Nov. 8, 1955 T. G. BANK ET AL 2,723,326

MULTIPHASE TRIP INDICATOR MEANS WITH COMMON RESET

Filed Sept. 22, 1954 3 Sheets-Sheet 1

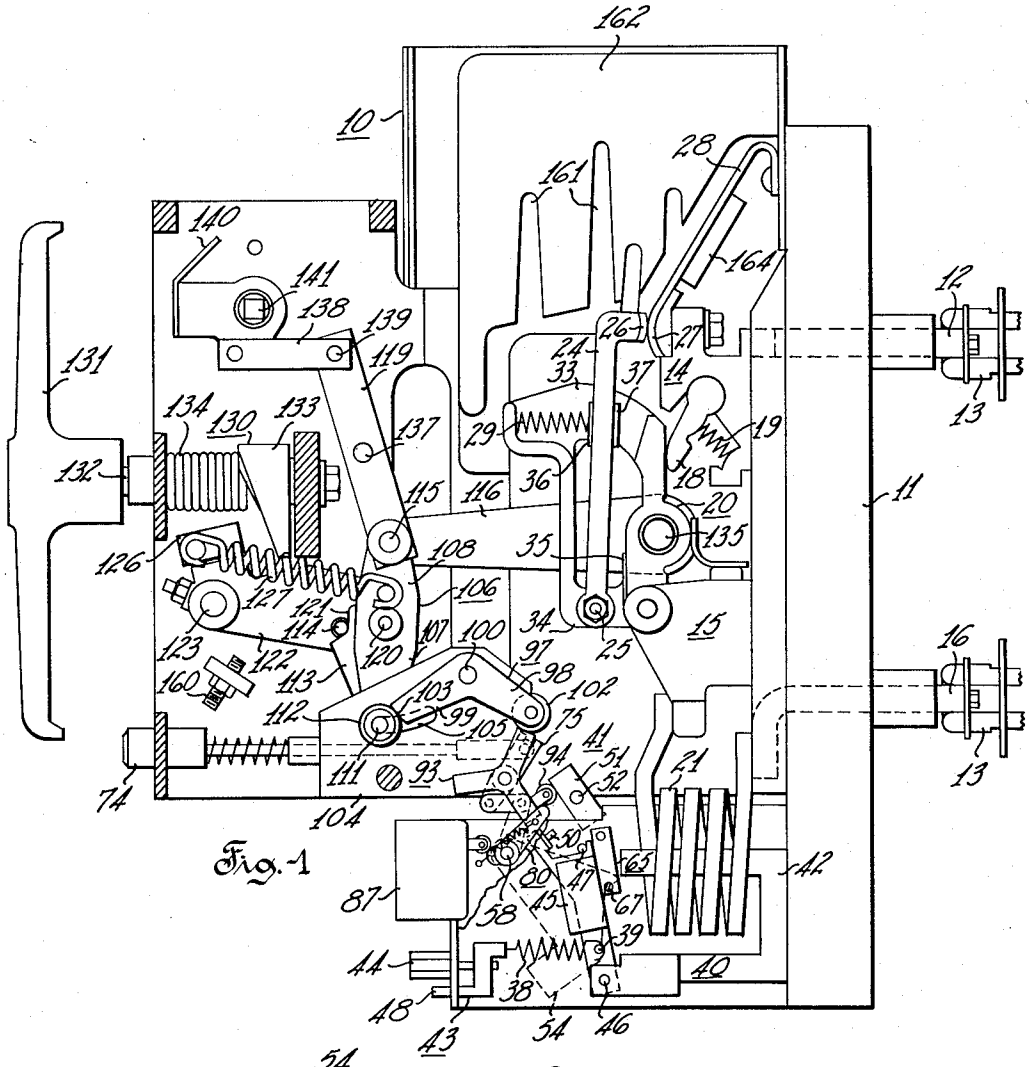


Fig. 1

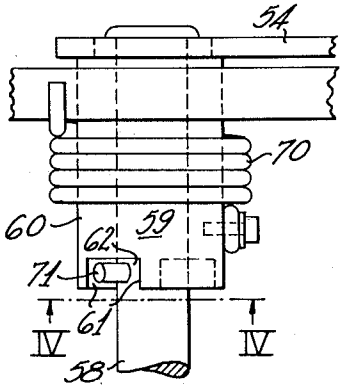


Fig. 3

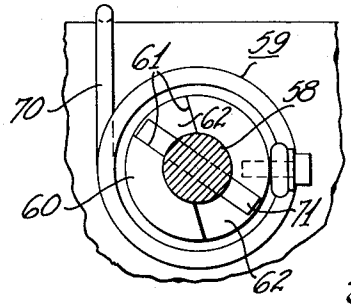


Fig. 4

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MULTIPHASE TRIP INDICATOR MEANS WITH COMMON RESET

Filed Sept. 22, 1954 3 Sheets-Sheet 2

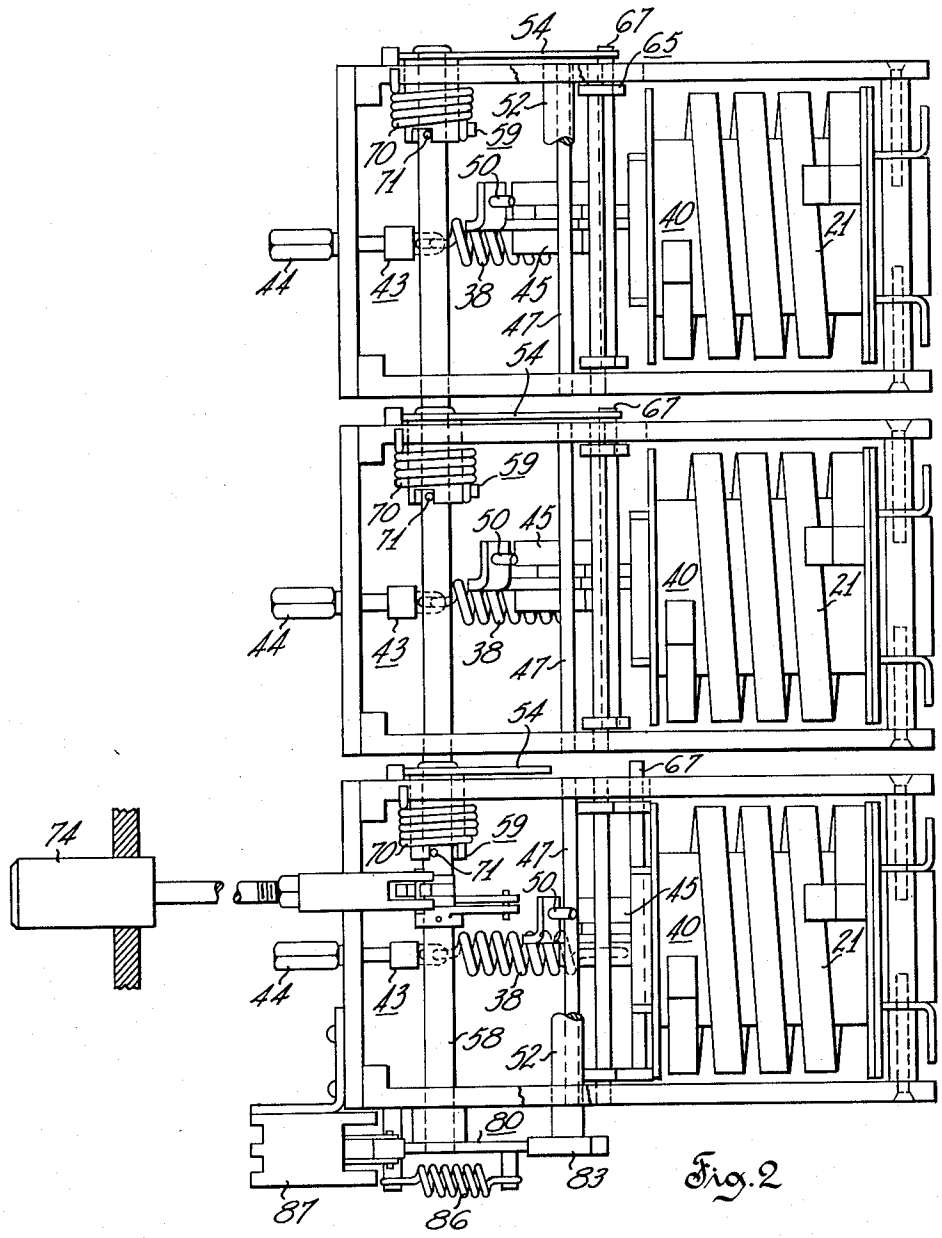


Fig. 2

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MULTIPHASE TRIP INDICATOR MEANS WITH COMMON RESET

Filed Sept. 22, 1954 3 Sheets-Sheet 3

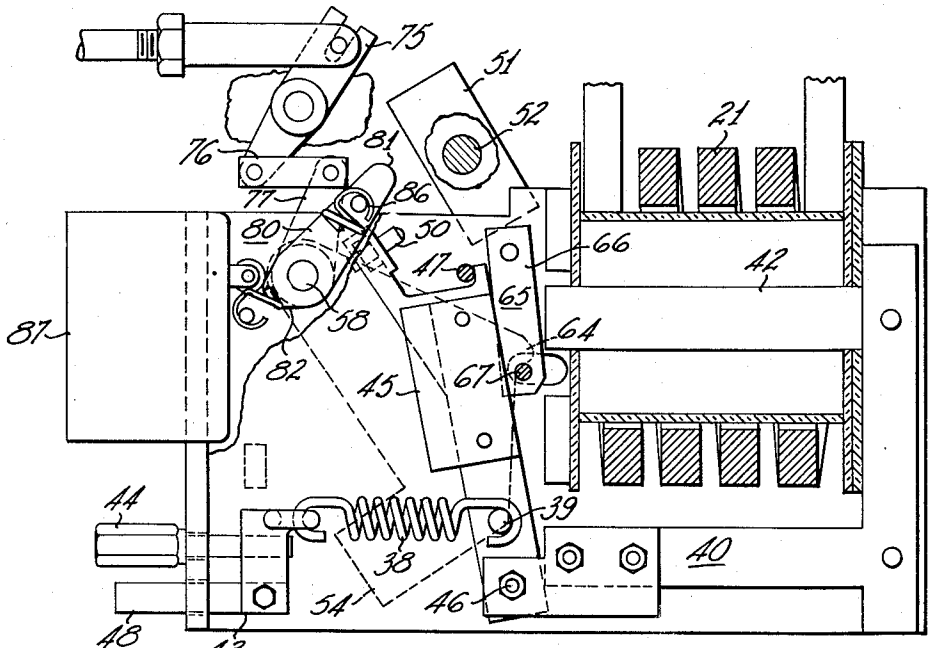


Fig. 5

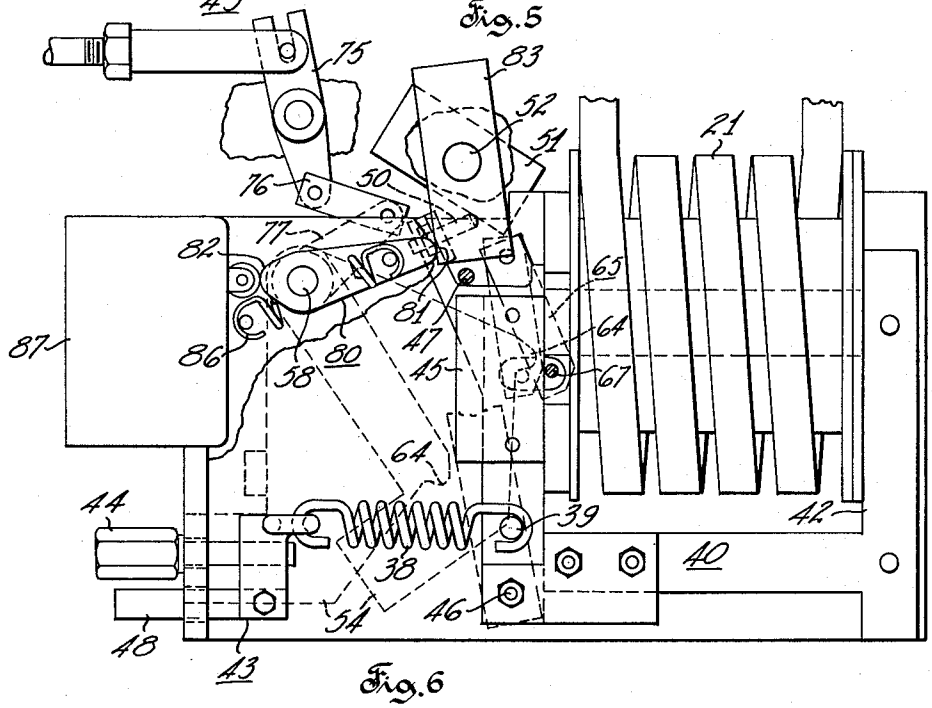


Fig. 6

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Patented Nov. 8, 1955

2,723,326

MULTIPHASE TRIP INDICATOR MEANS WITH COMMON RESET

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Application September 22, 1954, Serial No. 457,745

6 Claims. (Cl. 200—167)

This invention relates generally to a multiphase electrical installation, in which each phase is protected by a circuit breaker.

More particularly the invention is directed to a trip indicator means for identifying one or more phases of the multiphase installation, the indicator means being provided with a common reset for all phases.

The invention permits one or more phases to trip in response to electrical overload conditions and to be indicated without affecting the nontripped phases. A trip shaft, common to all of the phases in the multiphase installation, is provided. Each phase has an indicator means for visually identifying a trip and a nontrip phase. Each of the indicator means includes a collar which is journaled in alignment with collars of the other indicator means, in a common support. The collars all cooperate to journal a trip shaft in alignment and common to all of the phases. Each of the collars is provided with a recess at one end thereof and carries an indicator affixed to the collar for rotation therewith. The indicator is provided with a latched portion for cooperation with a latch. The latch cooperates with the latch portions to hold the indicator in a nontrip position. The latch is connected to means which are responsive to operation of the tripping mechanism of one of the breakers and disengages the latch from the latched portion to drop the indicator in response to the operation of these means.

A limit pin is mounted on the shaft and extends into the recess of each of the collars. The limit pin is mounted in the recess with a clearance for turning the shaft with lost motion in response to engagement of a wall of the recess with the pin. In addition, mounted on the collar is a torsion resilient means which maintains tension on the collar causing the latched portion of the indicator to be biased against the latch.

Means are also provided for rotating the shaft to reset any of the indicator means from a tripped to a nontripped position. This means includes a reset button with appropriate linkages which causes the shaft to be rotated in a direction opposed to that of tripping. The reset button also acts as a breaker tripped indicator by popping out when the breaker is tripped as a result of overload conditions in the protected installation.

An object of the present invention is to provide an improved multiphase trip indicator means in which the indicators operate independently of each other, to indicate the tripped and nontripped phases.

Another object of this invention is to provide a relatively simple and foolproof indicating means for visually identifying a tripped and a nontripped phase in a multiphase installation.

Another object of this invention is to provide indicator means which are readily adaptable to be combined with an alarm switch which is operated by action of the indicator means upon tripping of any of one or more of the phases of the multiphase installation.

Another object of this invention is to provide an indicating means in a multiphase installation which includes

a lockout device combined with the indicator means to lock the breaker trip shaft in a tripped position, to prevent personnel from accidently closing the circuit breaker until circuit faults have been eliminated.

Other objects and advantages than those set forth will be apparent from the following description when read in connection with the accompanying drawings, in which:

Fig. 1 is a side view in elevation of a circuit breaker employed in a phase of the multiphase protected installation embodying the invention, portions of the breaker are broken away to show greater details;

Fig. 2 is an enlarged fragmentary plan view showing the trip relays and portions of a three phase protected installation embodying the invention;

Fig. 3 is an enlarged fragmental view of the collar and trip shaft assembly;

Fig. 4 is a view taken along line IV—IV of Fig. 3;

Fig. 5 is an enlarged view in elevation of the tripping mechanism and the indicator means shown in a nontripped position; and

Fig. 6 is a view of the same structure shown in Fig. 5, however, shown in a tripped position.

Structure embodying the invention is shown in Figs. 1 through 6. The multiphase protected installation to which the invention relates is a three phase protected installation in which each individual phase employs a circuit breaker **10** such as shown in Fig. 1. Accordingly, the complete structure and operation of only one of the circuit breakers is shown and described, while the trip relay **40** of each circuit breaker of the three phase installation is shown in Fig. 2.

Referring more particularly to the drawing, Fig. 1 shows a circuit breaker **10** for protecting a circuit (not shown). Breaker **10** may be connected in series with the circuit and must therefore be made large enough to interrupt the maximum currents to be carried by such circuit. Circuit breaker **10** and its component parts are mounted on a back panel **11**.

Copper bar studs **12**, **16** are mounted in and project through the back panel and may be made of any known good conductive material but are preferably made of copper. Mounted on one extremity of bar studs **12**, **16** are primary fingers **13** which connect breaker **10** with the circuit. Upper and lower contact blocks **14**, **15** are of like construction, with the lower block **15** being mounted on back panel **11** in a position 180°, as viewed in Fig. 1 of the drawing, to the position of upper contact block **14**. The bar stud **12** is firmly affixed to upper contact block **14** by means known in the art which will produce a low resistance joint, preferably being brazed or bolted to block **14**. Bar stud **16** is affixed in like manner to a trip coil **21**.

A main finger **18** is fulcrumly carried by the contact block **14** to permit limited arcuate movement of main finger **18** relative to block **14**. A spring **19** is positioned intermediate main finger **18** and block **14** to produce a permanent closing bias for main finger **18**. A contact arm **20** is pivotally mounted on contact block **15** and mechanically and electrically engages main finger **18**. A trip coil **21** is connected to contact block **15** at one of the coil ends, and the other end thereof is connected to the bar stud **16**, which is connected with the primary fingers **13** mounted thereon, completing the series circuit through the breaker **10**.

This provides a current path designated as the primary current path which carries substantially full circuit current, which current is conducted through the breaker **10** from primary fingers **13** to bar stud **12** to contact block **15** and through the trip coil **21**, the bar stud **16** and the primary fingers **13**, thus completing the primary current path through the breaker **10**.

A secondary or arcing current path includes an arcing

contact arm 24 which is pivotally carried by and mounted on contact arm 20 at a pivot 25. Arcing contact arm 24 may be extruded from a good conducting material, such as copper. An arcing contact 26 is brazed to arcing contact arm 24. The arcing contact 26 being preferably made of silver tungsten alloy must be capable of withstanding high arcing temperatures and currents. A complementary arcing contact 27, which extends into an arc runner 28 is similar in material to arcing contact 26, and is affixed to and carried by contact block 14.

When breaker 10 is in a closed position (as shown in Fig. 1) arcing contact 26 of arcing contact arm 24 is biased by a spring 29 carried by contact arm 20, against arcing contact 27 carried by contact block 14. The contact arm 20 which is integral at its top part 33 is cut apart at its bottom part 34 forming two legs physically and electrically insulated from each other by insulating washer 35. The secondary or arcing current path receives its current from contact block 14 through arcing contacts 26, 27 flowing down arcing contact arm 24 through the pivot 25 and up the left hand leg of contact arm 20 from the lower part 34 to the upper part 33 thence down the right hand leg contact arm 20 to contact block 15, aiding the primary current. This secondary current path aids to hold arcing contact arm 24 and contact arm 20 in a closed position because of the electromagnetic force created by the loop type current path.

The spring 19 provided intermediate the main finger and the contact block biases main finger 18 against contact arm 20 when breaker 10 is closed. Another spring 29 exerts force on arcing contact arm 24 to bias arcing contacts 26, 27 in a closed position. An insulating disk 36 is provided intermediate spring 29 and arcing contact arm 24 to electrically insulate one from the other. Another such insulating disk 37 is provided on the arcing arm 24 opposing disk 36 to cushion and insulate the opening of contact arm 20.

The series trip coil 21 is shown as part of an overcurrent trip relay 40 which in turn is part of a breaker tripping mechanism 41 adapted to make and break main finger 18 and contact arm 20. Trip coil 21 is illustrated as series connected with the primary circuit but may be parallel connected with the circuit to provide potential responsiveness for breaker operation, as is well known in the art. Trip relay 40 has a magnetizable core 42 and trip coil 21 mounted thereon and magnetically coupled therewith. An armature 45, part of relay 40, is pivotally carried by core 42 at pivot 46 and is responsive to electrical changes in the circuit. The armature 45 is limited in movement to its open position by a stop pin 47 carried by breaker 10.

Armature 45 is biased by a spring 38 against pickup. One end of spring 38 engages a knob 39 on the armature 45 and the other end thereof is carried by a pickup adjusting structure 43. The pickup adjusting structure 43 is carired by breaker 10 and includes an adjusting member 44 to adjust the spring tension of spring 38 for increasing or decreasing the amount of flux in the relay 40 needed to pick up armature 45. Moving with and carried by adjusting member 44 is a visual indicator 48 which may be calibrated to indicate the pickup ratings of armature 45 or the amount of tension spring 38 is exerting on armature 45 against pickup.

Armature 45 has mounted thereon an adjusting screw tripping hammer 50 which initiates operation of tripping mechanism 41, the means acted upon by the armature for breaking the circuit. Tripping mechanism 41 includes a block 51 which is mounted on a breaker trip shaft 52 journaled in breaker 10. The block 51 is fixed to breaker trip shaft 52 causing it to rotate when the block 51 is rotated through contact with tripping hammer 50.

An indicator trip shaft 58 common to all of the phases is combined in the three phase protected installation with indicator means 59 for individual identification of tripped and nontripped phases. Each of the phases is provided with indicator means 59 which utilizes a portion of common indicator trip shaft 58 presented to that phase. Each indicator means 59 includes a collar 60 journaled in alignment with the collars of the other indicator means, which collars 60 may be journaled in a common support, such as the breaker 10. Collar 60 also cooperates with the collars of the other indicator means to journal indicator trip shaft 58.

Collar 60 presents walls 61 defining a recess 62 therebetween. Collar 60 further has rigidly attached thereto an indicator 54 for rotation therewith. Indicator 54 is provided with a latched portion 64 which, in a nontrip position, engages a latch 65 for holding latch portion 64 in the nontripped position. Latch 65 includes a phase indicator trip bar 66 mounted on breaker 10 and a phase indicator trip pin 67 mounted on phase indicator trip bar 66. Means responsive to operation of tripping mechanism 41 of one of the breakers is provided for disengaging latch 65 from latched portion 64 to drop indicator 54. These means are shown as relay 40 and its armature 45. As armature 45 closes, it engages phase indicator trip pin 67 thereby disengaging pin 67 from latch portion 64 and freeing the phase trip indicator 54. Phase trip indicator 54 rotates clockwise by its own weight and is aided in that rotation by torsional resilient means, shown as torsion spring 70. Fig. 5 of the drawings shows the nontripped relay 40, and Fig. 6, the tripped position thereof. Torsion spring 70 also maintains tension on collar 60 to bias the latched portion 64 of indicator 54 against latch 65.

A limit pin 71 is mounted on indicator trip shaft 58 adjacent collar 60, and extends into recess 62 of collar 60 with a clearance. Limit pin 71 cooperates with lost motion with walls 61 of recess 62 to turn or rotate the shaft 58. The lost motion with which limit pin 71 and walls 61 cooperate facilitate ease of alignment and adjustment of pin 71 with each recess 62. Collar 60 rotates upon release of phase trip indicator 54. Collar 60 rotates in response to the urging of walls 61 of recess 62 upon limit pin 71.

Means are provided for resetting indicator trip shaft 58 to thereby reset any of indicator means 59 from a tripped to a nontripped position. These means include a breaker tripped indicator reset button 74 (Figs. 1 and 2) mounted in breaker 10 for indicating the tripped breaker by popping out when overload conditions exist in the protected installation. Button 74 may be pushed in toward the breaker 10 for resetting indicating means 59 by rotation of indicator trip shaft 58. Manual pressure is applied to button 74 and is translated into rotary motion exerted on shaft 58 by links 75, 76 and 77.

Mounted on one end of indicator trip shaft 58 is a trip cam 80 which is affixed to indicator trip shaft 58 for rotation therewith. Trip cam 80 is provided with a first end 81 and a second cammed end 82. A lockout device or block 83 may be provided and mounted on the breaker trip shaft 52 and affixed thereto. On tripping of breaker 10 the first end 81 of trip cam 80 engages lockout block 83 and prevents accidental reclosing of the breaker without resetting the indicator trip shaft 58. A spring 86 is provided to effect positive lockout by exerting a positive torque to hold indicator trip shaft 58 and the associated trip cam 80 in a tripped position. Spring 86 also biases first end 81 of trip cam 80 against lockout block 83 preventing rotation of block 83 and further aids in the clockwise rotation of indicator 54 and locking cam 80 in a tripped position as a result of the toggle action of spring 86. Manual pressure applied to the reset button 74 is necessary to overcome the resilient force and restore spring 86 to a nontrip position.

Resetting indicator trip shaft 58 from a tripped to a nontripped position, causes first end 81 of trip cam 80 to disengage itself from lockout block 83. Lockout

block 83 is then free to be restored to its nontripped position.

The second cammed end 82 of trip cam 80 engages an electrical switch 87 which is carried by breaker 10 and mounted adjacent trip cam 80. This switch 87 is used to effect operation of desired audible, visual or the like devices to additionally effect indication of a tripped phase.

Tripping mechanism 41 further includes a Y-shaped star wheel 93 pivotally carried by breaker 10. A roller 94 is mounted on one of the legs of the star wheel 93 and is in engagement with block 51. A trip rocker 97, having a first and a second rocker arm 98, 99 is pivotally carried by breaker 10 at a pivot 100. Pivotally mounted on first rocker arm 98 is a roller 102 which engages one of the legs of the star wheel 93 in endwise engagement. The second rocker arm 99 has an outer surface 103 eccentrically ground with its geometric center within the rocker 97 but above its pivot 100. Therefore pressure exerted on the outer surface 103 of the second rocker arm 99 will produce a clockwise turning torque (as viewed in Fig. 1) on the rocker 97 about its pivot 100. A cam plate 104 having an arcuate inner cam opening 105 is mounted on breaker 10 and is adjacent rocker 97. An operating arm 106 having a first end 107 and a second end 108, has its first end 107 mounted adjacent cam plate 104. The first end 107 carries a pin 111 which projects through the cam plate 104 at the inner end of cam opening 105. The pin 111 has a roller 112 journaled thereon which roller 112 is free to rotate but is firmly held against axial movement by pin 111 and operating arm 106. The roller 112 abuts and engages the outer surface 103 of the second rocker arm 99. A trip latch 113 having a cam surface 121, is pivotally carried by the operating arm 106 at its pin 111. The second end 108 mounts a pivot element 115 for pivotally attaching an insulating arm 116 and a first indicator link 119.

Operating arm 106 has a changing pivot point which shifts from a center point 120 intermediate the ends 107, 108, when the contacts are opened, to a point coinciding with the pin 111 of the first end 107 when the contacts are reclosed. A trip pin 114 is mounted on a trip latch bar 122 and engages cam surface 121 of a trip latch 113. Trip latch bar 122 is pivotally mounted on a shaft 123. A cam rider 126 is carried by trip latch bar 122. A spring 127, biasing the trip latch bar 122 and its trip pin 114 against cam surface 121 of trip latch 113, is connected at one end thereof to breaker 10 and the other end thereof is connected to the operating arm 106 intermediate the center point 120 and the second end 108.

A manual reclosing mechanism 130 comprises a handle 131 mounted on a shaft 132 journaled in breaker 10. A reclosing cam 133 is affixed to shaft 132 and rotates therewith upon rotation of handle 131. Handle 131 is spring biased by a torsion spring 134 which returns the handle 131 to a normal reset position upon release. Cam rider 126 slidingly engages closing cam 133 when the breaker has tripped and the contacts are open. Reclosing is effected by rotating handle 131 whereupon the cam rider 126 follows closing cam 133 to reset the trip pin 114 against cam surface 121, thereby resetting trip latch bar 122.

Insulated arm 116, which is pivotally attached to the second end 108 of operating arm 106, is also pivotally attached at its opposite extremity to contact arm 20 at pivot 135. First indicator link 119 is pivoted at pivot 137 and has a second indicator link 138 pivotally attached at pivot 139. The second indicator link 138 is attached to an open-closed breaker indicator 140 pivotally mounted on pivot 141 carried by breaker 10.

The opening of breaker 10 (shown in Fig. 1 in a closed position) which operation is hereafter explained, occurs when overload currents cause the single phase circuit it is protecting, to be interrupted.

As a prolonged overload current or a short circuit condition is presented to breaker 10, trip coil 21 presents an increased magnetic flux to relay 40. This increased magnetic flux attracts armature 45 for pickup. However, armature 45 is restrained from pickup by spring 38. Therefore, when the overload current through trip coil 21 is great enough, armature 45 will overcome the tension of spring 38 and pick up.

As the armature 45 approaches closing, it engages the phase indicator trip pin 67 causing it to be dislodged from latch portion 64, thereby dropping phase trip indicator 54 into tripped indicating position. As phase trip indicator 54 drops, it rotates collar 60 clockwise by its own weight and the added torsional force of spring 70. Rotation of collar 60 causes walls 61 of recess 62 to traverse the lost motion and to engage limit pin 71 which in turn rotates indicator trip shaft 58 a portion of one revolution. Rotation of indicator trip shaft 58 is translated by links 75, 76 and 77 into horizontal popping-out of breaker tripped indicator reset button 74 indicating the tripped breaker.

Trip cam 80 also rotates with rotation of indicator trip shaft 58, and engages lockout block 83 with its first end 81. Second cammed end 82 engages electrical switch 87 to effect operation of desired audible, visual or like alarm devices. Spring 86 provides positive locking bias to hold trip cam 80 in the lockout or tripped position.

As closing of armature 45 is effected, it also causes tripping hammer 50 of armature 45 to engage block 51 and cause block 51 to be rotated counterclockwise a portion of a revolution. The counterclockwise rotation of block 51 causes roller 94 of one of the legs of star wheel 93 to transmit a clockwise rotation to the star wheel 93. As the star wheel 93 rotates clockwise, roller 102 mounted on first rocker arm 98, which roller 102 endwise engages one of the legs of star wheel 93, drops from endwise engagement therewith freeing rocker arm 97 for clockwise rotation about its pivot 100. Roller 112 of operating arm 106 exerts the forces of spring 127 and breaker contact springs 19, 29 against outer surface 103 of rocker arm 97 and further causes a positive clockwise rotation of rocker arm 97. Roller 112 of operating arm 106 becomes disengaged from outer surface 103, thus permitting pin 111 carried by the first end 107 of operating arm 106 to follow the cam opening 105 in cam plate 104. This movement of first end 107 of operating arm 106 permits operating arm 106 to pivot about the center point 120. Trip latch 113 has its latched cam surface 121 released from the trip pin 114, also freeing trip latch bar 122. The trip latch bar 122 rotates clockwise about its pivot 123, being limited by a stop 160. This places cam rider 126 in engagement with closing cam 133. The pivoting of operating arm 106, aided by the spring 127 and breaker contact springs 19, 29, causes second end 108 to move counterclockwise to aid insulated arm 116, which being attached also to the contact arm 20, draws the contact arm 20 out of contact with the main finger 18. Breaking the contact of contact arm 20 and main finger 18 transfers the current flow to arcing contacts 26, 27 which open after main finger 18 and contact arm 20. The arc drawn in opening arcing contacts 26, 27 travels upward toward an arc chute 161 defined by notched barrier plates 162 and leaves the arcing contacts 26, 27 to advance along arc runner 28 and an arcing jet 163 carried by arcing contact arm 20. Arc chute 161, barrier plates 162 and the addition of a magnetic iron core 164 adjacent the underside of arc runner 28, in combination with the thermal and magnetic conditions caused by the arc, all aid in its extinguishment.

At the same time insulating arm 116 is drawn back to open breaker 10, the first indicator link 119 pivots clockwise about pivot 137 which causes link 119 to act on second indicator link 138 to pivot the open-closed

breaker indicator **140** about pivot **141** indicating the open condition of the contacts of breaker **10**.

A clockwise rotation of handle **131** of manual reclosing mechanism **130** after pushing the phase trip indicator reset button **74**, will restore breaker **10** to a closed position.

Although but one embodiment has been illustrated and described it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In a multiphase protected installation in which each phase is provided with a circuit breaker, each circuit breaker having make and break contacts for interrupting a circuit and a tripping mechanism adapted to make and break said contacts; the combination of an indicator trip shaft with indicator means for visually identifying a tripped and a nontripped phase, each said indicator means comprising a collar journaled in alignment with the collars of the other said indicator means and cooperating with the collars of the other said indicator means for journaling said trip shaft, said collar having a recess, an indicator rigidly attached to said collar for rotation therewith, said indicator being provided with a latched portion, a latch for holding said latched portion in a nontrip position, means responsive to operation of said tripping mechanism of one of said breakers for disengaging said latch from said latched portion to drop said indicator, a limit pin mounted on said shaft and extending into said recess of said collar for turning said shaft in response to engagement of the wall of said recess with said pin, torsional reilient means for maintaining torsional tension on said collar; and means for resetting said shaft to thereby reset any of said indicator means from a tripped to a nontripped position.

2. In a multiphase protected installation in which each phase is provided with a circuit breaker, each circuit breaker having make and break contacts for interrupting a circuit and a tripping mechanism adapted to make and break said contacts; the combination of an indiactor trip shaft with indicator means for visually identifying a tripped and a nontripped phase, each said indicator means comprising a collar journaled in alignment with the collars of the other said indicator means and cooperating with the collars of the other said indicator means for journaling said trip shaft, said collar having a recess, an indicator rigidly attached to said collar for rotation therewith, said indicator being provided with a latched portion, a latch for holding said latched portion in a nontrip position, means responsive to operation of said tripping mechanism of one of said breakers for disengaging said latch from said latched portion to drop said indicator, a limit pin mounted on said shaft and extending into said recess of said collar with a clearance for turning said shaft with lost motion in response to engagement of the wall of said recess with said pin, torsional resilient means for maintaining torsional tension on said collar; and means for resetting said shaft to thereby reset any of said indicator means from a tripped to a nontripped position.

3. In a multiphase protected installition in which each phase is provided with a circuit breaker, each circuit breaker having make and break contacts for interrupting a circuit and a tripping mechanism adapted to make and break said contacts; the combination of an indicator trip shaft with indicator means for visually identifying a tripped and a nontripped phase, each said indicator means comprising a collar journaled in alignment with the collar of the other said indicator means in a common support and cooperating with the collars of the other said indicator means for journaling said trip shaft, said collar having a recess, an indicator rigidly attached to said collar for rotation therewith, said indicator being provided with a latched portion, a latch for holding said latched portion in a nontrip position, means responsive to operation of said tripping mechanism of one of said breakers for disengaging said latch from said latched portion to drop said indicator, a limit pin mounted on said shaft and extending into said recess of said collar with a clearance for turning said shaft with lost motion in response to engagement of the wall of said recess with said pin, torsional resilient means for maintaining torsional tension on said collar; a trip cam mounted on said shaft for rotation therewith and an electrical switch mounted on said breaker adjacent said trip cam, said trip cam engaging said switch for actuation thereof in response to rotation of said shaft.

4. In a multiphase protected installation in which each phase is provided with a circuit breaker, each circuit breaker having make and break contacts for interrupting a circuit and a tripping mechanism adapted to make and break said contacts; the combination of an indicator trip shaft with indicator means for visually identifying a tripped and a nontripped phase, each said indicator means comprising a collar journaled in alignment with the collar of the other said indicator means in a common support and cooperating with the collars of the other said indicator means for journaling said trip shaft, said collar having a recess, an indicator rigidly attached to said collar for rotation therewith, said indicator being provided with a latched portion, a latch for holding said latched portion in a nontrip position, means responsive to operation of said tripping mechanism of one of said breakers for disengaging said latch from said latched portion to drop said indicator, a limit pin mounted on said shaft and extending into said recess of said collar with a clearance for turning said shaft with lost motion in response to engagement of the wall of said recess with said pin, torsional resilient means for maintaining torsional tension on said collar; a lockout block presented by said tripping mechanism, a trip cam mounted on and rotating with said shaft for locking said lockout block in a tripped position, and means for resetting said shaft and said trip cam to thereby reset any of said indicator means and to reset said lockout block from a tripped to a nontripped position.

5. In a multiphase protected installation in which each phase is provided with a circuit breaker, each circuit breaker having make and break contacts for interrupting a circuit and a tripping mechanism adapted to make and break said contacts; the combination of an indicator trip shaft with indicator means for visually identifying a tripped and a nontripped phase, each said indicator means comprising a collar journaled in alignment with the collars of the other said indicator means in a common support and cooperating with the collars of the other said indicator means for journaling said trip shaft, said collar having a recess, an indicator rigidly attached to said collar for rotation therewith, said indicator being provided with a latched portion, a latch for holding said latched portion in a nontrip position, means responsive to operation of said tripping mechanism of one of said breakers for disengaging said latch from said latched portion to drop said indicator, a limit pin mounted on said shaft and extending into said recess of said collar with a clearance for turning said shaft with lost motion in response to engagement of the wall of said recess with said pin, torsional resilient means for maintaining torsional tension on said collar; a trip cam, an electrical switch mounted on said breaker adjacent said trip cam, a lockout block presented by said tripping mechanism, said trip cam being mounted on and rotating with said shaft, said trip cam upon rotation of said shaft simultaneously engages said switch for actuation thereof and locks said lockout block in a tripped position, and means for resetting said shaft and said trip cam to thereby reset any of said indicator means and to reset said switch and said lockout block from a tripped to a nontripped position, said indicator means providing

visual indication of the tripped and nontripped condition of said breaker.

6. In a multiphase protected installation in which each phase is provided with a circuit breaker, each circuit breaker having make and break contacts for interrupting a circuit and a tripping mechanism adapted to make and break said contacts; the combination of a trip shaft with indicator means for visually identifying a tripped and a nontripped phase, each said indicator means comprising a collar journaled in alignment with the collars of the other said indicator means in a common support and cooperating with the collars of the other said indicator means for journaling said trip shaft, said collar having a recess, an indicator rigidly attached to said collar for rotation therewith, said indicator being provided with a latched portion, a latch for holding said latched porton in a nontrip position, means responsive to operation of said tripping mechanism of one of said breakers for disengaging said latch from said latch portion to drop said indicator, a limit pin mounted on said shaft and extending into said recess of said collar with a clearance for turning said shaft with lost motion in response to engagement of the wall of said recess with said pin, torsional resilient means for maintaining torsional tension on said collar; a trip cam, an electrical switch mounted on said breaker adjacent said trip cam, a lockout block presented by said tripping mechanism, said trip cam being mounted on and rotating with said shaft, said cam being adapted to effect simultaneous operation of said switch and of said lockout block in a tripped position upon rotation of said shaft, resilient means carried by said breaker and said trip cam for positive biasing of said trip cam holding it in a tripped position, and means for resetting said shaft and said trip cam to thereby reset any of said indicator means and to reset said switch, said lockout block and said resilient means from a tripped to a nontripped position.

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