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E. T. PLATZ ET AL

2,874,247

CIRCUIT BREAKER TRIP MECHANISM

Filed March 13, 1953

6 Sheets-Sheet 1

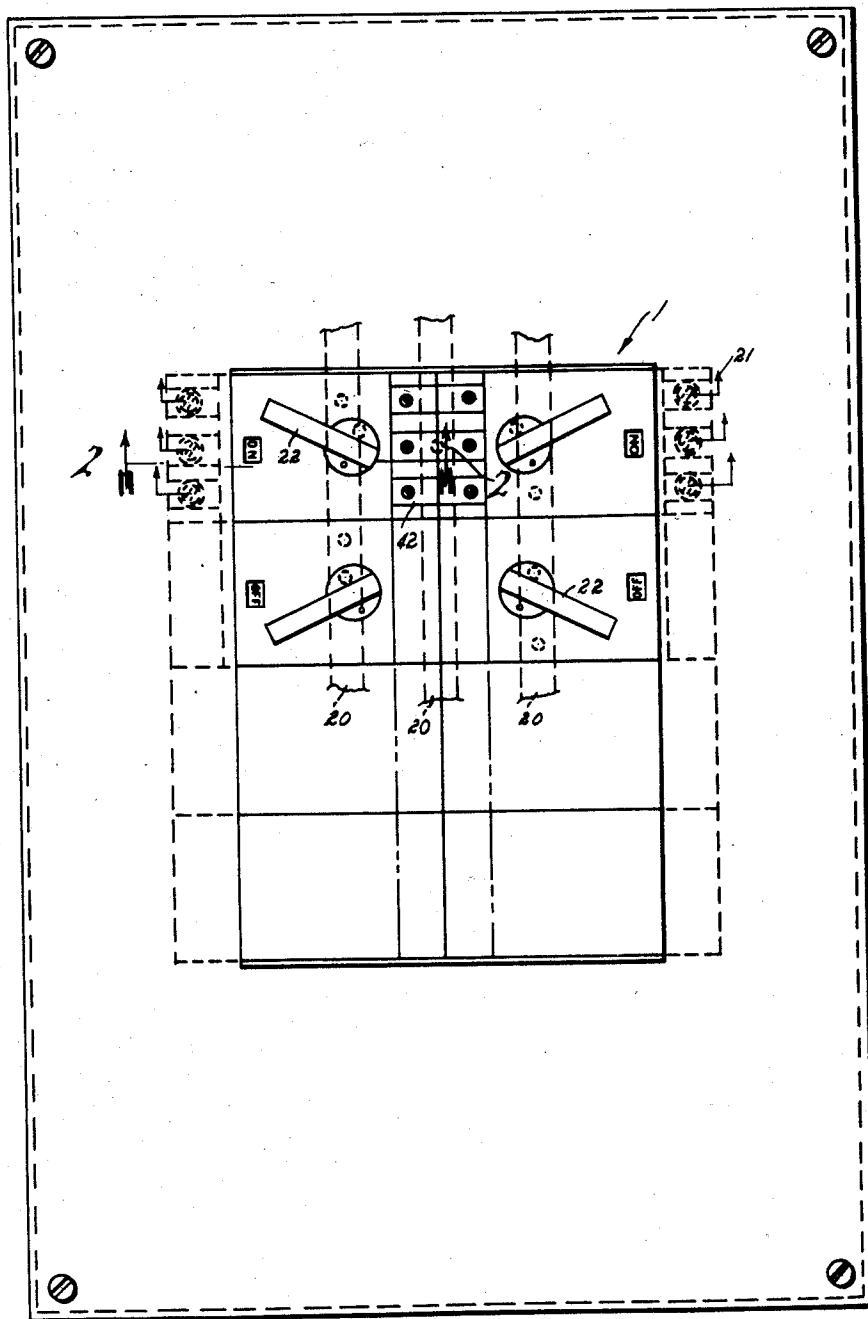


Fig. 1

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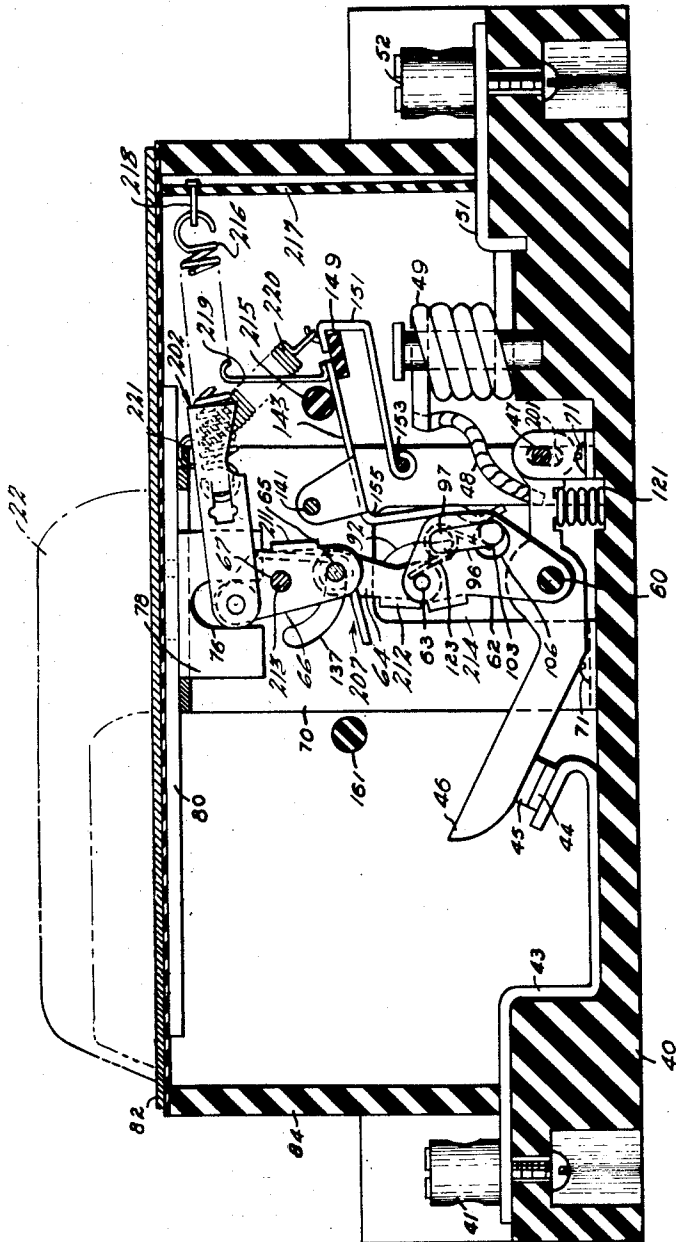
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## CIRCUIT BREAKER TRIP MECHANISM

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6 Sheets-Sheet 2



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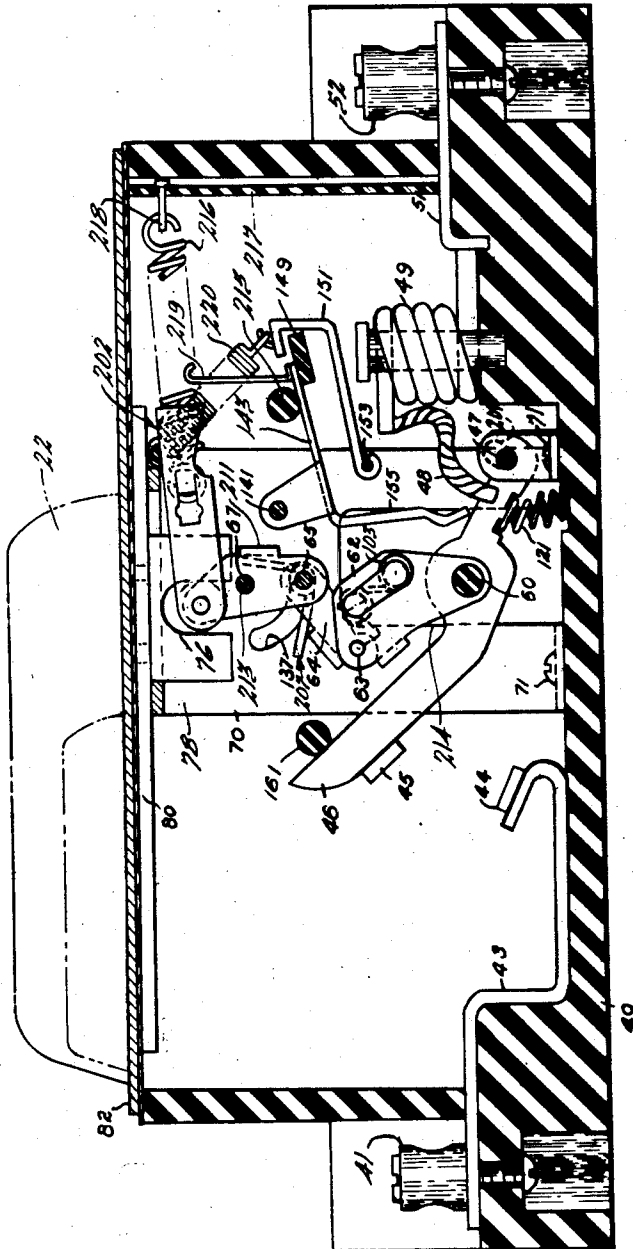
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## CIRCUIT BREAKER TRIP MECHANISM

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CIRCUIT BREAKER TRIP MECHANISM

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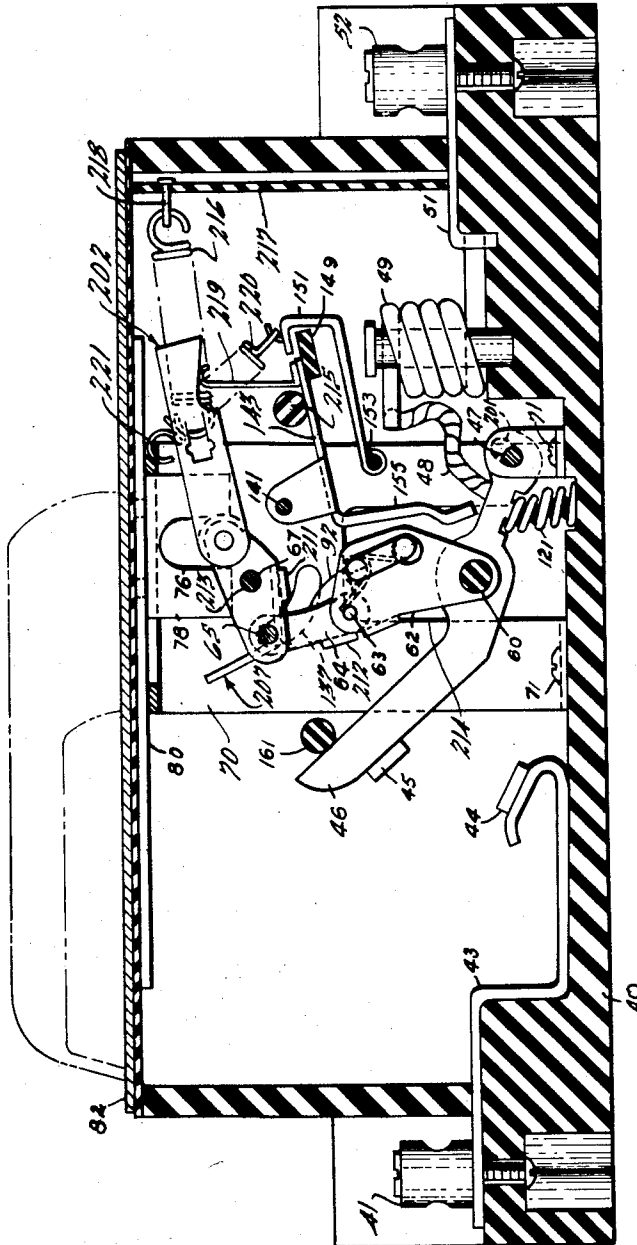


Fig. 4 OFF

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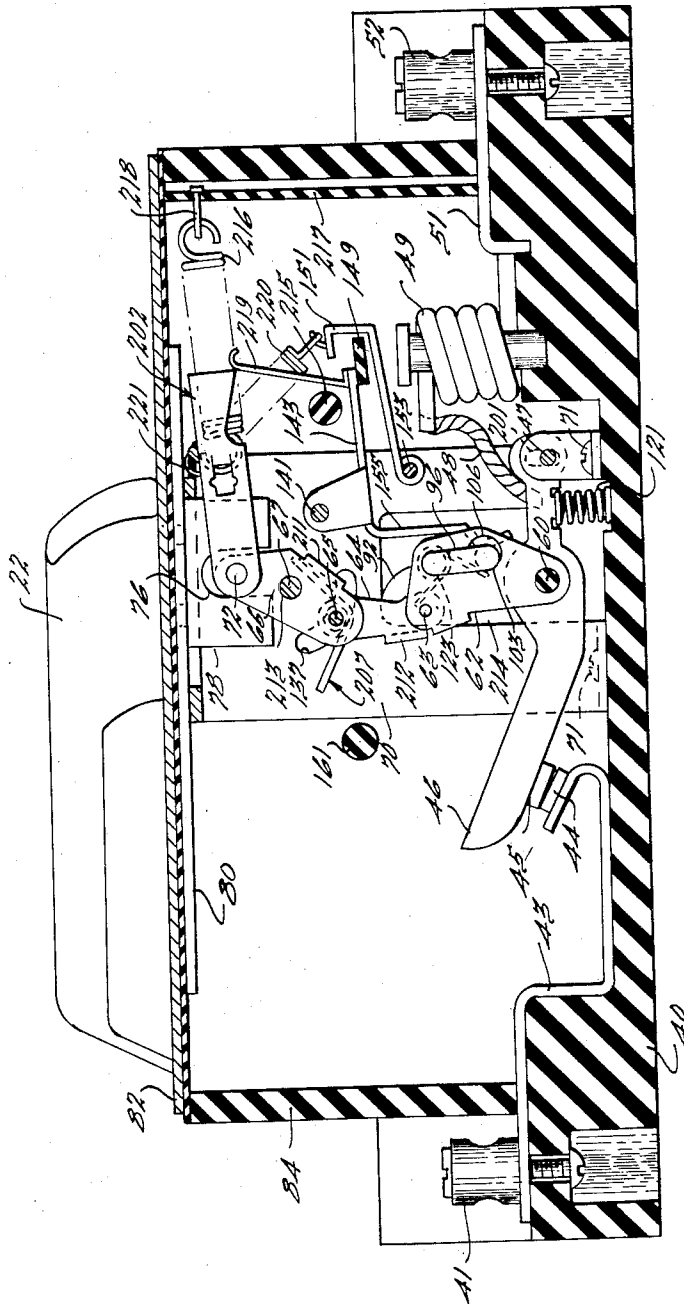
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# CIRCUIT BREAKER TRIP MECHANISM

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6 Sheets-Sheet 5



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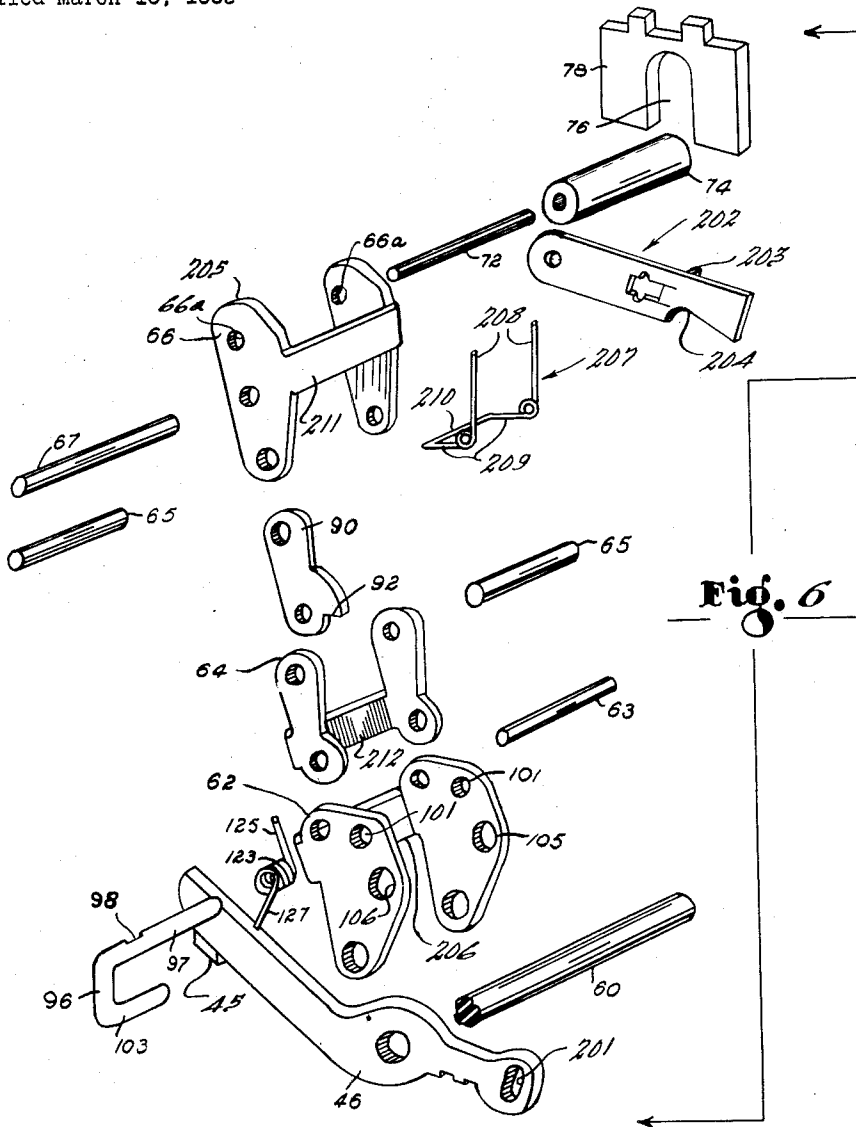
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## CIRCUIT BREAKER TRIP MECHANISM

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6 Sheets-Sheet 6



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2,874,247

## CIRCUIT BREAKER TRIP MECHANISM

Elwood T. Platz and Russell S. Davis, Detroit, Mich., assignors, by mesne assignments, to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Application March 13, 1953, Serial No. 342,174

4 Claims. (Cl. 200—106)

This invention relates generally to improvements in automatic electric circuit interrupting devices and particularly to a novel means for operating a circuit breaker mechanism.

A principal object of this invention is to maintain operativeness of the circuit breaker overload mechanism.

Another object of this invention is to provide circuit interruption independent of the position of the actuator upon manual operation of a circuit breaker.

A further object of this invention is to provide positive return for the manual operating structure.

A further object is to provide retarded opening of the circuit breaker mechanism.

A still further object of the invention is to provide rapid separation of the contacts upon manual actuation of the circuit breaker.

Still other objects and advantages will be apparent to those skilled in the art after a consideration of the description and drawings wherein:

Fig. 1 is a plan view of a panelboard containing circuit breakers embodying the invention.

Fig. 2 is a sectional view, taken on line 2—2 of Fig. 1, showing the control mechanism for one of the breakers of Fig. 1 and the fixed and movable contactors for one pole of such breaker.

Fig. 3 is a sectional view similar to Fig. 2 showing the breaker mechanism in an intermediate position immediately after automatic tripping.

Fig. 4 is a sectional view similar to Fig. 2 but showing the breaker in the fully "off" or open circuit position after automatic resetting and preparatory to manual closing.

Fig. 5 is a sectional view similar to Fig. 2 but showing the first portion of the manual "off" movement, i. e., immediately after manual tripping.

Fig. 6 is an exploded perspective view of certain parts of the breaker mechanism.

Referring to Fig. 1, a panelboard is shown which consists of eight circuit breakers 1 employing the invention. These circuit breakers 1 are installed adjacent one another and are supplied with electric current through conductors 20 in the form of bus bars. Branch or load circuits are indicated schematically at 21. The particular breakers shown are known in the art as three pole circuit breakers and function to interrupt the flow of current in all three phase circuits containing the breaker upon the occurrence of a fault in one or more of such circuits. Exposed on the front of the panel are symmetrically arranged handles 22 for opening and closing the breakers. The invention disclosed in pending application No. 80,710 filed March 10, 1949, and assigned to the assignees of the present invention permits the use of the breaker on either the left or right side of the panelboard while maintaining the identical movement of raising the handle 22 for turning the breakers to the "on" position and moving it downward to turn the breaker to the "off" position.

Fig. 2 shows the control mechanism of one of the

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breakers of Fig. 1. Such mechanism may control one or more circuits through an equivalent number of fixed and movable contacts and current overload units. The breaker as disclosed herein is specifically designed for three phase current and is known in the electrical art as a "three pole" circuit breaker.

As seen in Fig. 2 the circuit breaker consists of an insulation housing 40 having connectors 41 for electrical connection by straps (not shown) to bus bars 20 of Fig. 1. Straps 43 connect with connectors 41 and have stationary contacts 44 affixed thereto.

Movable contacts 45 are secured to contactors 46. The ends of contactors 46 are journaled by elongated holes 201 therein on shaft 47 to provide lost motion vertically for reasons discussed below. Shaft 47 is rigidly secured to housing 40. Contactors 46 are biased upwardly and moved to the open circuit position by main operating springs 121. Connected to contactors 46 are flexible conductors 48 which are connected on the opposite end to overload trip units 49 shown as magnetic coil units but may be any type of overload trip units. These units 49 are connected to strap 51 which in turn is connected to the load connectors 52. Thus the circuit is from the bus bar supply 20 through connectors 41, straps 43, stationary contacts 44, movable contacts 45, contactors 46, flexible conductors 48, overload trip units 49, strap 51, load connectors 52 to branch load circuits 21 (Fig. 1) which are connected to load connectors 52.

The control mechanism of the breaker for controlling the opening and closing of contactors 46 is a latchable linkage system, elements of which are shown separately in Fig. 6. A portion of this latchable linkage system is disclosed in Patent 2,607,868 which issued August 19, 1952, to the assignee of the present application. This system includes a U-shaped lower link 62 pivoted on a shaft 60 and having aligned pairs of large openings 105, 106 and small openings 101 in its respective legs, the latter journaling the upper leg 97 of latch member 96 (see Fig. 6). Shaft 60 floats and is common to all poles of the breaker. The lower leg 103 of latch member 96 can move laterally in opening 106 when the latch member is rotated in journal openings 101. Pivotaly connected at its lower portion to lower link 62 by floating shaft 63 is an intermediate U-shaped link 64. Intermediate link 64 is pivotaly connected to floating shaft 65 which in turn connects it with a U-shaped upper link 66. Also pivoted on shaft 65 is a holding member or latch 90 having latch projection 92 thereon engageable with latch member 96 when the breaker is in the "on" circuit position and disengageable from latch member 96 through notch 98 (Fig. 6), either manually or automatically, to thereby release the linkage system and cause the circuit breaker to open with a snap action. Upper link 66 is pivoted on fixed shaft 67 and has in its upper portion openings 66a in which shaft 72 is mounted and which serves as a support for roller 74. Roller 74 journals on shaft 72 and is rotatable freely with respect to shaft 72. Latch trip member 202 is pivotaly mounted at one end of shaft 72 between the side portion 205 of upper link 66 and the end of roller 74 (Fig. 6). Latch trip member 202 has spring attachment lug 203 extending from its side and trip clearance notch 204 cut from its end. Latch spring 123 mounted on upper leg 97 of latch member 96 has one extending leg 125 abutting shaft 63 of lower link 62 and the other extending leg 127 abutting end 103 of latch member 96 to bias this latch member 103 laterally in opening 106 to its latching position. Engaging roller 74 by means of notch 76 is lug 78 which in turn is fixedly mounted upon a slider plate (not shown in Fig. 6). This latter structure is disclosed and claimed

in application No. 80,710 referred to above, to which reference is made for further details of such structure.

An auxiliary linkage return and cushioning spring 207 mounted on pin 65 has upper legs 208 abutting bridge portion 211 of upper link 66 and lower legs 209 connected by bridge portion 210 extending laterally for contacting bridge portion 212 of intermediate link 64 upon opening movement of the breaker.

Auxiliary linkage return spring 207 through the linkage mechanism inhibits the upward movement of contactors 46 until they are stopped by stops 161. Additionally, spring 207 aids in the relatching of the linkage mechanism and the movement of handle 22 to the "off" position.

Disposed within housing 40 and secured thereto at its base by screws 71 is a U-shaped frame 70. This frame has openings 213 in its sides for the rigid affixation of shaft 67. Arcuate shaped slots 137 have disposed therein the ends of shaft 65 and serve as limits to the motion of shaft 65. Frame 70 has cut out portions 214 to provide clearance for the lower parts of the linkage system.

Pivotaly mounted upon pin 141 (Figs. 2, 3, 4, 5) which is rigidly secured at its ends to frame 70 is trip lever 143 having a lower portion 155 arranged to contact the lower leg 103 of latch member 96 to move it laterally in opening 106 and thereby trip the control mechanism, as described below. An upper portion disposed at right angles to the lower portion has attached an insulating plate 149 which extends across all three poles of the breaker. Extending upward and secured to trip lever 143 is latch trip spring 219 arranged to be contacted by latch trip member 202 upon its lateral movement. Constantly biasing trip lever 143 against stop 215 and the lower portion 155 away from lower leg 103 of latch member 96 is a spring (not shown). Over the edge of insulating plate 149 is hooked a portion of an armature 151, which is common to all of the overload trip units 49 and which is pivoted at 153 to frame 70. Armature 151 is arranged to be pulled downward upon the occurrence of an overload current in one or more of the overload trip units 49. Secured to armature 151 is an armature return spring 220, which is in turn secured to frame 70 at 221.

Affixed to latch trip member 202 by lug 203 is a latch trip member spring 216 (Figs. 2, 3, 4, 5). This spring is secured to plate 217 by lug 218 and continually biases lug 78 and handle 22 to the "off" position. Plate 217 is removably secured to housing 40.

A cover 82 has removably mounted thereon handle 22 to provide for manual operation of the breaker through slider plate 80 and lug 78.

A slot (not shown) is provided in the top portion of frame 70 for the lateral movement of lug 78.

Referring to Fig. 2, which shows the breaker in the "on" position and the linkage system locked, lower link 62 has the lower leg 103 of latch member 96 disposed laterally in opening 106 so that latch projection 92 of holding member 90 is resting upon the upper surface of the upper leg 97 of latch member 96 adjacent notch 98. Intermediate link 64 is disposed vertically above lower link 62 with the ends of pivotal shaft 65 located at the far right side of arcuate slots 137. Upper link 66 is disposed vertically above intermediate link 64. This position is maintained by the biasing action of main springs 121 and latch spring 123 holding notch 98 of latch member 96 away from latch projection 92 of holding member 90.

In this position latch trip member 202 is positioned to the left of and below the upper end of latch trip spring 219. Trip lever 143 is biased counterclockwise by its spring so that lower leg 155 is not in contact with lower leg 103 of latch member 96.

Armature 151 is biased upwardly away from magnetic

trip units 49 by armature return spring 220. Lug 78, together with slider plate 80 to which it is secured, is positioned to the left with roller 74 positioned in notch 76. The linkage system is restrained from moving upwardly by the engagement of shaft 65 with the right end of frame slots 137, and the fact that such position is to the right of a centerline through pivot shafts 60 and 67.

Upon the occurrence of a fault in any of the load circuits 21, an overload current will be drawn through one or more of the poles of the breaker. This current will energize one or more of the overload trip units 49 (Fig. 3), creating a magnetic field which will attract armature 151 and pull it downwardly against the upward force exerted by the armature return spring 220. The hooked end of armature 151 abutting insulating plate 149 pulls the plate downward rotating trip lever 143 clockwise about its pivot 141 and against the force of its spring (not shown). Lower leg 155 of trip lever 143 will strike the lower leg 103 of latch member 96 moving it laterally in opening 106 against the force of spring 123. As lower leg 103 is moved laterally, upper leg 97 is rotated in journal openings 101. Upon rotation of upper leg 97 notch 98 of upper leg 97 comes into position below latch projection 92 of holding member 90, permitting the projection to move downwardly as holding member 90 rotates about shaft 65. In this manner, the lower and intermediate links 62 and 64 are released from their latched engagement, enabling spring 121 to snap them to the tripped or open position shown in Fig. 3. The movement of link 62 carries with it the shaft 60, which in turn carries all contactors 46 to the open position of Fig. 3. Upon separation of the several pairs of contacts 44, 45 the electric circuits through the breaker are interrupted and all overload trip units 49 de-energized, thereby releasing armature 151 which is moved upwardly by return spring 220. This action enables the trip lever spring to restore trip lever 143 to its normal position.

Before reaching the position shown in Fig. 3, the bridge portion 212 of intermediate link 64 strikes the lower legs 209 of linkage return spring 207. Because of the inertia of the handle 22, slider plate 80 and handle lug 78 the linkage return spring 207 is loaded to help rotate upper link 66 clockwise about its pivot 67 and away from its locking engagement in the right end of slots 137. Primary handle return force is provided by latch trip member spring 216 which constantly biases latch trip member 202 laterally to the right. Upon rotation of upper link 66, lug 78 moves to the right carrying with it slider plate 80. As slider plate 80 and lug 78 move to the right, the handle 22 is moved to circuit open or "off" position. As latch trip member 202 moves laterally to the right, it strikes latch trip spring 219, depresses it and continues on with latch trip member spring 219 taking a position in trip clearance notch 204 of the latch trip member. Contactors 46 continue to move upwardly, their movement being cushioned by the action of linkage return spring 207 until reaching stops 161.

The resetting action is as follows: As shaft 65 moves upwardly and to the left in slots 137 of frame 70, lower link 62 and intermediate link 64 are straightened from their collapsed position, and latch projection 92 of holding member 90 clears the upper surface of leg 97 of latch member 96 which has been rotated back to normal position by spring 123. The latching engagement of the intermediate link 64 and lower link 62 is thus re-established. The breaker mechanism is then in the fully "off" or circuit open position as shown in Fig. 4.

Should it be desired to open the breaker manually, handle 22 is actuated. Through structure (not shown) slider plate 80 is caused to move laterally to the right (Fig. 2), carrying with it lug 78, the notch 76 of which is in engagement with roller 74 mounted in the upper part of upper link 66. As the upper link 66 rotates, the

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lower portion is moved clockwise about pivot 67 carrying shaft 65, which is positioned in arcuate slots 137 of frame 70. Intermediate link 64 and lower link 62, still in latched engagement, move upward slightly, raising the ends of contactors 46 pivotally mounted in elongated holes 201 and rocking contacts 44 and 45 to the position shown in Fig. 5. The current flow immediately prior to separation of contacts 44 and 45 is thus concentrated at the ends of these contacts. If any arcing and consequent burning of the contacts occurs, it will be concentrated at these points. Upon further lateral movement of slider plate 80 and rotation of upper link 66, the end of latch trip member 202, under the bias of and guided by latch trip member spring 216, contacts latch trip spring 219, moving the end of the latch trip spring to the right and rotating trip lever 143 clockwise about pivot 141. The operation of the breaker mechanism is then obtained as upon automatic overload trip. Rapid separation of the contacts 44, 45 is thus obtained.

Closing of the breaker is accomplished by reverse operation of the handle 22 to the "on" circuit position. Upper link 66 is rotated counterclockwise under the influence of lug 78, moving shaft 65 downwardly in slots 137. Intermediate link 64 and lower link 62 having been re-established previously in latching engagement, the downward movement of shaft 65 moves links 64 and 62 and contactors 46 downwardly until movable contacts 45 strike stationary contacts 44. At this point, further motion is taken up by the elongated holes 201 in the end of contactors 46 until shaft 65 positions itself in the right end of arcuate slots 137 and to the right of a line joining shafts 60 and 67. The breaker is then in the "on" circuit position.

Having described our invention, what we desire to claim is:

1. In a circuit breaker having a control mechanism including a plurality of links, some of which are latchably engageable and disengageable, and manual unlatching means for unlatching said latchable links, means for actuating said unlatching means including a latch trip member secured to one of said links, a latch trip member element mounted independently of said plurality of links secured to said unlatching means and arranged to be contacted by said latch trip member for actuating said latch trip member element and therefore said unlatching means for permitting movement of said circuit breaker to open circuit position.

2. In a circuit breaker, an actuator, a contactor, an automatic tripping mechanism, a control system, trip means; said control system comprising a plurality of links, some of which are latchably disengageable, operatively connecting said actuator and said contactor; said automatic tripping mechanism being mounted independently of said control system and operatively positioned to be engageable with said control system upon the occurrence of an overload condition; said automatic tripping mechanism

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including a resilient member; said trip means secured to said control mechanism and engageable with said resilient member for manual releasing of said control system to permit said circuit breaker to move to the open circuit position with a snap action during manual operation.

3. In a circuit breaker, an actuator, a contactor, an automatic tripping mechanism, a control system; trip means; said control system comprising an upper link, an intermediate link, and a lower link some of which are latchably disengageable; said upper link being secured to a fixed pivot and operatively connected to said actuator; said lower link being operatively connected to said contactor; said intermediate link operatively connecting said upper and lower links; said automatic tripping mechanism being mounted independently of said control system and operatively positioned to be engageable with said control system upon the occurrence of an overload condition; said trip means secured to said upper link and engageable with said automatic tripping mechanism for manual releasing of said control system to permit said circuit breaker to move to the open circuit position.

4. In a circuit breaker, an actuator, a contactor, an automatic tripping mechanism, a control system, trip means; said control system comprising an upper link, an intermediate link and a lower link; said upper link being operatively connected to said actuator and said lower link operatively connected to said contactor; latch means operatively connecting said intermediate and lower links; said upper link and said intermediate link forming a lockable toggle mechanism when said intermediate and lower links are latched; said automatic tripping mechanism being mounted independently of said control system and operatively positioned to be engaged; said latch means upon the occurrence of an overload condition; said trip means secured to said upper link and engageable with said automatic tripping mechanism for manual releasing of said latch means to permit said circuit breaker to move to the open circuit position.

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