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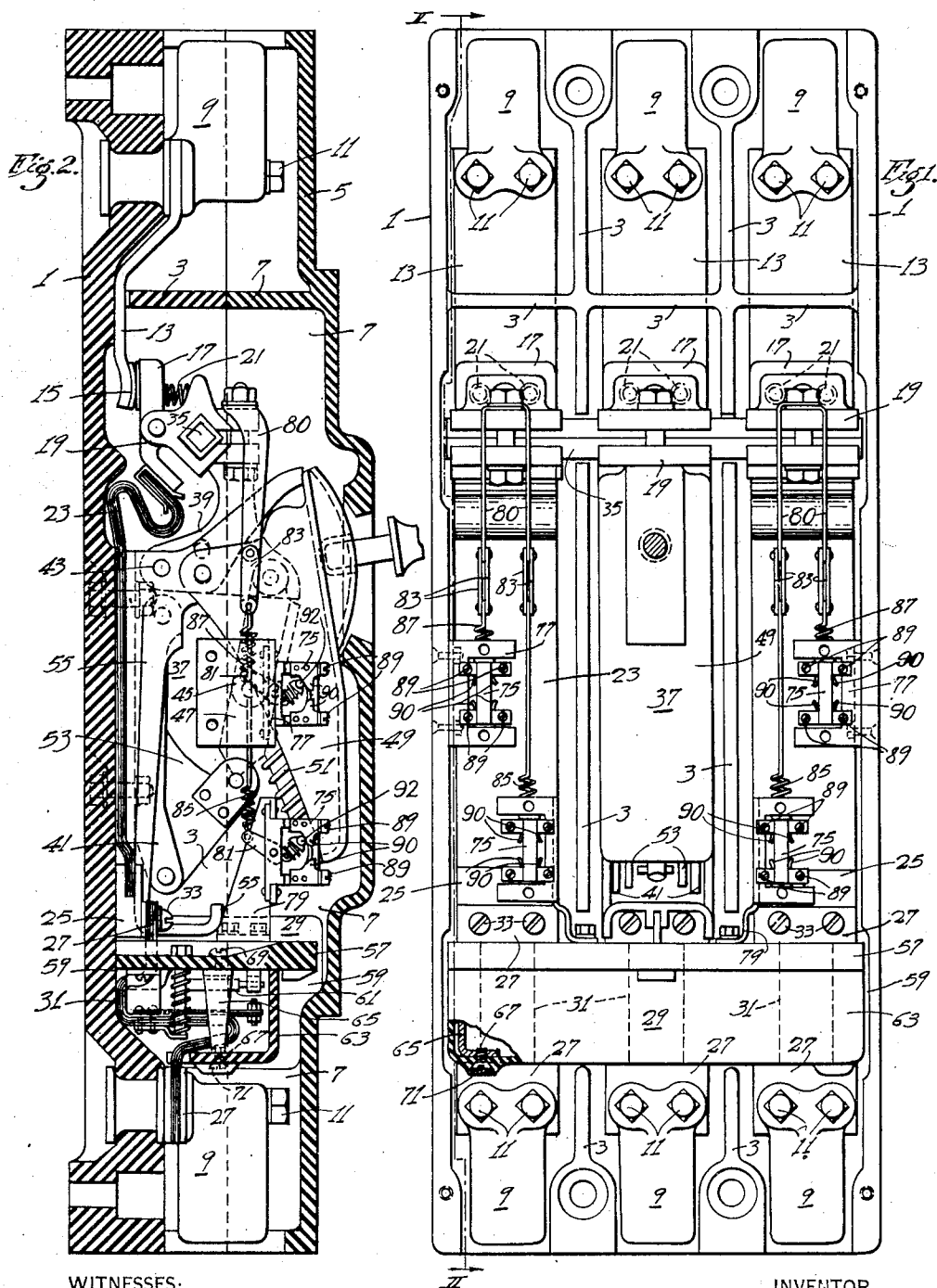
J. M. SANDIN

2,102,284

CIRCUIT INTERRUPTER

Filed Sept. 12, 1935

3 Sheets-Sheet 1



WITNESSES:

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Dec. 14, 1937.

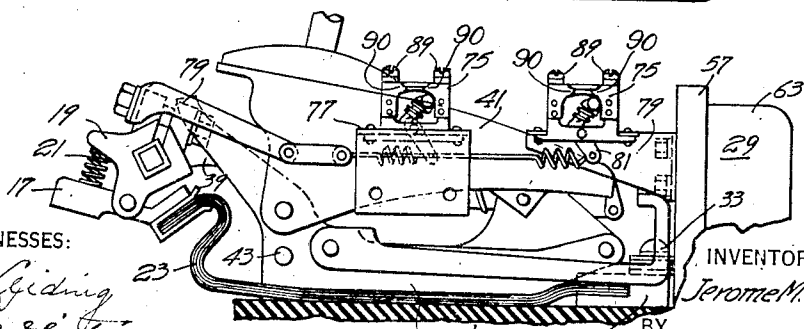
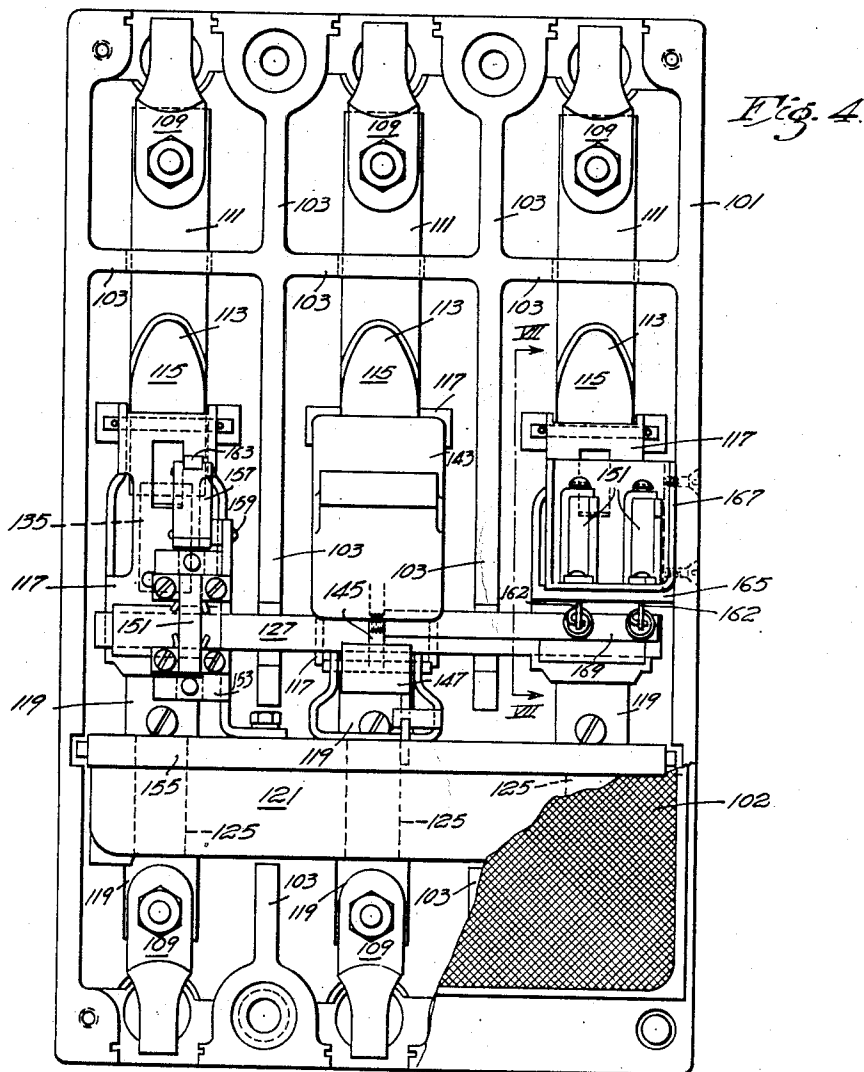
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2,102,284

CIRCUIT INTERRUPTER

Filed Sept. 12, 1935

3 Sheets-Sheet 2



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Fig. 3.

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3 Sheets-Sheet 3

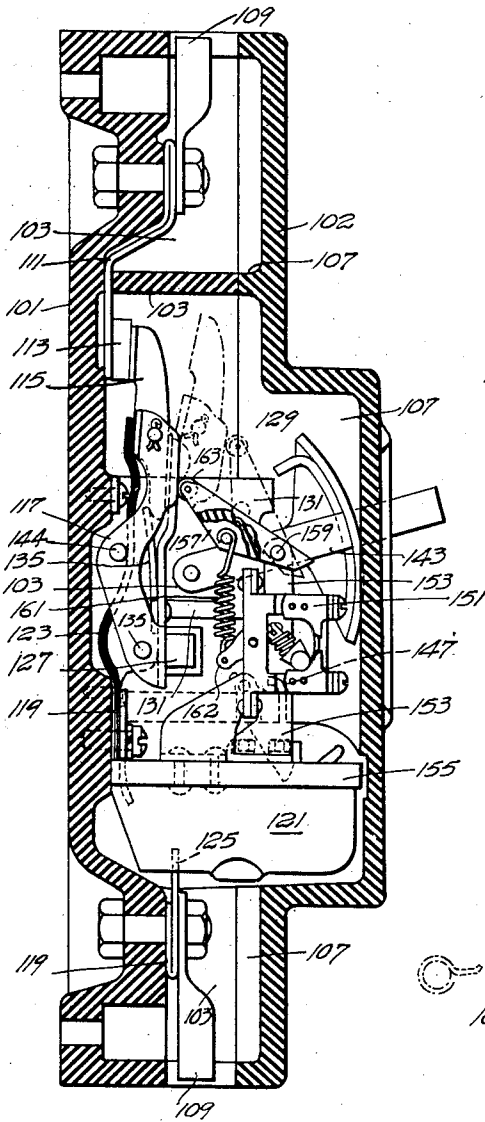


Fig. 5.

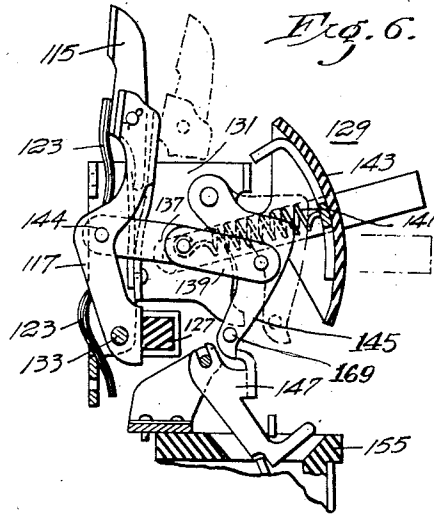


Fig. 6.

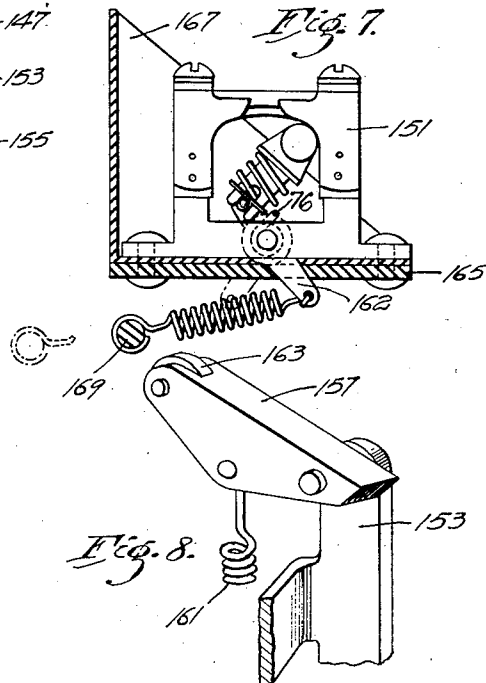


Fig. 7.

Fig. 8.

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UNITED STATES PATENT OFFICE

2,102,284

CIRCUIT INTERRUPTER

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Application September 12, 1935, Serial No. 40,193

16 Claims. (Cl. 200—107)

My invention relates generally to electrical apparatus and particularly to circuit breakers of the type used for controlling industrial power distribution and secondary network circuits.

The provision of a satisfactory circuit breaker for this type of service has always presented a troublesome problem to the art, due, primarily, to the numerous and somewhat conflicting requirements which must be met. Foremost among these, are the requirements that the breaker shall be positive and reliable in operation and shall be capable of interrupting very large amounts of power within short intervals of time. To prevent unnecessary discontinuities in service while at the same time providing adequate protection of the connected equipment, the breaker must include an overload tripping means which is capable of accurately distinguishing between prolonged overloads and transient conditions not necessarily dangerous in themselves. Further, in order to permit remote and automatic supervisory control of the systems in which the breakers are used, it is necessary that auxiliary control switches actuable in response to the operation of the breaker shall be made available.

In contrast with these operational requirements, all of which necessitate the use of a rather large amount of apparatus, it is imperative that the physical dimensions of the breakers shall be kept within certain defined limits in order to permit their use in existing panelboard and other switch structures. In addition, it is necessary that the initial cost of the breakers shall not be excessive, due to the large numbers which are used on even a small system or network. Further, it is highly desirable that the breakers shall be easy to service in order to minimize maintenance costs.

The principal object of the present invention, therefore, is to make possible a circuit breaker which is capable of meeting all of the above stated requirements.

One form of breaker which has met with considerable success in the past utilizes a single, standardized contact structure and actuating mechanism for a wide range of current values, the rating of my particular breaker being determined by the provision of a suitable trip device. The closure for these breakers comprises a co-operating base and cover, preferably formed of molded insulating material. In the multi-pole forms, suitable ribs and partitions molded into the base and cover serve to define separate passages or chambers for each of the poles. The movable contacts for the several poles are me-

chanically interconnected so as to move as a unit, and a single operating mechanism, normally disposed in one of the pole chambers, is utilized for actuating all of the contacts. The effective and is adapted to engage and be retained within the breaker closure constitutes a further object of the present invention.

The trip device for the multi-pole breakers of this type extends across all of the poles thereof and is adapted to engage and be retained within a suitable recess formed in the cooperating cover and base. The device includes a plurality of tripping elements, each operable in response to predetermined electrical conditions in the circuit controlled by one of the poles of the breaker, to effect the actuation of the trip device. Since the trip device is readily removable and is interchangeable with other similarly proportioned devices, it is possible to market a whole line of breakers, built up around a single standardized contact structure and actuating mechanism.

A third object of the invention is the provision of a removable, interchangeable trip device for use in conjunction with a circuit breaker of the type under consideration which shall be provided with a plurality of auxiliary switching devices, forming an integral part thereof so as to be removable from the breaker closure as a unit with the trip device.

A further object of the invention is to provide auxiliary switching means for use in conjunction with a circuit breaker of the type discussed above which shall be actuable in response to the operation of the contacts and the operating mechanism of the breaker to effect the operation of relay or similar means for indicating the position thereof.

An ancillary object of the invention is to provide an improved form of auxiliary switch actuating means which may be embodied into existing forms of circuit interrupting devices without necessitating substantial modifications or structural change thereof.

These and other objects of the invention will be made more apparent by reference to the following drawings and descriptions of certain preferred embodiments thereof. Referring particularly to the drawings,

Figure 1 is a plan view of a three-pole circuit breaker wherein are embodied a number of the more important features of the present invention. The cover of the breaker has been removed in order to more clearly illustrate the structural features thereof,

Fig. 2 is a sectional view of the breaker shown

in Fig. 1, the view is taken on the line II—II of that figure,

Fig. 3 is a fragmentary, elevational view showing the auxiliary switches, the breaker contacts, and portions of the breaker actuating mechanism in the normal open circuit position,

Fig. 4 is a plan view similar to Fig. 1 of a second form of breaker structure to which the present invention particularly appertains,

Fig. 5 is a sectional view on the line V—V of Fig. 4,

Fig. 6 is a fragmentary, elevational view of the operating mechanism of the circuit breaker shown more particularly in Figs. 4 and 5,

Fig. 7 is a fragmentary view showing the features of one of the auxiliary switch structures embodied into the breaker shown in Figs. 4 and 5. The view is taken on the line VII—VII of Fig. 4, and

Fig. 8 is a fragmentary view of a portion of the actuating means for another of the auxiliary switch structures embodied into the breaker structure shown in Figs. 4 and 5.

The circuit breaker illustrated particularly in Figs. 1 and 2 is, as mentioned above, of the three-pole type. The base 1 upon which the several structural features of the breaker are mounted is formed of molded insulating material and is provided with suitable ribs and partitions 3 molded integral therewith for separating the three poles. The cover 5 is likewise of molded insulating material and is provided with cooperating partitions and ribs 7, as is shown particularly in Fig. 2 for engaging the similarly disposed ribs 3 formed in the base. In the completed structure, these ribs or partitions 3 and 7 serve to define three separate chambers, having the substantial form of rectangular prisms, which are spaced side by side.

Six terminals 9, three of which are affixed to either end of the base 1 by means of suitable bolts 11, provide a means whereby the breaker may be connected into an electrical circuit. The electrical circuit through each of the poles of the breaker is substantially the same. A strap member 13 of conducting material, preferably copper, rigidly affixed to the base 1, serves to support each of the stationary contact members 15 and to connect those members with the adjacent cooperating terminals 9. A movable contact member 17, pivotally supported on a suitable frame 19, is provided for cooperating with each of the stationary contacts 15. Two contact pressure securing springs 21 disposed intermediate each of the movable contacts 17 and the supporting frame 19 therefor insure a resilient engagement between each pair of cooperating contacts. A flexible conductor 23, formed of laminated material, is electrically and mechanically connected to the rear end of each of the movable contacts 17 and each of these flexible conductors terminates in a solid terminal member 25 which is adapted to cooperate with one of the terminals 27 of the trip device 29.

As is shown particularly in Fig. 1, the trip device is provided with six terminals 27, two for each of the poles of the breaker. Each pair of these terminals are electrically interconnected within the device itself by a looped laminated conducting strip 31 which serves as an energizing heater for one of the electro-responsive tripping elements and one of the magnetically responsive tripping elements operable upon the occurrence of predetermined conditions to effect the actuation of the trip device.

Each of the upper terminals 27 of the trip device 29 is affixed to one of the block members 25 by means of a pair of screws 33 and each of the lower terminal members 27 is, in turn, affixed to one of the lower terminals 9 of the breaker by a pair of the bolts 11. Thus, the conducting strip 29 interposed between each of the pairs of terminals of the trip device serves to complete the electrical circuit for each of the poles of the breaker from the terminal member 25 of that pole to the corresponding lower breaker terminal 9.

Each of the contact supporting frames 19 is bolted to a square tie member 35 comprising an inner rod of steel and an outer sheath of insulating material in order to permit the simultaneous actuation of the movable contacts 17. A single operating mechanism 37 is provided for simultaneously actuating the interconnected contacts.

The supporting frame 19 for the central contact has a link member 39 cast integral therewith, and this link member is pivotally supported upon the frame 41 of the actuating mechanism by a suitable pivot pin 43. The pin 43, serves, therefore, to support the entire assemblage formed by the interconnected contacts.

Neither the actuating mechanism 37 nor the trip device 29 is a particularly important part of the present invention and any suitable means whereby the contacts may be moved to the open and to the closed circuit position in response to the actuation of an operating handle and whereby the contacts will be automatically opened upon the operation of the trip device irrespective of the position of the operating handle may be used. I prefer to utilize an actuating mechanism of the type disclosed in the patent of Harry J. Lingal, No. 2,083,305, which issued June 8, 1937 and which is assigned to the assignee of the present invention, and I prefer to utilize a trip device of the type disclosed in my patent No. 2,043,306, which issued June 9, 1936, and which is assigned to the assignee of the present invention.

A mechanism of this type, as is illustrated in Fig. 2, comprises a pair of pivotally connected toggle links 45 and 47, an operating member 49, an over-center spring 51 intermediate the operating member, and the toggle links for causing those links to move from the normal closed circuit position shown in Fig. 2 to a collapsed open circuit position or vice versa, in response to movement of the operating member 49. One end of the linkage formed by the interconnected toggle links 45 and 47 is supported upon a cradle member 53, normally retained in the position shown in Fig. 2 by a trigger 55 which is adapted to engage and cooperate with the trip device 29. When the trigger 55 and the cradle 53 are in the position shown in Fig. 2, the actuating mechanism 37 is operable in response to movement of the operating member 49 to actuate the toggle linkage and thereby cause the interconnected movable contacts 17 to be moved to the open and to the closed circuit position.

Upon the actuation of the trip device 29 in response to predetermined abnormal conditions, the trigger member 55 is released and moves automatically to a position where it causes the actuating mechanism 37 to effect the opening of the breaker independently of the position of the operating handle 49. The actuating mechanism thus has a normal open circuit position, a nor-

mal closed circuit position, and a tripped position. By virtue of the over-center spring construction, the contacts are moved from and to each of these positions with a snap action.

The various structural elements of the trip device 29 are mounted upon a separate base member 57 which is adapted to engage a suitable recess 59 formed within the cooperating base 1 and cover 5 which comprise the breaker closure. The device includes a trip bar 61 (Fig. 2) which extends across all of the poles of the breaker and which is movable from a normal inoperative to an operative position to effect the actuation of the trip device, a plurality of thermally responsive trip elements, each of which is energized in response to the current flow in one of the poles of the breaker and is operable to move said trip bar to said operative position and a plurality of magnetically responsive trip elements, each of which is likewise energized in response to the current flowing in one of the poles of the breaker and is also operable to move said trip bar to said operative position. The various trip elements and the trip bar are biased to the untripped or inoperative position and the device is thus automatically resettable following each operation thereof.

A removable cover 63 formed of molded insulating material is provided for enclosing the various structural features of the trip device. This cover is normally supported by a pair of brackets 65, being affixed thereto by means of suitable screws 67, and the brackets in turn, are affixed to the base 57 of the trip device by means of similar screws 69, as is shown particularly in Fig. 2. The cover supporting screws 67 are sealed in position by a suitable sealing means 71 during the manufacture of the trip device in order to prevent unauthorized persons from altering or tampering with calibration of the trip elements.

In order to provide for supervisory control of the apparatus and the circuits protected by the breaker a plurality of auxiliary switching means, each operable in response to movement of the contacts 17 from one position to the other, are provided. Each of these switching means comprises a single pole, double break auxiliary switch 75 normally biased by spring 76 (Fig. 7) away from the position shown in Fig. 2 toward the position shown in Fig. 3. Two of these switches 75 are mounted upon suitable bracket members 77 affixed to the outer side walls of the base 1 of the breaker and the other two switches 77 are mounted upon similar bracket members 79 bolted to the base 57 of the trip device so as to be removable therefrom without breaking the seal 71.

As part of the actuating means for these switches, a pair of link members 80 are rigidly affixed to the contact supporting frames 19 for the two outer poles of the breaker, and each of these link members 80 is mechanically connected to the actuating member 81 (Figs. 2 and 3) of one of switches 75 through a pair of insulating links 83 and one of the springs 85 or 87. Since the switches 75 are biased to the position opposite that shown in Fig. 2, i. e. to the position shown in Fig. 3, the opening of the contacts and the subsequent decrease in the tension upon the springs 85 and 87, which interconnect the switch actuating members 81 with the links 80 and 83 serves to permit the biasing means for the operating members to automatically move the

switches from the position shown in Fig. 2 and to the opposite position.

Each of the auxiliary switches 75 is preferably of the over-center spring, tumbler type in order that movement from one position to the other shall take place with a snap action, and each of the switches is provided with four screw terminals 89 for permitting it to be connected into an electrical circuit. Each terminal 89 is connected to one fixed contact 90 and the circuit is completed between opposite pairs of contacts 90 by means of the movable bridging contact 92.

It will thus be seen that the auxiliary switches 75 are automatically moved from one position to the other in response to the opening and the closing of the breaker contacts. They constitute, therefore, a convenient means for actuating position indicating relays or similar devices which may be employed in the control of the circuits or apparatus protected by the breaker. Being directly connected to the supporting frames 19 for the movable contacts 17, the operation of the auxiliary switches is entirely independent of the position of the operating handle and is effected solely in response to movement of the contacts.

The arrangement of these auxiliary switches 75 constitutes one of the important features of the invention. As mentioned above, the cooperating ribs and partitions 3 and 7 serve to divide the breaker closure into three separate chambers, one for each of the poles thereof. The contact means for each of the poles is disposed adjacent one end of one of these chambers. The base 57 of the trip device extends across the other end. The actuating mechanism 37 for the breaker occupies remaining space of the middle chamber and the auxiliary switches 75 are disposed in the outer chambers. Further, at least some of the auxiliary switches are mounted upon the base 57 of the trip device itself and are thereby removable as a unit with that device. Through this arrangement, the space within the breaker closure is utilized to the best possible advantage and an extremely flexible structure adapted to meet all possible operational requirements is effected.

The breaker illustrated particularly in Figs. 4 and 5 is somewhat similar in form and structural arrangement to the breaker previously described, and the trip device utilized in conjunction therewith is removable as a unit from operative engagement with the remaining portions of the breaker exactly as in the previously described structure. It is a three-pole breaker and the closure therefor comprises a base 101 of molded insulating material and a cooperating cover 102 also of molded insulating material. The base and the cover are provided with cooperating ribs and partitions 103 and 107 for defining a separate passage or chamber for each of the poles of the breaker. Three terminals 109, one for each pole, are mounted at the upper end of base 101 and three similar terminals 109 are mounted at the lower end of the base 101 for permitting the breaker to be connected into an electrical circuit.

The electrical circuit through each of the poles is very direct. A strap member 111 of conducting material rigidly affixed to the base 101 serves to support each of the stationary contact members 113 and to connect those members with the cooperating upper terminals 109. The movable contact 115 for each of the poles of the breaker is pivotally supported upon a suitable frame member 117 and is connected to one of 75

the upper terminals 119 of the trip device 121 by a flexible, laminated conductor 123. The circuit to the cooperating lower terminal 119 of the trip device 121 is completed within the structure of that device by a suitable conducting means 125. Each of the lower terminals 119 is directly connected to one of the lower terminals 109 of the breaker, thereby completing an electrical circuit through each of the poles.

The three supporting frames 117 for the movable contacts 115 are mechanically interconnected by a square tie rod 127 of insulating material and the entire assemblage is pivotally supported upon the frame 131 of the breaker operating mechanism 129 by a suitable pivot pin 133. Each of the movable contacts 115 is resiliently biased in the direction of the cooperating stationary contact therefor by a flat leaf spring 135.

The operating mechanism 129 for this breaker is of the type shown particularly in the patent of Harry J. Lingal, No. 2,047,739 which issued June 14, 1936 and which is assigned to the assignee of the present invention; it includes a pair of link members 137 and 139 pivotally connected to form a toggle linkage, an operating member 143, an overcenter spring 141 for connecting the operating member to the contact actuating linkage, in order to permit the actuating linkage to be moved from the normal closed circuit position shown in Fig. 6 to a collapsed open circuit position in response to movement of the operating member 143.

One end of the toggle linkage pivotally engages the interconnected switch members through a pin 144, and the other end is supported upon a cradle member 145 normally restrained in an operative position by the latch 147 associated with the trip device 121. Upon the operation of the trip device 121, this latch 147 moves to release the cradle member 145, and that member moves under the reaction force of the over-center operating spring 143 to the position shown in the dot and dash lines in Fig. 6. In this position, the toggle linkage is an unstable condition and is moved automatically to the collapsed position by the over-center operating spring, thereby moving the interconnected contact supporting frames 117 to the open circuit position.

The operating mechanism 129 thus has three positions, a normal open circuit, a normal closed circuit and a tripped position. In order to give complete supervisory control over such a structure, it is necessary to provide auxiliary switching means which are operable to actuate relays or similar position indicating means so as to indicate which of the three positions the breaker is in. According to the present invention, this objective is accomplished by the provision of two separate auxiliary switching means, one of which is actuated in response to movement of the contact means to the open and to the closed circuit position, and the other of which is actuated by movement of the cradle member, i. e. in response to operation of the trip device.

The first-mentioned of these auxiliary switching means comprises at least one snap acting tumbler switch 151 supported upon a suitable bracket member 153 affixed to the base 155 of the trip device, biased to the position shown in that figure, and operable in response to the movement of a mechanical linkage means to move to the other position. This linkage means is illustrated particularly in Figs. 4, 5, and 8 and in-

cludes a link 157 adapted to be supported upon a pivot pin 159 affixed to the outer end of the switch supporting bracket 153, and a spring 161 for mechanically connecting this link with the operating member 162 for the auxiliary switch 151. The unsupported end of this link member 157 is provided with an insulating roller 163 adapted to ride on the surface of one of the switch member frames 117, and when the assemblage formed by the interconnected frames is moved from the normal closed circuit position shown in Fig. 5 to the open circuit position indicated by the dot and dash lines of Fig. 5, the roller 163 rides along the upper surface of the left-hand frame 117 so as to move the link 157 from the position shown in full in Fig. 5 to the position shown by the dot and dash lines of that figure. In this latter position, the spring 161 is stressed sufficiently to overcome the biasing force normally exerted on the operating member 162 of the tumbler switch 151 and that switch is moved from the position shown in Fig. 5 to the opposite position.

It will be seen that the entire auxiliary switch means, including the operating means therefor, is entirely supported upon the base 155 of the trip device 121 and is removable as a unit with that device from the breaker closure. Thus a reliable and convenient means for indicating the position of the breaker contacts is provided and since the auxiliary switch and the actuating means therefor are entirely supported on the base 155 of the trip device external of the closure therefore, the arrangement may be embodied into existing equipment without any substantial change or alteration thereof.

The other auxiliary switching means comprises a pair of the snap acting tumbler switches 151 mounted upon a suitable bracket 165 which is affixed to the base 161 of the breaker. A liner 167 of insulating material, as is illustrated particularly in Fig. 7, is interposed between the bracket and the switches to aid in preventing grounding or short circuiting thereof. The actuating means for these switches comprise a rod member 169 of insulating material which is affixed to the unsupported end of the cradle 145. The rod member 169 moves in response to movement of the cradle from the normal operative position of that member indicated by the dot and dash lines of Fig. 7 to the tripped position indicated by the full lines of Fig. 7, and in so moving permits the biasing means for the operating members 162 of the switches to move the switches automatically from the normal position thereof to the position shown in Fig. 7.

It will thus be seen that the breaker just described is provided with auxiliary switching means operable to indicate which of the three operating positions the device may be in. The contact position indicating auxiliary switches constitute auxiliary structures which, since they are entirely mounted upon the base 155 of the removable trip device 121, may be readily embodied into existing forms of apparatus without any change or modification thereof. The other switching means which in reality indicates the position of the breaker actuating mechanism 129, is mounted directly upon the base of the breaker proper. This means also may be readily applied to existing breaker structures. In accordance with the objects of the invention, each of the two types of auxiliary switching means is so arranged that it may be disposed within those portions of the breaker closure not ordinarily

occupied by the contacts or the breaker actuating mechanism.

From the foregoing, it will be seen that my invention makes possible the embodying of auxiliary switching devices into substantially all of the known forms of circuit breaking equipment of the type under discussion. I have shown how these devices may be mounted either upon the base of the trip structure so as to be removable as a unit therewith, or upon the side walls of the breaker closure itself. I have disclosed operating linkages capable of effecting the actuation of these auxiliary switches in response to movement of the breaker contacts and the actuating means therefor regardless of whether the pivot point of the contact assemblage is disposed adjacent the position in which the switches must be mounted or whether it must be disposed at some distance therefrom. In each of the disclosed embodiments the auxiliary switch structures are arranged in accordance with the novel concepts of the invention in order to most effectively utilize the available space within the breaker closure, without decreasing the factor of safety or interfering with the normal operation of the breaker.

In accordance with the patent statutes I have disclosed the structural features of a number of the specific embodiments of my invention. It is to be understood, however, that these structural arrangements are merely illustrative and that variations in their precise form will be not only desirable but necessary in certain instances. I desire, therefore, that the language of the accompanying claims shall be accorded the broadest reasonable construction and that my invention shall be limited only by what is expressly stated therein and by the prior art.

I claim the following as my invention:

1. In a circuit interrupter, separable contact means for opening and for closing the main electrical circuit therethrough, actuating means for said main contact means mechanically connected thereto, said main contact actuating means having three positions, an open circuit, a closed circuit, and a tripped position, a plurality of auxiliary switching means, said auxiliary switching means being mechanically connected to be operated by said main contact actuating means, and at least one of said auxiliary switching means being operated when said main contact actuating means is moved to the open circuit and to the closed circuit position and at least one other of said auxiliary switching means being operated by an element of said main contact actuating means which moves only when said main contact actuating means is moved to the tripped position.

2. In a circuit interrupter, separable contact means for opening and for closing the electrical circuit therethrough, actuating means for said contact means operable in response to the movement of an operating member to move said contacts to an open and to a closed circuit position and operable in response to the movement of a trigger member movable only to move said contacts automatically to the open circuit position irrespective of the position of said operating member, a trip device for controlling the operation of said trigger member, a plurality of auxiliary switching means, and actuating means for said auxiliary switching means operable to effect the actuation of at least one of said switching means in response to the movement of said contact means to the open and to the closed circuit position and operable to effect the actuation of

at least one other of said switching means in response to movement of said trigger member.

3. In a circuit interrupter; separable contact means for opening and for closing the electrical circuit therethrough; actuating means for said contact means; a trip device operable upon the occurrence of predetermined conditions to cause said actuating means to move said contact means automatically to the open circuit position; said trip device having a plurality of snap acting auxiliary switches mounted thereon and removable therewith as a unit from operative engagement with the other elements of said interrupter; and means for effecting the actuation of said auxiliary switches in response to the movement of said contact means and said contact actuating means.

4. In a circuit interrupter, a base member, a cover means for cooperating therewith to define a closure for said interrupter, separable main contact means mounted on said base member and disposed within said closure, for opening and for closing the electrical circuit through said interrupter, actuating means for said interrupter mounted on said base member and within said closure, said actuating means being movable to three positions, a normal open circuit position; a closed circuit position, and a tripped open circuit position, a plurality of two position auxiliary switches also disposed within said closure and mechanical connections between said actuating means and said auxiliary switches for effecting the actuation of at least one of said switches when said actuating mechanism moves to any one of said three positions.

5. In a circuit interrupter, separable contact means for opening and for closing the electrical circuit therethrough, actuating means for said contact means, a trip device operable upon the occurrence of predetermined conditions to cause said actuating means to move said contact means automatically to the open circuit position, said trip device including, a base, electroresponsive tripping means for effecting the operation thereof, auxiliary switching means supported on said base, and actuating means for said auxiliary switching means likewise supported on said base, said last mentioned means effecting the operation of said auxiliary switching means in response to the operation of said interrupter, said trip device, including said auxiliary switching means and said actuating means therefor, being removable as a unit from operative engagement with the other elements of said interrupter.

6. In a trip device for a circuit interrupter, a sealed closure which includes a base member, electroresponsive tripping means disposed within said closure, and one or more snap-acting, two-position, auxiliary switches mounted on said base, outside said sealed closure, by means of suitable bracket members, said switches and the supporting brackets therefor being removable from said base without necessitating the opening of said sealed closure to permit the substitution therefor of similarly proportioned auxiliary control means.

7. In a trip device for a circuit interrupter, a base, a cover which cooperates with said base to define a closure for said trip device, electroresponsive tripping means disposed within said closure, and one or more auxiliary switching means mounted on said base, outside said closure, by means of suitable bracket means, said bracket means and the auxiliary switching means supported thereon being removable from operative engagement with said trip device, without

necessitating the opening of said closure, to permit the substitution therefor of other auxiliary means.

8. In a trip device for a circuit interrupter, a base, electro-responsive tripping means mounted on said base, an auxiliary switching means mounted on said base, by means of a suitable bracket, and actuating means for said auxiliary switch likewise mounted on said bracket; said trip device, said auxiliary switch, and said actuating means for said auxiliary switch comprising a unitary structure which may be readily placed into, or removed from, operative engagement with the other elements of a circuit interrupter.

9. In a circuit interrupter, a stationary contact, a pivotally supported switch member including a frame and a contact supported on said frame for cooperating with said stationary contact, actuating means for moving said switch member to open and to close the electrical circuit through said interrupter, and a trip device operable upon the occurrence of predetermined conditions to cause said actuating means to move said switch member automatically to the open circuit position, said trip device being mounted on a base, an auxiliary switch mounted on said base of the trip device, and means for effecting the operation of said auxiliary switch in response to movement of said switch member, said auxiliary switch actuating means comprising a member which is pivotally supported on said base and which is provided with a roller for directly engaging the frame of said switch member and means for operatively connecting said member with said auxiliary switch.

10. In a circuit interrupter, a stationary contact, a pivotally supported switch member including a frame and a contact supported on said frame for cooperating with said stationary contact, actuating means for moving said switch member to open and to close the electrical circuit through said interrupter, and a trip device operable upon the occurrence of predetermined conditions to cause said actuating means to move said switch member automatically to the open circuit position, said trip device including a base, a cover which cooperates with said base to define a closure for said device, and electro-responsive tripping means disposed within said closure, an auxiliary switch mounted on said base of the trip device without said closure, means for effecting the operation of said auxiliary switch in response to movement of said switch member, said auxiliary switch actuating means comprising an actuating member which is pivotally supported on said base and which is provided with a roller for directly engaging the frame of said switch member and means for operatively connecting said member with said auxiliary switch, and said trip device, said auxiliary switch and said auxiliary switch actuating means being removable as a unit from the other elements of said interrupter.

11. In a multi-pole circuit interrupter; a base; a cover for cooperating therewith to provide a closure for said interrupter; conducting means, including a plurality of pairs of separable contacts, one pair for each of a plurality of poles of said interrupter; means for dividing said closure into a plurality of separate chambers extending longitudinally of said base, one chamber being provided for each of said poles; the conducting means for each of said poles being disposed in one of said chambers and having line terminals at opposite ends of the base; a single

actuating means, disposed in one of said pole chambers, for actuating all of said pairs of separable contacts; one or more auxiliary switches at least one of which is disposed in one of the said pole chambers beside the pole chamber containing the actuating means; and means for effecting the actuation of said one or more auxiliary switches in response to the movement of said separable contacts and said contact actuating means.

12. In a multi-pole circuit interrupter; a base; a cover for cooperating therewith to provide a closure for said interrupter; conducting means including a pair of separable contacts adjacent one end of the base for each of the plurality of poles of said interrupter; means for dividing said closure into a plurality of separate chambers, one for each of said poles, said pole chambers being arranged side by side and extending longitudinally of said base; the conducting means for each of said poles being disposed in one of said chambers and having line terminals at the opposite ends of the base; a single actuating means, disposed in one of said pole chambers for actuating said plurality of pairs of said separable contacts; a trip mechanism mounted on said base and extending across a plurality of said pole chambers and responsive to the current in a plurality of the conducting means extending there-through; one or more auxiliary switches, at least one of which is disposed in one of the said pole chambers beside the pole chamber containing the actuating means; and means movable in said last mentioned pole chamber for effecting the actuation of said auxiliary switch in response to the movement of said separable contacts and said contact actuating means.

13. In a three-pole circuit interrupter; a base; a cover for cooperating therewith to provide a closure for said interrupter; conducting means, including three pairs of separable contacts, one pair being for each of the three poles of said interrupter; means for dividing said closure into three separate chambers, one for each of said poles, which are arranged side by side; the conducting means for each of said poles being disposed in one of said chambers; a single actuating means, disposed in the central pole chamber for actuating said three pairs of separable contacts; a plurality of auxiliary switches, at least one of which is disposed in each of the outer pole chambers; and means movable in each of said outer pole chambers for effecting the actuation of said auxiliary switches in response to the movement of said separable contacts and said contact actuating means.

14. In a multi-pole circuit interrupter, a base; a cover for cooperating therewith to provide a closure for said interrupter; conducting means, including a plurality of pairs of separable contacts, for defining the plurality of poles of said interrupter; means for dividing said closure into a plurality of separate chambers, one for each of said poles; the conducting means for each of said poles being disposed in one of said chambers; a single actuating means, which is disposed in one of said pole chambers, for said plurality of pairs of separable contacts, said actuating means being movable to three positions, an open circuit, a closed circuit, and a tripped position; a plurality of auxiliary switches disposed within said pole chambers; and means movable within said pole chambers to effect the actuation of at least one of said auxiliary switches when said

actuating mechanism moves to any one of said three positions.

5 15. In a circuit breaker, a pair of separable contacts for opening and closing the circuit through the circuit breaker, an actuating mechanism for said separable contacts, said actuating mechanism including an operating member movable to normally both open and close said separable contacts and a tripping member biased to move and cause opening of said separable contacts, current responsive means retaining said tripping means from movement by its biasing means when said contacts are normally actuated by said operating member to both open and closed positions, said current responsive means releasing said tripping means upon the occurrence of a predetermined electrical condition and causing opening of said separable con-

tacts, and an auxiliary switch mechanically operated by movement of said tripping member by its biasing means.

16. In a circuit interrupter; separable contact means for opening and for closing the electrical circuit therethrough; actuating means for said contact means; a trip device operable upon the occurrence of predetermined conditions to cause said actuating means to move said contact means automatically to the open circuit position; said trip device having an auxiliary switch mounted thereon and removable therewith as a unit from operative engagement with the other elements of said interrupter; and means for effecting the actuation of said auxiliary switch in response to the movement of the circuit interrupter.

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