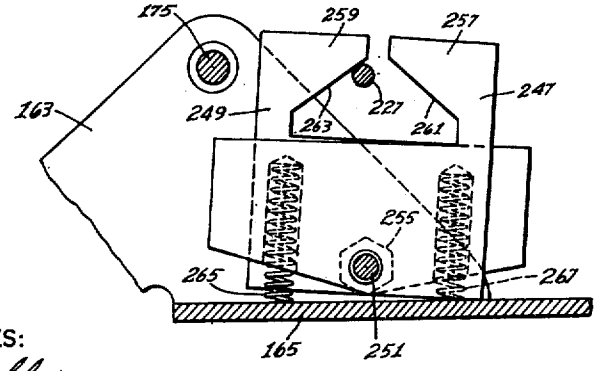


Fig. 4.

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2,337,565

CIRCUIT BREAKER

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Application April 4, 1942, Serial No. 437,637

11 Claims. (Cl. 200—109)

This invention relates to circuit breakers and more particularly to shock proof circuit breakers of the type which are automatically tripped open in response to predetermined overload conditions.

One object of the invention is to provide a circuit breaker in which an improved device prevents the automatic opening of the breaker in response to shocks or jarring forces to which it may be subjected.

Another object of the invention is to provide a circuit breaker having an improved device operable in response to shocks or jarring forces, which applies a force to the trip device of the breaker opposing tripping action of the trip device.

Another object of the invention is to provide a circuit breaker with a normally static device which is effective only upon the occurrence of a jarring force to prevent tripping the breaker in response to jarring forces.

Another object of the invention is to provide a circuit breaker having a shock proof device comprising a minimum number of parts.

Another object of the invention is to provide a circuit breaker having a shock proof device in which a plurality of members are disposed for movement in opposite directions and are operable in response to shocks occurring in either of the opposite directions to prevent tripping the breaker.

Another object of the invention is to provide a trip device for a circuit breaker with an improved shock proof device in which a pair of unbalanced members each is operable independently of the other in response to sudden jarring forces to apply a force opposing tripping of the breaker.

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

Figure 1 is a vertical sectional view through the center pole of a three pole circuit breaker embodying the features of the invention;

Fig. 2 is a fragmentary sectional view taken on line II—II of Fig. 1;

Fig. 3 is a vertical sectional view through the trip device taken substantially on line III—III of Fig. 2; and

Fig. 4 is an enlarged fragmentary view of the shock proof device showing one of the shock proof members in the position assumed in response to a sudden shock or jarring force.

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 having spaced sides 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 sides 17 of the frame 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 sides of the frame 16 pivotally supports a pair of spaced arms 31 (only one being shown) 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 contact arms 30 are thus mechanically connected for movement together. Rectangular tubes 68 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 and therefore only the center pole contact means has been shown. 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 respectively engage 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 portions 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 (not shown) 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 screws 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 pole of the breaker in an electrical circuit. Conductors similar to the conductor 81 are connected to the connectors 27 of the outer poles and form the lower terminals of the outer poles.

The electrical circuits for the several poles of the breaker are essentially the same. The circuit of each pole extends from the corresponding 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 member 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, controlled from a remote point and in a manner well known in the art, to operate the trip rod and trip the breaker.

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 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 95 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 sides of the frame. The inner ends of the levers 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 overset 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 antifriction 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 previously 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.

Each 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, 2 and 3) 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 frame 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, (Fig. 3), 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.

A trip bar 187 is rotatably supported in a bracket 189 secured to the casing 138 for the shunt trip 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 springs 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 overload trip device 33 includes a dash pot time delay device of the suction disc type removably mounted on the yoke 165 of the frame 163 (Figs. 1 and 3). The construction and operation of the dash pot is the same as that disclosed in the copending application of John W. May and William H. Stuellein, Serial No. 392,048, filed May 6, 1941, and assigned to the assignee of the instant invention. For this reason, only a brief description of the dash pot is given herein.

A suction disc 209 (Fig. 3) mounted on the lower end of a vertically disposed rod 211 cooperates with a suction disc 213 mounted for universal movement in a dash pot 215. The disc 209 is secured to the rod 211 by means of a screw thread and is prevented from rotating relative thereto by means of a pin 217. The rod 211 passes through an opening in a circular plate 219 which is secured to the yoke 165 by screws 221, the plate serving as a guide for the rod. The enlarged upper end 223 of the rod 211 is provided with an open slot 225 engaging a pin 227 supported on and extending between the sides of the tripping lever 173. The enlarged upper end 223 of the rod 211 is slidable longitudinally in a cylinder 229 pivotally supported on the pin 227 and having its lower end formed into an inwardly extending flange 231. A compression spring 233 is disposed between the flange 231 and the enlarged end of the rod 211.

The suction disc 213 is mounted for universal tilting movement on a spherical bearing molded integral with the bottom of the dashpot 215. A shouldered screw 235 threaded into the bearing retains the suction disc 213 in place, and at the same time, permits tilting movement thereof so that the suction surfaces of the discs will be accurately aligned when they are brought into engagement. The suction disc 209 is provided with a pair of opposed suction areas which are adapted to cooperate with similar suction areas on the face of the disc 213 to effect a time delay tripping on overloads below a predetermined magnitude. Provision is made for rotating the disc 213 relative to the disc 209 in order to vary the time delay on low overloads. The dash pot 215 is rotatably supported by means of spring clips 237 projecting downward from a disc 239 supported between the disc 219 and the yoke 165. The spring clips 237 are formed in a manner to cooperate with annular projections 241 on the periphery of the dash pot 215. The force exerted by the spring clips 237 on the beveled portions of the projections 241 press the dash pot into engagement with an annular gasket 243 to form an oil seal and at the same time permit manual rotation of the dash pot. The rotation of the dash pot is communicated to the disc 213 by means of projections 245 molded integral with the bottom of the dash pot and projecting into openings in the disc. By rotating the dash pot 215, the suction disc 213 is rotated relative to the suction disc 209 and thus the area of engagement of the suction surfaces is varied to provide for a longer or shorter time delay depending upon the extent of displacement of the suction surfaces.

Upon the occurrence of overload currents below a predetermined value for example below 1000% of normal current for which the breaker is rated, the magnet 161 attracts the armature 179 with a force sufficient to overcome the tension of the springs 191 and, acting through the cylinder 229 and spring 233, applies a pressure to the enlarged end 223 of the rod 211 in an upward direction. This pressure, after a time delay, breaks the suction seal between the discs 209 and 213 whereupon the magnet 161 moves the armature to attracted position rocking the trip lever 173 counterclockwise to effect tripping of the breaker in the previously described manner.

Upon the occurrence of an overload above the predetermined value or a short circuit, the magnetic pull is sufficient to cause instantaneous tripping of the breaker. Under this circumstance, the trip lever 173 is operated instantaneously compressing the spring 233 without waiting for the force applied to the rod 211 to break the suction seal between the discs. The springs 191 act to restore the trip lever 173 to its normal position as soon as the contacts are opened and the magnet 161 deenergized.

The construction of the circuit breaker as thus far described in detail is substantially the same as that fully disclosed in the copending application of John W. May and William H. Stuellein, Serial No. 392,048, filed May 6, 1941, and assigned to the assignee of the instant invention.

In certain installations of circuit breakers embodying the above described trip device, the

breakers, including the trip devices, are often subjected to shocks of such magnitude as to cause movement of the trip levers to trip the breaker. In such cases, the circuits controlled by the breakers are interrupted and serious consequences may result. Normal current flowing through the circuit of the breaker energizes the trip magnet 161 (Figs. 1 and 3) which attracts the armature 179 but not sufficiently to alone overcome the springs 191 and cause tripping of the breaker. If, however, the breaker is subjected to a jarring force the armature might be moved closer to the magnet 161 thus reducing the magnetic air gap to an extent that the magnet, under normal circuit conditions, would attract the armature and cause undesirable and false tripping of the breaker.

In order to prevent accidental movement of the armature 179 and consequently the trip lever 173 toward tripping position in response to jarring forces, there is provided a pair of relatively heavy, dynamically unbalanced latches 247 and 249 (Figs. 2, 3 and 4). The latches 247 and 249 are pivotally supported by means of shouldered pivot pins 251 and 253, respectively, on the side members 163 of the trip device frame. The pivots 251 and 253 pass through suitable openings in the side members 163 and in the lower central part of the latches. Nuts 255 on the outer ends of the pivot pins retain the pivots securely in position. The latches 247 and 249 are provided with hook-shaped projections 257 and 259, respectively, having inner inclined faces 261 and 263 adapted to engage the previously described pin 227 which extends laterally beyond the sides of the trip lever 173. The latches are disposed each reversed from the other and light springs 265 and 267 are provided of just sufficient strength to overcome the gravity unbalanced weight of the latches and maintain the latches in static position regardless of any tilted position of the breaker. The springs 265 and 267 which abut against the yoke 165 and are seated in spring seats in their respective latches, bias the latches against the yoke 165, in which position the pin 227 is free to move in tripping direction between the hook shaped projections 257 and 259. However, if a jarring force is applied to the base of the breaker of such magnitude as to cause the armature 179 and the trip lever 173 to move in tripping direction, the jarring force will also be imparted to one or both of the unbalanced latches causing the latch or latches to rotate about their pivots away from the yoke 165. As the latch rotates the beveled or inclined face 261 or 263 engages the pin 227, whereupon a binding action occurs between the mass of the armature and the mass of the latch which prevents movement of the trip lever 173 in tripping direction, and thereby prevents a reduction of the magnetic air gap during the existence of the jarring force. When the jarring force ceases, the spring 265 and 267 restore their respective latches 247 and 249 to the normal positions.

The inclined surfaces 261 and 263 are so arranged that should a heavy overload or short circuit occur during the existence of a jarring force, the increased energization of the trip magnet 161 will overcome the action of the shock proof latch or latches and move the trip lever to tripping position in response to such short circuit conditions.

From the foregoing it can be seen that there has been provided a shock proof device which prevents tripping movement of the trip lever in response to shocks or jarring forces only during the existence of such jarring forces and which does not obstruct normal operation of the trip lever in response to overload circuit conditions.

There has been provided a shock proof device which comprises but two essential parts which are simple and rugged, and which may be readily applied to many standard forms of circuit breaker structures.

Having described the preferred embodiment 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.

I claim as my invention:

1. In a circuit breaker, contact means, means for actuating said contact means to an open or to a closed position, a trip device including a trip lever operable to a tripping position to cause movement of the contact means to open position in respose to predetermined abnormal circuit conditions, and a shock proof means operable in response to jarring forces to prevent movement of the trip lever to tripping position, said shock proof means comprising an unbalanced latch member movable in response to jarring forces to apply a force to the trip lever in a direction to oppose movement of said trip lever to tripping position.

2. In a circuit breaker, contact means, actuating means for moving said contact means to an open or to a closed position, a trip device including a trip member operable to a tripping position to cause movement of the contact means to open position in response to predetermined abnormal circuit conditions, and a shock proof device comprising a plurality of unbalanced latch members each operable independently in response to sudden jarring forces to apply a force to the trip member in a direction to restrain said trip member against movement to tripping position.

3. In a circuit breaker, contact means, means for actuating said contact means to an open or to a closed position, a trip device including an electromagnet, an armature operable by said electromagnet in response to abnormal circuit conditions to cause movement of the contact means to open position, and a shock proof device comprising an unbalanced latch member operable in response to sudden jarring forces to apply a force to said armature in a direction to oppose operation of the armature and reduction of the magnetic air gap.

4. In a circuit breaker, contact means, actuating means for moving said contact means to an open and to a closed position, a trip device operable to a tripping position to cause movement of the contact means to open position, a time delay device normally opposing movement of the trip device to tripping position, and a shock proof device comprising a plurality of unbalanced members each operable in a different direction from the other in response to sudden jarring forces to apply a force to the trip device in a direction to prevent movement thereof to tripping position by jarring forces.

5. A trip device for a circuit breaker including a trip member movable from a normal position to a tripping position to trip the breaker, and means normally permitting movement of said trip

member and operable in response to and only during the existence of sudden jarring forces to apply a force to the trip member to prevent movement of said trip member to tripping position by jarring forces.

6. A trip device for a circuit breaker comprising a trip member movable from a normal position to a tripping position to cause opening of the breaker, an electromagnet operable in response to predetermined circuit conditions to move said trip member to tripping position, and means operable in response to sudden jarring forces to apply a force to the trip member opposing movement of said trip member to tripping position, said electromagnet being operable in response to predetermined circuit conditions occurring during the existence of a jarring force to overcome the force applied by said opposing means and move the trip member to tripping position.

7. A trip device for a circuit breaker comprising a trip member movable from a normal position to a tripping position to cause opening of the breaker, means operable in response to predetermined abnormal circuit conditions to move the trip member to tripping position, and means comprising a plurality of independently movable members each operable in response to sudden jarring forces to engage a part movable with the trip member to oppose movement thereof during the existence of jarring forces.

8. A trip device for a circuit breaker comprising a trip member operable to cause opening of the breaker, means operable in response to predetermined circuit conditions to operate the trip member, and shock proof means comprising a pair of independently mounted unbalanced masses disposed for movement in opposite directions, said unbalanced masses each being operable in response to shocks and jarring forces to engage and oppose operation of the trip member.

9. A trip device for a circuit breaker comprising a trip member operable to cause opening of the breaker, electroresponsive means operable in response to predetermined abnormal circuit conditions to operate said trip member, and means comprising a plurality of members disposed for movement in opposite directions and each being operable in response to jarring forces to apply a force to the trip member opposing operation of said trip member.

10. A trip device for a circuit breaker comprising a trip member having a normal position and operable to a tripping position to trip the breaker, electro-responsive means operable in response to predetermined circuit conditions to operate said trip member, and a shock proof device comprising a plurality of pivotally mounted unbalanced masses, said unbalanced masses being disposed for movement in opposite directions and operable in response to sudden jarring forces to apply a force to the trip member opposing movement of said trip member to tripping position.

11. A trip device for a circuit breaker comprising a trip member movable from a normal position to a tripping position to trip the breaker, a plurality of means disposed for movement in opposite directions, said means normally permitting movement of the trip member to tripping position and each of said means being independently operable to prevent movement of said trip member in response to and only during the existence of sudden jarring forces.

JOHN W. MAY.