Dec. 2, 1941. L. PIERCE ET AL 2,265,004

CIRCUIT BREAKER

Filed Jan. 28, 1938 3 Sheets-Sheet 1

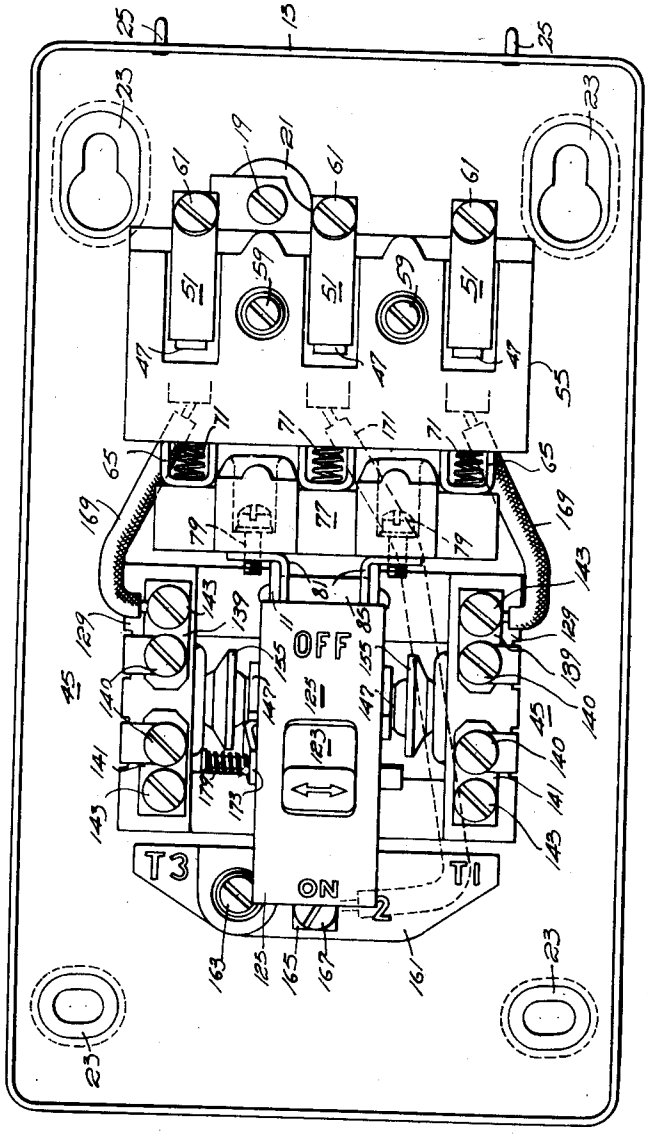


Fig. 1.

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Filed Jan. 28, 1938 3 Sheets-Sheet 2

Fig. 2.

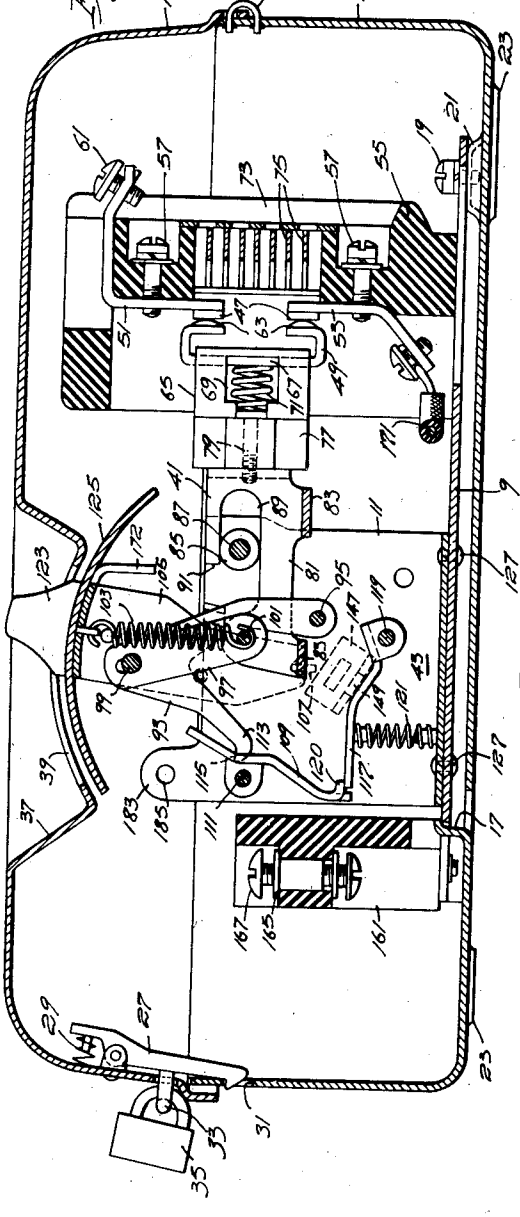
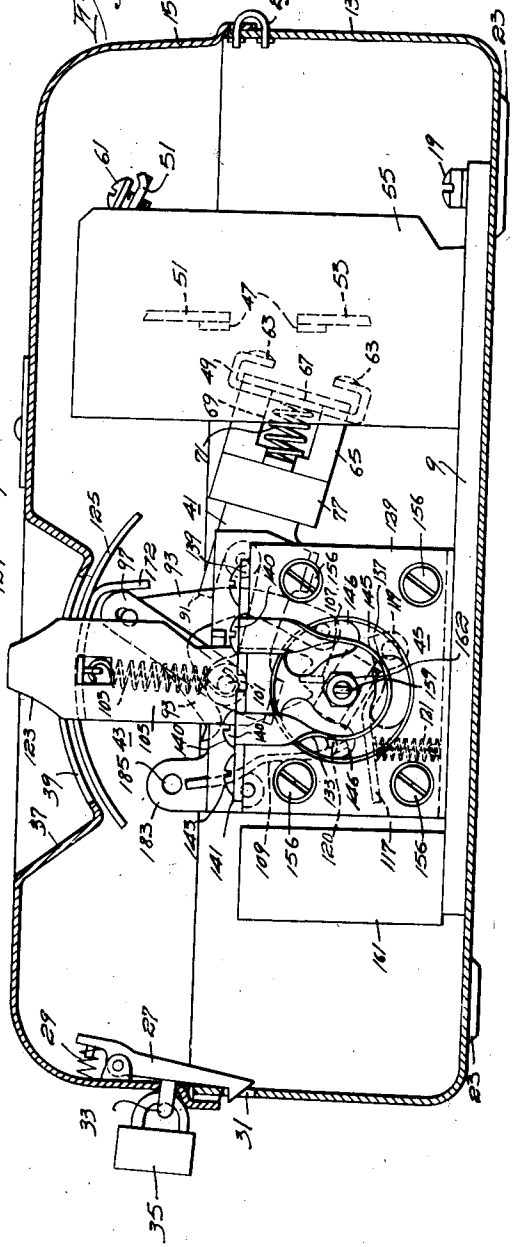


Fig. 3.



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CIRCUIT BREAKER

Filed Jan. 28, 1938 3 Sheets-Sheet 3

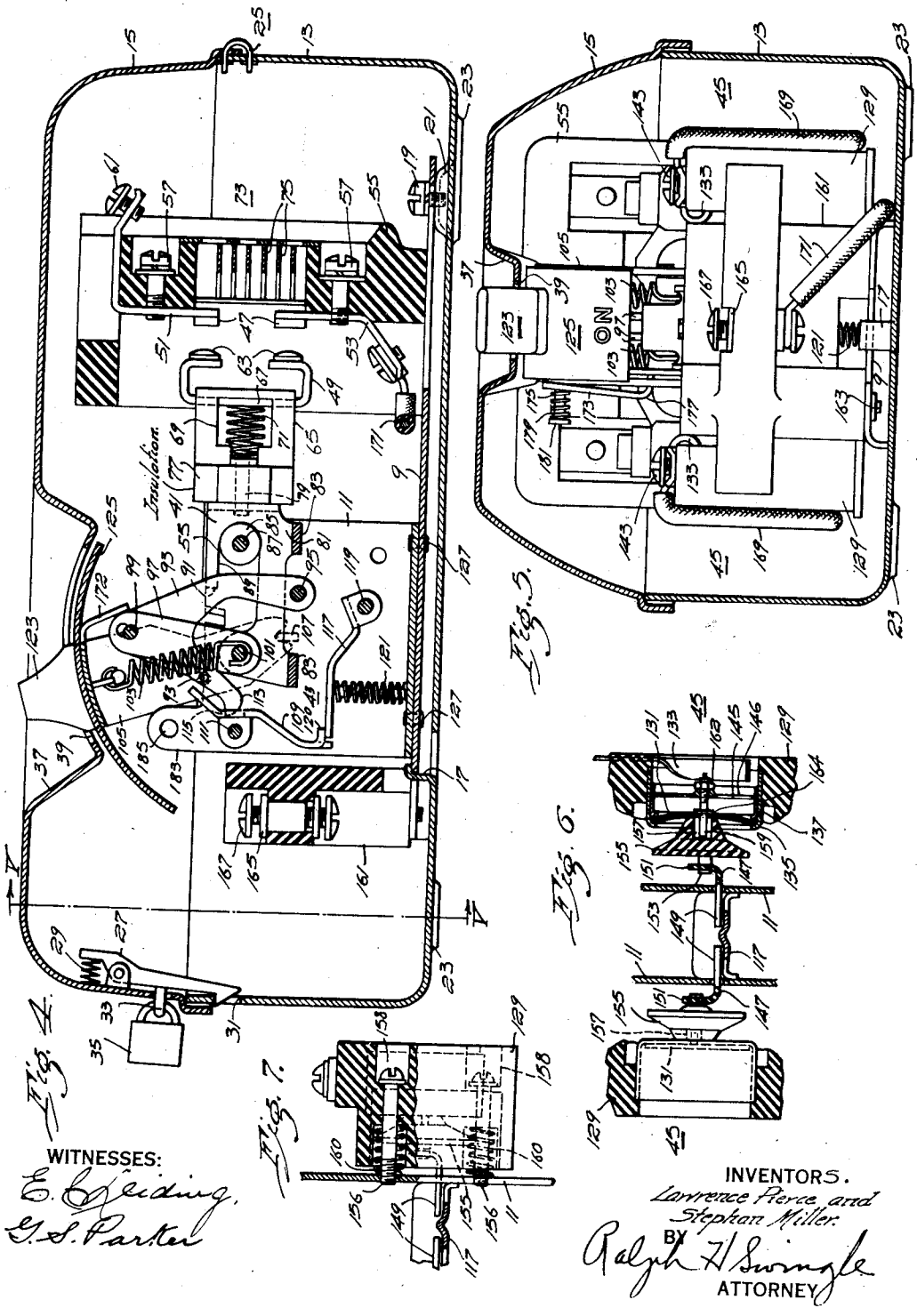


Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE

2,265,004

CIRCUIT BREAKER

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Application January 28, 1938, Serial No. 187,446

24 Claims. (Cl. 200—116)

The invention relates to circuit breakers in general and more particularly to circuit breakers for controlling and protecting lighting and motor circuits.

An object of the invention is the provision of a circuit breaker embodying an improved operating mechanism that is manually operable to effect movement of the switch member to open and to closed circuit position with a snap action, and automatically operable by current responsive release means in response to predetermined conditions to effect movement of the switch member to a tripped open circuit position with a snap action irrespective of the position of the manual operating member.

Another object of the invention is the provision of a circuit breaker embodying an improved operating mechanism and mounting means for the movable switch member whereby the switch member is moved in a substantially straight line path during normal switching operations and in a different path during a tripping operation.

Another object of the invention is the provision of a circuit breaker embodying an improved mounting means for the movable switch member whereby it is supported and guided for free rolling movement to its different actuated positions.

Another object of the invention is the provision of a circuit breaker in which the movable switch member and the current responsive release means are detachably mounted on the support for the operating mechanism to facilitate assembly and disassembly of the parts.

Another object of the invention is the provision of a circuit breaker in which the current responsive release device is adjustably mounted for movement relative to the breaker mechanism so that the trip element of the release device can be set in the proper position relative to the means which transmits its movement to the latch means of the breaker mechanism.

Another object of the invention is the provision of a circuit breaker in which the contact means, switch member, operating mechanism and the current responsive release means are mounted on a common support and arranged in a novel manner to reduce the space occupied by the breaker and provide a compact structure.

Another object of the invention is the provision of an enclosed circuit breaker or switch mounted in a casing having a removable cover which can be locked in closed position, with a normally inoperative safety locking means disposed within the casing which is manually settable to lock the operating member in one of its operating positions.

Another object of the invention is the provision of an improved circuit breaker as described above that is simple, safe and reliable in operation, and inexpensive to manufacture and service.

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 best be understood from the following detailed description thereof when read in connection with the accompanying drawings, in which:

Figure 1 is a plan view of a circuit breaker constructed in accordance with the invention, the cover for the casing having been removed to show the arrangement of the various parts.

Fig. 2 is a vertical sectional view of the breaker illustrating the mechanism and contact means in closed circuit position.

Fig. 3 is a vertical sectional view of the breaker, the mechanism and contact means being shown in elevation and in the tripped open position following a tripping operation.

Fig. 4 is a vertical sectional view similar to Fig. 2 illustrating the mechanism and contact means in the manually opened position.

Fig. 5 is a vertical sectional view of the circuit breaker taken substantially on the line V—V of Fig. 4 and looking in the direction of the arrows.

Fig. 6 is a fragmentary view, partly in section, illustrating the current responsive release devices and a portion of the latching means of the breaker, and

Fig. 7 is a fragmentary view, partly in section, illustrating the mounting arrangement of the current responsive release devices.

Referring to the drawings, the circuit breaker comprises a channel shaped base 9 of sheet metal construction provided with a frame 11 for supporting the circuit breaker unit. The base 9 and circuit breaker unit are removably mounted in the sheet metal enclosure formed by a generally rectangular casing 13 and a cooperating removable cover 15.

The base 9 is removably mounted on the bottom wall of the casing 13 by means of a hook-shaped lug 17 struck up from the bottom of the casing which hooks over the end edge of a notch formed in one end of the base 9, as shown in Figs. 2 and 4, and by a fastening screw 19 which fastens the opposite end of the base 9 to a raised boss 21 formed integral with the bottom wall of the casing 13.

The casing 13 is provided with integrally formed perforated bosses 23 adjacent the corners for mounting the breaker on a panel or other form of support. Suitable knockouts may be provided in the walls of the casing for accommodating lead-in conductors for connecting the breaker in an external circuit.

The cover 15 is pivotally mounted on the casing 13 by hinges 25 and is adapted to be latched in closed position covering the casing by means

of a latch member 27 which is pivotally mounted inside the cover 15 and biased by a spring 29 to latching position in which its hooked end engages the edge of an opening 31 formed in the end wall of the casing 13. The latch 27 is provided with a U-shaped bail 33 which projects through an opening in the end wall of the cover 15 and serves as an operating member for the latch which may be pushed in to release the latch to permit opening of the cover 15. A padlock or other form of locking means 35 may be provided for engaging the bail 33 of the latch member 27 to lock the cover in closed position. The cover 15 is provided with a well 37 having an elongated opening 39 through which projects the operating handle of the circuit breaker.

The circuit breaker unit comprises, in general, a movable switch member indicated generally at 41 for controlling the contact means of the breaker, an operating mechanism indicated generally at 43 for operating the switch member to open and to closed circuit position, and a pair of current responsive release devices indicated generally at 45 (Fig. 1), each of which is operable in response to predetermined overload conditions to cause the operating mechanism to move the switch member to a tripped-open circuit position.

The contact means of the breaker comprises a plurality of sets of spaced stationary contacts 47 and a plurality of cooperating movable bridging contact members 49, which serve to bridge the stationary contacts 47 and close the circuit in the closed position of the breaker.

The stationary contacts 47 of each set are secured in spaced relation on the opposed ends of a pair of conducting strips 51 and 53 which are mounted in vertical alignment and in spaced transverse relation on a transversely disposed insulating block 55, the strips being secured to the block by means of the fastening bolts 57. The insulating block 55 is removably mounted on the base 9 adjacent the upper end thereof by means of a pair of bolts 59 (Fig. 1) which pass through the block 55 and engage in threaded openings provided in the base 9. The upper or outer conducting strips 51 are bent at right angles to project beyond the block 55 and are provided with terminal screws 61 for connecting the contacts of the breaker to external electrical circuits.

The movable bridging contact members 49 are identical in construction and each consists of a loop-shaped strip of conducting material, the inturned ends of which carry a pair of movable contacts 63 for engaging a corresponding pair of the stationary contacts 47. Each movable contact member 49 is mounted on a U-shaped contact carrying frame 65 and is guided for movement along its frame by a pair of laterally projecting ears 67 (Fig. 2) formed integral with the contact member 49, which engage in guide slots 69 provided therefor in the side walls of the contact carrying frame 65. Each contact member 49 is biased toward its corresponding pair of stationary contacts 47 by means of a coil compression spring 71 interposed between the back of the contact member 49 and the contact carrying frame 65.

The particular mounting of the stationary contacts 47 cooperates with the loop-shaped construction of the movable bridging contact member 49 to provide sharp bends in the path of the current flowing through the stationary contacts and the movable bridging contact member so that when the movable bridging contact member separates from the stationary contacts 47, the magnetic reaction produced by the sharp bends in the current path causes the two arcs drawn between the stationary contacts 47 and the movable contacts 63 to be moved toward one another and merge to form a single arc which plays between the opposed ends of the conducting strips 51 and 53. An arc extinguishing means, indicated generally at 73, is provided for each set of stationary contacts 47. Briefly, each arc extinguishing means 73 consists of a plurality of spaced and notched plates 75 of magnetic material carried in an opening provided therefor in the insulating block 55 adjacent the spaced stationary contacts 47. The resulting single arc described above which plays between the opposed ends of the conducting strips 51 and 53 sets up a magnetic flux in the plates 75 which quickly draws the arc into the plates where it is immediately cooled and extinguished in a well known manner.

The contact carrying frames 65 and the movable bridging contact members 49 carried thereby are mounted in spaced transverse relation on a cross bar 77 of insulating material which is secured intermediate its ends to the outer end of the movable switch member 41 by a pair of screws 79 (Fig. 1).

The movable switch member 41 is constructed of sheet metal and formed to provide a pair of spaced parallel legs 81 which are connected at their lower edges by a pair of integral cross braces 83. The outer ends of the legs 81 of the switch member 41 are bent at right angles and provided with threaded openings for receiving the fastening screws 79 which serve to secure the cross bar 77 to the switch member 41. The legs 81 of the switch member 41 extend into the space between the side walls of the main frame 11 and the switch member is detachably mounted for movement on the frame 11 by means of a roller 85 which is carried by a fixed shaft 87 extending transversely between the side walls of the frame 11, the legs 81 of the switch member 41 being provided with elongated parallel guide slots 89 for engaging the roller 85. The slots 89 at their inner ends each open to the upper edge of the legs 81, as indicated at 91 (Figs. 2 and 4), so that the switch member 41 is removably mounted on the roller 85.

The operating mechanism 43 is supported on the U-shaped main frame 11 and comprises, in general, a releasable carrier 93 which is pivotally mounted between the side walls of the main frame by means of a pivot pin 95, a pair of actuating links 97 pivotally connected at their upper ends by a pivot pin 99 to the carrier 93 and pivotally connected at their lower ends by means of a removable pivot pin 101 to the inner end of the movable switch member 41, and a pair of overcenter springs 103 which are disposed on opposite sides of the carrier 93 and the links 97. The lower ends of the overcenter springs 103 are connected to the removable pivot pin 101 which detachably connects the lower ends of the links 97 to the switch member 41, and the upper ends of the springs are connected to the bight portion of a U-shaped operating member 105 which is pivotally mounted on a pair of lugs 107 struck out from the side walls of the frame 11. The operating member 105 is retained in pivotally mounted position on the frame 11 by means of the tension of the overcenter springs 103.

The carrier 93 is releasably held in a normal latched position, as shown in Fig. 2, by means of a latch 109 which is pivotally mounted on a pivot pin 111 which extends transversely between the

side walls of the frame 11, the free end of the carrier 93 being provided with a latch nose 113 which is normally engaged under the edge of an opening 115 provided in the latch member 109. The latch member 109 is releasably retained in latching position as shown in Fig. 2 by a second latch member 117 which is pivotally mounted on a pivot pin 119 extending between the side walls of the main frame 11. The latch member 117 is biased in a clockwise direction about the pivot pin 119 by means of a coil compression spring 121. The lower end of the latch member 109 normally abuts the free end of the second latch member 117 so that the latch member 117 normally prevents counter-clockwise or releasing movement of the main latch 109. A lug 120 is struck inwardly from the lower end of the latch 109, which engages the upper side of the second latch 117 to prevent clockwise movement of the second latch 117 when the latches are engaged, as shown in Fig. 2.

The upper end of the operating member 105 is provided with an operating handle 123 which extends through the opening 39 in the cover 15, and an arcuate shield 125 which serves to close the opening 39 in all positions of the operating member.

The U-shaped main frame 11 is mounted centrally on the base member 9 adjacent one end thereof by means of a pair of rivets 127 so that the frame 11 and mechanism carried thereby are disposed substantially in alignment with the contacts which form the center pole of the circuit breaker unit, as best shown in Fig. 1, and the entire operating mechanism, with the exception of the manual operating member 105 and its handle 123 and shield 125, is disposed between the side walls of the frame 11. If desired, the frame 11 may be formed integral with base 9 instead of as a separate member secured to the base.

The pair of current responsive release devices 45 are mounted on opposite sides of the U-shaped main frame 11 and each comprises, in general, an insulating block 129 having a recess in which is mounted a bimetallic thermal disk 131 and a heating coil 133 (Fig. 6). The bimetal disk 131 is of the type which has a preformed deformation that moves from an original position to an inverted position, with a snap action, when heated a predetermined amount and which returns to its original position with a snap action when cooled below a predetermined temperature. The edges of the disk 131 are clamped in a fixed position between the in-turned flanges of a pair of interfitting cylinders 135 and 137 which are mounted within the recess in the insulating block 129. The heater coil 133 is disposed within the cylinder 135 in spaced relation to the bimetallic disk 131 and is removably electrically connected by screws 140 to a pair of terminal strips 139 and 141 (Fig. 1) secured to the upper edge of the insulating block 129. The terminal strips 139 and 141 are provided with terminal screws 143 for connecting the heater coil 133 in circuit with one of the pairs of stationary contacts and one of the terminals of the breaker. A diaphragm 145 is interposed between the heater coil 133 and the bimetal disk 131 and the diaphragm has a plurality of elongated openings 146 (Fig. 3) for permitting the radiated heat of the heater coil to pass directly to the surface of the disk. The diaphragm 145 is rigidly secured in any suitable manner as by brazing or welding to the cylinder 137, which is in turn rigidly secured within the cylinder 135 in any suitable manner.

The bimetallic disks 131 of the current responsive release devices 45 are adapted when heated a predetermined amount to actuate the latch member 117 to its released position to effect a tripping operation of the circuit breaker. A pair of angle-shaped tripping members 147 (Fig. 6) are loosely mounted for rocking movement or partial rotation in openings provided therefor in the opposite side walls of the main frame 11. Each of the tripping members 147 has the reduced leg 149 which passes through the opening for engaging the upper surface of the latch member 117, as best shown in Figs. 2 and 6. The angular portion 151 of each trip member 147 which is disposed outside of the frame 11 is provided with a rectangular opening for loosely engaging a smaller rectangular projection 153 of an insulating button 155 which serves to operatively connect the trip member 147 to its corresponding bimetal disk 131. The trip member 147 is adapted to be partially rotated or rocked inwardly about the lower edge of the opening provided therefor in the frame 11 as a fulcrum when the bimetallic disk is snapped to its inverted position by an overload. The side of the button 155 opposite the trip member 147 is provided with a circular recess 157 for receiving the end of an adjusting screw 159 threaded through the center portion of the diaphragm 145. The adjusting screw 159 carries a collar 164 which engages the center portion of the disk 131, and a lock nut 162 for locking the screw in adjusted position. The screw 159 is turned to adjust the tripping point of the disk 131. The trip members 147 are removably inserted in the openings provided therefor in the side walls of the frame 11 and the insulating buttons 155 are floated between the trip members 147 and the current responsive bimetallic disks 131, thus facilitating assembly and disassembly of these parts as well as the current responsive release devices 45.

Each current responsive release unit 45 is detachably mounted on the frame 11 by means of a plurality of screws 156 which pass through countersunk openings 158 (Fig. 7) in the block 129 and engage threaded openings provided in a side wall of the frame 11. Each screw 156 is encircled by a coil spring 160 which is interposed between a shoulder formed in the screw opening 158 of the block 129, and the side wall of the frame 11, so that the springs 160 bias the block 129 away from the side wall of the frame against the heads of the screws 156. The screws 156 are adjusted during the assembly of the breaker to properly position the bimetal disk 131 carried by the block 129, so that when the disk 131 snaps from its original position to its inverted position, it effects release of the latches 117 and 109. This particular mounting arrangement of the current responsive release devices 45 in addition to detachably mounting the devices, provides a means for properly positioning the bimetal disks 131 relative to buttons 155 and trip levers 147, so as to compensate for any slight manufacturing inaccuracies of the various parts. By reason of the novel mounting arrangement of the current responsive release units 45, greater tolerances are permitted in the manufacture of the various parts so that the production cost is materially reduced. After the current responsive release units have been ad-

justed to their proper positions relative to the frame 11 by means of the screws 156, the enlarged openings in the blocks for accommodating the heads of the screws may be filled with a suitable sealing wax.

It will be noted that the current responsive release devices 45, together with the tripping members 147 and the insulating buttons 155, are mounted within the width required for the contact means of the outer poles of the circuit breaker, thus providing a very compact circuit breaker structure which occupies a minimum amount of space.

An insulating block 161 is mounted by means of a screw 163 (Fig. 1) on the end of the base opposite the end which supports the stationary contact means, and this block serves to support the center pole end terminal member 165 and its terminal screw 167.

The electrical circuit through the two outer poles of the circuit breaker are identical and each extends from the upper end terminal strip 51 through the upper stationary contact 47, bridging contact member 49, lower stationary contact 47, conducting strip 53 through a flexible insulated conductor 169, to the terminal strip 139 of the current-responsive release device 45, through the heater coil 133 of the release device to the opposite terminal member 141. The circuit for the center pole of the breaker extends from the upper terminal strip 51 through the upper stationary contact 47 carried thereby, the movable bridging contact member 49 and lower stationary contact 47 for the center pole through the conducting strip 53 and a flexible insulated conductor 171 directly to the center pole end terminal member 165.

The operation of the circuit breaker is briefly as follows: With the parts in the position shown in Fig. 2, let it be assumed that it is desired to manually open the circuit. The operating member 105 is moved in a counter-clockwise direction by the handle 123 from the position shown in Fig. 2 to the position shown in Fig. 4. During this movement of the operating member, the line of action of the overcenter springs 103 is shifted to the left of the pivot pin 99 to effect movement of the actuating links 97 and the switch member 41 with the movable bridging contact members 49 carried thereby to open circuit position with a snap action. The manually opened position of the breaker is illustrated in Fig. 4.

To close the circuit breaker, the operating member 105 is moved in a clockwise direction from the position shown in Fig. 4 to the position shown in Fig. 2. During the clockwise movement of the operating member 105, the line of action of the overcenter springs 103 is shifted to the right of the pivot pin 99 which carries the links 97 to effect movement of the actuating links 97, the switch member 41 and the movable bridging contact members 49 carried thereby to closed circuit position with a snap action. The roller 85 permits the switch member 41 to be rolled freely to open and to closed position, and also serves to guide the switch member so that it is moved in a substantially straight line path during normal switching operations.

When an overload of predetermined magnitude and duration occurs in the circuits of either of the two outer poles of the circuit breaker, the corresponding bimetallic disk 131 of the current responsive release device 45 for the particular pole affected is heated by the current a sufficient amount to cause it to move from its original position to its inverted position with a snap action. The movement of the bimetallic disk 131 to its inverted position moves the insulating button 155 inwardly to effect inward rocking or inwardly directed partial rotation of the corresponding trip member 147 on the edges of the opening provided therefor in the side walls of the frame 11, to a tripping position. When the tripping member 147 is thus rocked to its tripping position, the leg 149 thereof is moved downwardly to effect counter-clockwise rotation of the latch member 117 about its pivot axis 119. The downward movement of the latch member 117 effects release of the main latch member 109 and the latch member 109 is moved to its releasing position under the influence of the overcenter springs 103 to effect release of the carrier 93. When the carrier 93 is released, it is moved in a clockwise direction by the force exerted by the overcenter springs 103. This clockwise movement of the pivoted carrier 93 carries the pivot pin 99 to the right, as viewed in Fig. 2, across the line of action of the overcenter springs 103. As soon as the pivot pin 99 crosses the line of action of the overcenter springs, these springs act to move the switch member 41 to a tripped open circuit position, and the operating member 105 to an intermediate trip indicating position as shown in Fig. 3. The switch member 41 in moving to its tripped open position pivots in a clockwise direction about the roller 85 and is then rolled by the force exerted by the springs 103 to open circuit position, as shown in Fig. 3.

Before the circuit breaker can be reclosed, it is necessary to reset the carrier 93 and the latches 109 and 117 to their latching positions. In order to reset the mechanism, the operating member 105 is rotated in a counter-clockwise direction. During the resetting movement of the operating member 105, a projection 172 carried by the operating member engages and moves the carrier 93 in a counterclockwise direction. The counterclockwise movement of the carrier 93 causes the latch nose 113 of the carrier 93 to engage the lower edge of the opening 115 of the latch member 109 and move that member to its latching position. When the latch member 109 has thus been returned to its latching position, the second latch member 117 is moved by the biasing spring 121 so that its end reengages the end of the latch member 109. When the operating member 105 is released following this resetting movement, the latch nose 113 is returned to its latching position in which it is engaged by the upper edge of the opening 115 of the latch member 109. The mechanism is now completely reset and the circuit breaker can be reclosed by moving the operating member 105 in a clockwise direction to closed circuit position to close the circuit breaker in the manner previously described.

A safety locking means is provided for locking the operating member 105 in open circuit position whenever it is desired to prevent unauthorized closing of the circuit breaker. The locking means comprises a lever 173 (Figs. 1 and 5) which is pivotally mounted on a stud 175 carried by one of the legs of the operating member 105 within the casing. The lower end of the lever 173 is provided with an inwardly bent projection 177 which normally engages an opening provided therefor in the leg of the operating member 105. A coil spring 179 is mounted on the stud 175 between the enlarged end 181 thereof and the lever 173. The spring 179 serves to maintain the lock-

ing lever 173 in either its inoperative or operative position, depending upon the setting thereof. One of the side walls of the main frame 11 is provided with an extension 183 (Fig. 2) having an opening 185 formed therein for receiving the inwardly projecting end of the locking lever 173 when that lever is set in locking position.

To lock the circuit breaker in open circuit position, the cover 15 is opened and the lever 173 is manually set with its inwardly projecting end 177 engaged in the opening 185 provided in the frame 11. The cover 15 is then returned to closed position and locked in closed position by the padlock or other locking means 35. Under these conditions, it is impossible for any unauthorized person to move the operating member 105 away from its open circuit position.

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

We claim as our invention:

1. In a circuit breaker, a frame member, a switch member movable to open and to close the circuit, a movable carrier for said switch member, means for releasably restraining said carrier in an operative position, operating means including an overcenter spring for moving said switch member to open and to closed circuit position and for biasing said carrier to a released position, one of said members being provided with a guide roller and the other of said members with a guide surface for engaging said roller to guide said switch member for rolling movement in a substantially straight line path during normal switching operations, said carrier when released causing said operating means to move said switch member to a tripped open circuit position.

2. In a circuit breaker, a frame member, a switch member movable to open and to close the circuit, a movable opening means for said switch member, means for releasably restraining said opening means in an operative position, operating means including an overcenter spring for moving said switch member to open and to closed circuit position and for biasing said opening means to a released position, one of said members being provided with a guide roller and the other of said members with a guide surface for engaging said roller to guide said switch member for rolling movement in a substantially straight line path during normal switching operations, said opening means when released causing said switch member to pivot on said roller and be rolled to a tripped open circuit position.

3. In a circuit breaker, a frame member, a switch member movable to open and to close the circuit, a movable opening means for said switch member, means for releasably restraining said opening means in an operative position, operating means including an overcenter spring for moving said switch member to open and to closed circuit position and for biasing said opening means to a released position, one of said members being provided with a guide roller and the other of said members with a guide surface for engaging said roller to guide said switch member for rolling movement in a substantially straight line path during normal switching operations, said opening means when released causing said switch member to pivot on said roller and be rolled to a tripped open circuit position by said operating means, and electro-responsive means operable in response to predetermined conditions to effect release of said opening means.

4. In a circuit breaker, a frame, a switch member movable to open and to close the circuit, a carrier pivoted on said frame, means for releasably restraining said carrier in an operative position, an actuating element mounted for movement on said carrier and connected to one end of said switch member, operating means including an overcenter spring connected to said actuating element for moving said switch member to open and to closed circuit position and for biasing said carrier to a released position, said frame and said switch member being provided one with a guide roller and the other with a guide surface for engaging said roller to guide said switch member for rolling movement in a substantially straight line during normal switching operations, said carrier when released causing said switch member to pivot on said roller and be rolled by said operating means to a tripped open circuit position.

5. In a circuit breaker, a frame, a switch member movable to open and to close the circuit, operating mechanism carried by said frame and detachably connected to one end of said switch member for moving said switch member to open and to closed circuit position, said frame and said switch member being provided one with a guide roller and the other with a cooperating elongated roller receiving slot for guiding said switch member for rolling movement on said frame in a substantially straight line during normal switching operations, said slot having an opening for removably mounting said switch member on said frame.

6. In a circuit breaker, a frame, a switch member movable to open and to close the circuit, operating mechanism carried by said frame and detachably connected to one end of said switch member for moving said switch member to open and to closed circuit position, said frame and said switch member being provided one with a guide roller and the other with a cooperating elongated roller receiving slot for guiding said switch member for rolling movement on said frame in a substantially straight line during normal switching operations, said slot having an opening for removably mounting said switch member on said frame, and electro-responsive trip means operable in response to predetermined conditions to cause said operating mechanism to move said switch member to a tripped open circuit position.

7. In a circuit breaker, a frame having side walls, a switch member carried by said frame movable to open and to close the circuit, operating mechanism carried by said frame between the side walls thereof operable to move said switch member to open and to closed position, said mechanism including means releasable to effect movement of said switch member to open position, a trip member extending through an opening in one of the side walls of said frame movable to a tripping position to effect release of said releasable means, and a trip element mounted outside said frame adjacent the side wall through which said trip member extends, operable in response to predetermined conditions to cause movement of said trip member to tripping position.

8. In a circuit breaker, a frame having side

walls, a switch member carried by said frame movable to open and to close the circuit, operating mechanism carried by said frame between the side walls thereof operable to move said switch member to open and to closed position, said mechanism including means releasable to effect movement of said switch member to open position, a trip member extending through an opening in one of the side walls of said frame movable to a tripping position to effect release of said releasable means, and a trip unit detachably mounted at the side of said frame adjacent the side wall through which said trip member extends, said unit including a resettable trip element operable in response to predetermined conditions in the circuit to cause movement of said trip member to tripping position.

9. In a circuit breaker, a frame having side walls, a switch member carried by said frame and movable to open and to close the circuit, operating mechanism carried by said frame between the side walls thereof operable to normally move said switch member to open and to closed position, said mechanism including means releasable to effect movement of said switch member to open position, a trip member removably mounted in an opening provided in one of the side walls of said frame and having a portion extending into the space between the side walls for engaging said releasable means, said trip member being movable to a tripping position to effect release of said releasable means, and a trip unit removably mounted outside said frame adjacent said side wall including an electro-responsive trip element operable in response to predetermined conditions to cause movement of said trip member to tripping position.

10. In a circuit breaker, a frame having side walls, a switch member carried by said frame and movable to open and to close the circuit, operating mechanism carried by said frame between the side walls thereof operable to normally move said switch member to open and to closed position, said mechanism including means releasable to effect movement of said switch member to open position, an angle shaped trip lever removably and pivotally mounted on a side wall of said frame having a reduced arm extending through an opening provided therefor in said side wall for engaging said releasable means, said lever being pivotally movable on an edge of said opening to a tripping position to effect release of said releasable means, and a trip unit removably mounted outside said frame adjacent said side wall including an electro-responsive trip element operable in response to predetermined conditions to cause rotation of said trip lever to its tripping position, said trip unit when in mounted position serving to retain said trip lever in its mounted position on said side wall.

11. In a circuit breaker, a frame having side walls, a switch member carried by said frame and movable to open and to close the circuit, operating mechanism carried by said frame between the side walls thereof operable to normally move said switch member to open and to closed position, said mechanism including means releasable to effect movement of said switch member to open position, a trip member removably mounted in an opening provided therefor in one of the side walls of the frame and having a portion extending into the space between the side walls for engaging said releasable means, said trip member being movable to a tripping position to effect release of said releasable means, a trip unit removably mounted at the outer side of said side wall including a thermally responsive trip element heated in response to the current flowing in the circuit and operable in response to predetermined overload conditions to cause movement of said trip member to tripping position and an insulating button loosely interposed between and connecting said trip member and trip element.

12. In a multipole circuit breaker, a base, a frame mounted on said base, a movable switch member carried by said frame, a transversely extending cross bar carried by said switch member, a plurality of contact members mounted in spaced relation on said cross bar, operating mechanism carried by said frame normally operable to move said switch member to open and to closed position, said mechanism including means releasable to effect movement of said switch member to a tripped open position, the width of said mechanism being less than the length of said transverse cross bar, and a current responsive release device comprising a bimetal trip element mounted at the side of said frame operable in response to predetermined conditions to effect release of said releasable means.

13. In a multipole circuit breaker, a base, a frame mounted on said base, a movable switch member carried by said frame, a transversely extending cross bar carried by said switch member, a plurality of contact members mounted in spaced relation on said bar, operating mechanism carried by said frame normally operable to move said switch member to open and to closed circuit position, said mechanism including means releasable to effect movement of said switch member and contact members to a tripped open circuit position, the width of said mechanism and frame being less than the length of said transverse cross bar, and a pair of current responsive release devices mounted on opposite sides of said frame and mechanism, each including a bimetal trip element operable in response to predetermined conditions to effect release of said releasable means.

14. In a multipole circuit breaker, a base, a frame having side walls mounted on said base, a switch member detachably mounted on said frame for movement thereon, a transversely extending cross bar carried by said switch member outside said frame, a plurality of contact members mounted in spaced relation on said bar, operating mechanism carried by said frame between the side walls thereof normally operable to move said switch member and contact members to open and to closed circuit position, said mechanism including means releasable to effect movement of said switch member and contact members to a tripped open circuit position, the width of said frame and mechanism being less than the length of said transverse cross bar, and a pair of current responsive release devices movably mounted on opposite sides of said frame each including a snap-acting bimetal trip element operable in response to predetermined conditions to effect release of said releasable means.

15. In a circuit breaker having an operating mechanism including a member releasable to effect opening of the circuit, and a latch means for releasably restraining said member, a trip unit carrying a snap-acting bimetal element which is operable in response to predetermined conditions to effect release of said latch means, and means movable to cause movement of said

trip unit which carries said element relative to said mechanism.

16. In a circuit breaker having an operating mechanism including a member releasable to effect opening of the circuit and latch means for releasably restraining said member, in combination, a current responsive release unit carrying a snap-acting bimetal element which is operable in response to predetermined conditions to effect release of said latch means, means interposed between said bimetal element and said latch means for transmitting the movement of said bimetal element to said latch means, and means movable to cause movement of said trip unit which carries said element relative to said operating mechanism.

17. In a circuit breaker having an operating mechanism including means releasable to effect opening of the circuit, a trip device including a trip element that is movable in response to predetermined conditions to effect release of said releasable means, said trip device being mounted for movement relative to the operating mechanism to permit accurate positioning thereof relative to the mechanism, and means for adjusting the trip characteristic of the trip element.

18. In an enclosed circuit breaker, an enclosure having an openable cover, means for locking said cover in closed position, a circuit breaker mounted within said enclosure having an operating mechanism including a movable operating member that is operable from outside said enclosure to open and to closed position to effect opening and closing of the breaker, a safety locking means comprising a normally inoperative locking lever carried by said operating member within said enclosure, said lever being manually settable to a locking position in which it locks said operating member in open position.

19. In a multipole circuit breaker having a plurality of pairs of relatively movable contacts forming a plurality of poles, a common operating mechanism for said contacts including a member releasable to cause opening of all of said pairs of contacts, latch means for releasably restraining said member, an individual trip device for each of at least two of the poles of the breaker, each trip device carrying a snap-acting bimetal element that is operable in response to predetermined conditions to effect release of said latch means and opening of the breaker, and movable means for each trip device for causing movement thereof relative to said mechanism.

20. A circuit interrupter comprising a switch member movable to open and to close the circuit, operating mechanism normally operable to move said switch member in a straight line path to open or to close the circuit, said mechanism including a member releasable to cause movement of said switch member to an open circuit position, trip means comprising a snap-acting bimetal element heated in response to the current in said circuit and operable in response to predetermined current conditions to effect release of said releasable member, said bimetal trip element being mounted at the side of said operating mechanism.

21. In a multipole circuit breaker, a base, a plurality of pairs of relatively movable contacts mounted in transverse spaced relation on said base adjacent one end thereof, a common operating mechanism mounted centrally on said base adjacent the other end thereof connected to said movable contacts, said mechanism being manually operable to open and to close all of said pairs of contacts and including means releasable to effect automatic opening of all of said pairs of contacts, the width of said mechanism being less than the width required for the mounting of said plurality of pairs of contacts; and a pair of current responsive release devices mounted on opposite sides of said mechanism substantially in transverse alignment with a portion thereof, each release device being operable in response to predetermined overload conditions to effect release of said releasable means.

22. In an enclosed electrical circuit breaker, a casing, an openable cover on said casing, means for locking said cover in closed position on said casing, a circuit breaker mounted in said casing having a movable operating means for opening and closing the breaker that is operable from outside said casing, and a locking means within said casing manually settable to lock said operating means in one of its operating positions.

23. In an enclosed electrical circuit breaker, a casing, an openable cover on said casing, means for locking said cover in closed position on said casing, a circuit breaker mounted in said casing having a movable operating means for opening and closing the breaker that is operable from outside said casing, and a locking means within said casing manually settable to lock said operating means in one of its operating positions, said last mentioned locking means being manually settable only when the cover of the casing is open.

24. A circuit breaker comprising a pair of spaced fixed contacts, a movable switch element, a cooperating movable bridging contact carried by said switch element, operating mechanism manually operable to cause movement of the switch element and the bridging contact carried thereby in a substantially straight line path to open and to closed position and operable in response to predetermined overload conditions to cause automatic opening of said contacts, said mechanism comprising an actuating lever connected directly to said switch element and movable to cause movement of the movable contact, an actuating spring connected to the actuating lever for moving said lever, an operating handle manually operable to cause said spring to operate the actuating lever, a pivoted releasable lever engaged by said actuating lever, said releasable lever being urged toward a released position by the force of the spring acting through said actuating lever when the contacts are closed, and being operable upon release to cause automatic opening of the movable contact irrespective of the position of said handle, and trip means normally preventing movement of the pivoted releasable lever to said released position, said trip means being operable in response to predetermined overload conditions to cause release of said pivoted releasable lever.

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