Feb. 18, 1947. G. J. FREESE 2,416,169

CIRCUIT BREAKER

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Fig. 1.

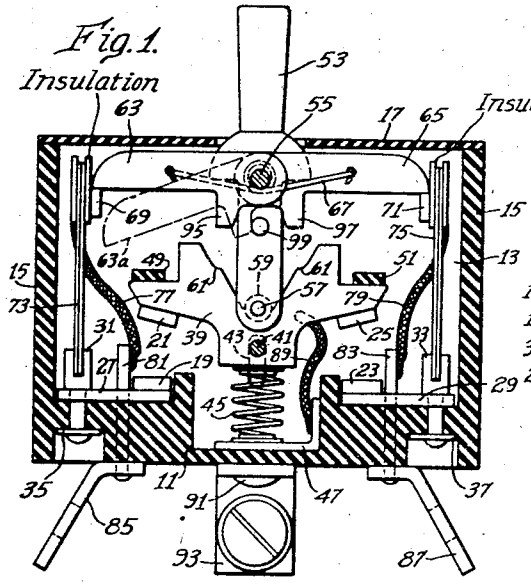


Fig. 2.

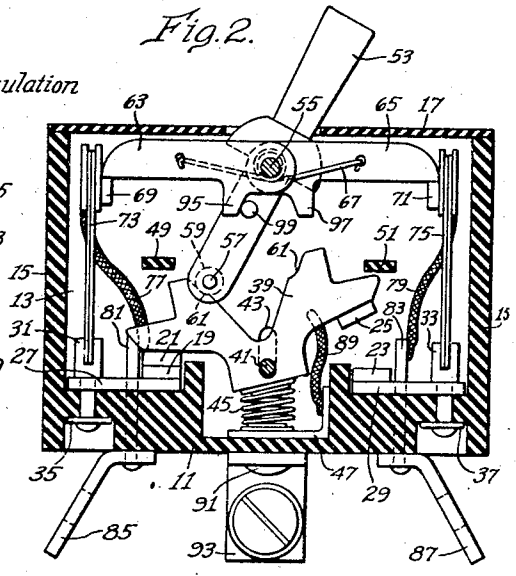
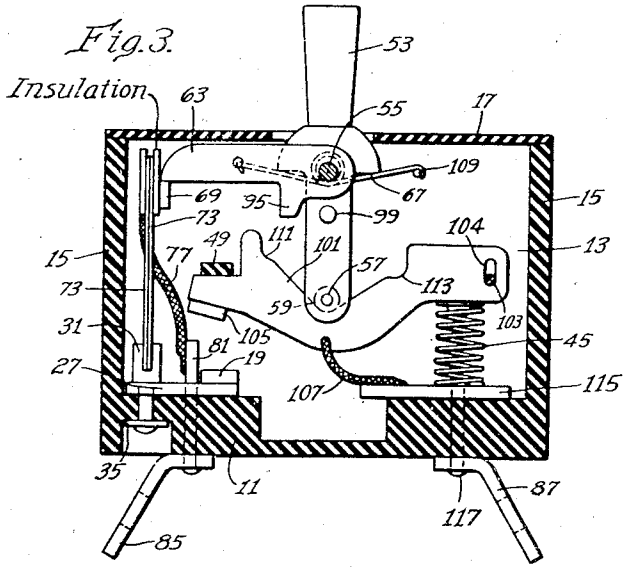


Fig. 3.



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CIRCUIT BREAKER

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This invention relates to circuit breakers and more particularly to manually and automatically operable circuit breakers for controlling and protecting electrical circuits.

An object of the invention is to provide a double-throw circuit breaker having contact means for controlling either of two circuits, and operating mechanism manually operable to selectively operate said contact means to open or close either circuit and automatically operable in response to predetermined overload currents to cause opening of the contact means.

Another object of the invention is to provide a double-throw circuit breaker having a releasable actuator for each pole, each of said actuators being independently and automatically operable to effect opening of its associated contacts in response to predetermined overload conditions.

Another object of the invention is to provide a double-throw circuit breaker having a manual operating handle operable to selectively close either of two sets of contacts, and having an individual overload tripping means including a spring biased releasable trip member associated with each set of contacts for tripping the breaker open in response to overload currents.

Another object of the invention is to provide a double-throw circuit breaker for selectively controlling either of two circuits, the breaker having independently mounted trip devices which control independently operable tripping members to effect automatic opening of related circuits in response to overload currents.

Another object of the invention is to provide a double-throw circuit breaker wherein a switch member is operable by a manual member to selectively close either one of two circuits, each of said circuits including a thermostatic element operable to effect automatic opening of its related circuit.

Another object of the invention is to provide a double-throw circuit breaker for selectively controlling a plurality of circuits wherein each circuit is provided with a related trip device and an actuator independently operable to effect automatic opening of the related circuit.

Another object of the invention is to provide an improved circuit breaker mechanism which can be made either a double-throw circuit breaker or a single-throw circuit breaker by substitution of few parts and without extensive changes in structure.

Another object of the invention is to provide a circuit breaker with novel operating mechanism having two positions at which the breaker contacts are closed, so that at one of the two closed positions the breaker contacts will be opened automatically in response to abnormal circuit conditions, and at the other closed position of the mechanism the breaker contacts are prevented from opening.

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Another object of the invention is the provision of a manually and automatically operable circuit breaker mechanism of compact and low-cost construction which is also usable in a single-throw circuit breaker.

Another object of the invention is to provide an improved circuit breaker construction that is simple, reliable in operation and relatively inexpensive to manufacture.

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

Figure 1 is a vertical sectional view of a circuit breaker constructed in accordance with the invention, the section being taken just inside one side wall of the breaker housing;

Fig. 2 is a vertical sectional view similar to Fig. 1, but showing the breaker in one of its closed positions; and

Fig. 3 is a view similar to Fig. 1 but showing a modification of the invention.

The circuit breaker is a double-throw circuit breaker and is mounted in a housing comprising a base section 11, having side walls 13 (only one being shown), and end walls 15. The housing is of one piece of molded insulating material and is provided with a cover plate 17 also of insulating material. One circuit of the breaker is controlled by a stationary contact 19 and a cooperating movable contact 21, and the other circuit is similarly provided with a stationary contact 23 and a cooperating movable contact 25. The stationary contacts 19 and 23, respectively are secured to conductors 27 and 29 which are in turn rigidly secured to the base 11 by means of shouldered members 31 and 33 of conducting material. The members 31 and 33 extend through openings in the base and have their ends riveted over washers 35 and 37, respectively.

The movable contacts 21—25 are rigidly secured to opposite ends of a movable switch member 39 having a pin 41 mounted therein whose

ends extend laterally into elongated slots 43 (only one being shown) formed in the side walls 13 of the housing. A coil spring 45 compressed between a conductor 47 secured to the base 11 and the switch member 39 biases the switch member to a central "off" position against a pair of stops 49 and 51 rigidly supported by the side walls 13. For operating the switch member 39 to close the contacts 19—21 or 23—25, there is provided an operating handle 53 pivotally mounted on a pivot pin 55 supported in the side walls 13 of the housing. The inner end of the handle 53 carries a pin 57 upon which is mounted an antifriction roller 59 engaging a V-shaped recess in the switch member 39.

The contacts 19—21 or 23—25 are closed by respectively rotating the handle 53 clockwise or counterclockwise from the "off" position (Fig. 1) to one or the other of the "on" positions depending upon the particular circuit it is desired to close. Assuming that it is desired to close the contacts 19—21, the handle is rotated clockwise to the position shown in Fig. 2. During this movement of the handle the roller 59, acting on the left hand edge of the V-shaped recess cams the switch member 39 in a counterclockwise direction about the pin 41 and at the same time moves the switch member toward the base of the breaker, the pin 41 sliding in the slot 43. Near the end of the clockwise movement of the handle, the contact 21 engages the stationary contact 19 and thereafter, during closing movement, the switch member 39 rotates slightly about the contacts as a fulcrum until the roller 59 engages a holding recess 61. As the roller is seated in the recess 61, the spring 45 biases the switch member 39 about the roller 59 in a direction to apply contact pressure to the closed contacts. As will be seen in Fig. 2, the spring 45 and the cooperation of the notch 61 and the roller 59 maintains the contacts 19—21 closed and the handle in the "on" position shown in Fig. 2. Movement of the handle 53 in the reverse or counterclockwise direction from the "off" position will close the contacts 23—25 in the manner described for closing the contacts 19—21 except that the movements of the parts are reversed.

The contacts are opened by merely flipping the handle 53 from either of its "on" positions toward the central "off" position. As soon as the roller 59 is disengaged from either notch 61, the outward pressure of the spring 45 moves the switch arm 39 outwardly and rotates it about the pivot 41 to the open position (Fig. 1). The side wall of the V-shaped recess cams the handle 53 to the "off" position wherein the roller 59 rests in the apex of the recess.

Means are provided for causing automatic movement of the switch member 39 to its open position from either one of the closed positions in response to an overload in whichever circuit is closed. These means include a pair of releasable actuators 63 and 65 pivotally supported on the pin 55 adjacent the handle 53. The actuators extend in opposite directions from the pin 55 and are biased in releasing direction by means of a coil spring 67 surrounding the pin 55 and having its ends hooked in suitable holes in the actuators. The actuators 63 and 65 are normally releasably restrained by engagement of their respective free ends with latch elements 69 and 71 mounted on but insulated from the free ends of corresponding bimetallic elements 73 and 75. The bimetallic elements 73 and 75 are rigidly mounted respectively in the members 31 and 33.

The bimetallic elements 73 and 75 are respectively connected by means of flexible shunt conductors 77 and 79 to conductors 81 and 83. The conductors 81 and 83 are shouldered and the narrow portions thereof extend through openings in the base 11, these conductors being spaced from and insulated from the conductors 27 and 29. The ends of the narrow portions of the conductors 81 and 83 also project through openings respectively in terminals 85 and 87 and are riveted over to rigidly secure the conductors 81 and 83 and the corresponding terminals 85 and 87 to the base. The switch member 39 is connected by means of a flexible shunt conductor 89 to the central conductor 47. The conductor 47 is rigidly secured to the base by means of a rivet 91 which also serves to secure an external line terminal 93 to the base.

The two electrical circuits through the breaker may be traced as follows: One circuit extends from the line terminal 93 through the rivet 91, conductor 47, flexible shunt conductor 89, switch member 39, contacts 21 and 19 when closed, conductor 27, member 31, bimetal element 73, flexible shunt conductor 77, conductor 81 to the load terminal 85. The other circuit extends from the line terminal 93, rivet 91, conductor 47, flexible shunt conductor 89, the switch member 39, contacts 25—23 when closed, conductor 29, member 33, bimetal element 75, flexible shunt conductor 79, and the conductor 83 to the other load terminal 87.

Upon the occurrence of an overload current in either of the circuits, depending upon the particular contacts 19—21 or 23—25 that are closed, the related bimetal element 73 or 75 will be heated by the overload current and when heated a predetermined amount deflects outwardly and releases the corresponding actuator 63 or 65. The spring 67 then drives the released actuator in a direction to engage a projection 95 or 97 on the released actuator with a pin 99 projecting laterally from the handle 53 to move the handle toward the central "off" position disengaging the roller 59 from the notch 61 in the switch member 39. The spring 45 thereupon acts to move the switch member 39 to the open position (Fig. 1) camming the handle to the "off" position.

The two bimetallic elements 73 and 75 may be arranged to release their respective actuators 63 and 65 at different values of overload current, if desired. For example, the double-throw circuit breaker of this invention may be used for controlling a lighting system arranged to give either bright or dim lighting. If, for example, the bright lights require 20 amperes and the dim lights only 10 amperes, the wire of the dim light circuit may be smaller than the wire of the bright light circuit, and each bimetallic element will be chosen to cause opening of the breaker when the safe current for its particular circuit is exceeded.

The released actuator 63 or 65 can be manually reset and relatched following an automatic opening operation and the contacts of the corresponding circuit manually closed by a single movement of the handle in the proper direction to close the contacts. For example, in Fig. 1 the actuator 63 is shown in dotted lines at 63*a* in the tripped-open position with the projection 95 resting against the pin 99. By rotating the handle 53 in a clockwise direction slightly beyond the closed contact position, the roller 59 effects closing of the contacts 19—21, in the previously described manner, and with the same movement of the handle, the pin 99 rotates the actuator 63 from the posi-

tion shown at 63a to the full-line position in which it is restrained by the latch 69. The actuator 65 is relatched in a similar manner by counterclockwise rotation of the handle to close the contacts 23—25.

The circuit breaker is adapted for assembly either as a double-throw breaker or as a single-throw breaker. According to the modification illustrated in Fig. 3, the stop 51 is omitted and a switch member 101 pivotally mounted on a pin 103 supported in the side walls 13 is substituted for the switch member 39 of the Fig. 1 embodiment. A slot 104 in the switch member surrounds the pin 103. The roller 59 and this handle 53 engages a V-shaped recess in the switch members 101 to actuate the switch member to closed positions. The switch member 101 carries a single movable contact 105 and is biased in opening direction by the spring 45. The line terminal 93, the flexible shunt conductor 89, the stationary contact 23 and its supporting conductor 29, the bimetal element 75, the flexible shunt conductor 79, and the right hand actuator 65 that were present in the original embodiment are also omitted. The spring 67 is hooked over a pin 109 at one end. The switch member 101 is connected to a conductor 115 by means of a flexible shunt conductor 107 and the conductor 115 is secured to the base 11 and electrically connected to the terminal 87 by means of a rivet 117. All other parts of the Fig. 3 modification are like the corresponding parts in the Fig. 1 modification and have been given corresponding reference numerals.

The circuit through the circuit breaker shown in Fig. 3 extends from the terminal 85 through the member 31, flexible shunt conductor 77, bimetal element 73, member 31, conductor 27, contacts 19—105 when closed, switch member 101, flexible shunt conductor 107, and conductor 115 to the terminal 87.

The operation of the Fig. 3 modification, assuming the breaker to be in the open position as shown, is as follows: In order to close the contacts 19—105 the handle 53 is rotated from its "off" position in a clockwise direction to the "on" position. During this movement the roller 59 on the inner end of the handle rotates the switch member 101 in counterclockwise or closing direction about the pivot pin 103, the spring 45 maintaining the bottom of the slot 104 in contact with the pin 103. Continued movement of the handle after the movable contact 105 engages the stationary contact 19 causes the switch member 101 to rotate slightly clockwise about the contacts as a fulcrum, the slot 104 moving downwardly over the pin 103, until the roller 59 on the handle is seated in a retaining notch 111. The contacts are now closed and contact pressure is applied by the spring 45 which now biases the switch member 101 counterclockwise about the roller 59 as a fulcrum.

The contacts are opened manually by moving the handle 53 to the "off" position which permits the spring 45 to move the switch arm to the open position. The contacts are opened automatically in response to overload currents in the circuit in the same manner described in connection with the Fig. 1 modification. When the bimetal element 73 is heated a predetermined amount by overload currents, it deflects and releases the actuator 63 which is then actuated by the spring 67 to disengage the roller 59 from the notch 111. Thereafter the spring 45 acts to move the switch member 101 to the open position and to move the handle 53 to its "off" position.

The mechanism can be manually reset and the contacts reclosed by moving the handle to the "on" position. This movement closes the contacts and at the same time returns the actuator back to its latched position.

In the Figure 3 modification of the invention the operating handle 53 can be moved counterclockwise to a "locked on" position to the left of the "off" position. This makes it possible to close the contacts and maintain them locked closed irrespective of the operation of the trip device and actuator 63, and without the necessity of manually holding the handle in the closed position.

When the handle 53 is moved in a counterclockwise direction from the "off" position, the roller 59 actuates the switch member 101 to close the contacts. At the end of the counterclockwise closing movement of the handle the roller 59 enters a retaining recess 113 where it retains the handle in the "locked on" position and maintains the contacts closed. With the handle in this position the actuator 63, when released in response to an overload current, will move idly until it strikes the stop 49, and will not displace the handle from the "locked on" position.

The contacts may be opened by movement of the handle to the "off" position. Movement of the handle from the "off" position to the "on" position closes the contacts and resets the actuator in the previously described manner.

From the foregoing description it will be apparent that there is provided in accordance with the Fig. 1 embodiment a very simple double-throw circuit breaker having a single operating member for selectively closing and opening one or the other of two circuits. Each of the circuits controlled by the breaker is provided with a trip device and a releasable actuator. Each of the trip devices is operable in response to overload current in its related circuit to effect operation of the corresponding actuator to thereby cause opening of the related circuit.

According to the Fig. 3 embodiment of the invention the operating mechanism has two positions at which the breaker contacts are closed, at one of the two closed positions the breaker contacts will be opened automatically in response to abnormal circuit conditions, and at the other closed position of the mechanism the breaker contacts are locked in the closed position irrespective of the load condition of the circuit.

Having described several embodiments of the invention in accordance with the patent statutes, it is to be understood that various changes and modifications may be made in the structural details thereof without departing from some of the essential features of the invention.

I claim as my invention:

1. A circuit breaker for selectively controlling a plurality of circuits, comprising a plurality of stationary contacts, a single switch member movable to selectively engage said stationary contacts to selectively close said circuits, manual means having a neutral "open" position and operable in either direction from said "open" position to closed position to move said switch member to selectively engage said stationary contacts, said plurality of stationary contacts and said single switch member all being substantially in line along the plane of movement of said manual means, a plurality of biased members each releasable to effect automatic opening of said contacts, a separate thermostatic element for each circuit heated in response to overload current in its cir-

cuit and normally restraining a corresponding one of said releasable members, each of said thermostatic elements being operable when heated a predetermined amount in response to overload current to release its associated releasable member to thereby effect movement of the switch member to open position.

2. A circuit breaker for selectively controlling either of two circuits comprising, two sets of contacts, a single contact actuating member movable to selectively close either set of contacts, manual means for moving said contact actuating member to selectively close said sets of contacts, a pair of biased members each being releasable to effect automatic opening movement of a corresponding set of said contacts, said releasable members and said contact actuating member all being substantially in line with the plane of movement of said manual means, a thermostatic element for restraining each of said releasable members, each of said elements being disposed to be individually heated in response to the current of its related circuit, and each of said thermostatic elements being operable when heated a predetermined amount to release the associated releasable member to effect opening of the corresponding set of contacts.

3. A circuit breaker for selectively controlling a plurality of circuits comprising a plurality of stationary contacts, a plurality of cooperating movable contacts, a floating switch member for supporting said movable contacts, manual means for moving said switch member from a neutral open position in either direction to closed position to selectively close said contacts, said manual means restraining said switch member in said closed position, a plurality of biased members each independently releasable to effect automatic opening of said contacts, a plurality of thermostatic elements, one associated with each of said releasable members, for restraining said releasable members, each of said thermostatic elements being disposed to be heated by the current of one of said circuits and operable when heated a predetermined amount to release its associated releasable member to thereby effect opening movement of the switch member.

4. A circuit breaker for selectively controlling a plurality of circuits comprising a plurality of sets of separable contacts, a floating switch member having a central open position and movable in either direction from said open position to closed position for selectively closing said circuits, an operating handle for moving said switch member to manually open and close said circuits, said handle being effective to restrain said switch member in the selected closed position, a plurality of biased members each releasable to cause said handle to release said switch member, a thermostatic element related to each circuit each of said elements being disposed to be heated by the current of its related circuit, each thermostatic element being operable when heated a predetermined amount to release the corresponding biased member.

5. A circuit breaker for selectively controlling a plurality of circuits comprising a plurality of stationary contacts, a switch member having a plurality of movable contacts mounted thereon for cooperating with said stationary contacts to close said circuits, means biasing said switch member to a neutral open position, an operating handle for moving said switch member in either direction from said open position to selectively engage the movable contacts with said stationary

contacts, said handle being engageable with portions of said switch member to releasably restrain the switch member in the selected closed position, releasable members movable in opposite directions when released to cause release of said switch member, and a separate current responsive trip device operable in response to overload currents in each circuit to release the corresponding releasable member.

6. A circuit breaker for selectively controlling a plurality of circuits comprising a set of separable contacts related to each circuit, a single contact actuating member movable from a neutral open position in either direction from said open position to selectively close said sets of contacts, operating mechanism for said contact actuating member including a handle for moving said switch member to selectively close either set of contacts, a plurality of biased members each operable when released to effect movement of said handle to cause automatic opening of said contacts, and a plurality of bimetal elements, there being a separate bimetal element heated in response to each of the circuits, said contact actuating member and said bimetal elements all being substantially in line with the plane of movement of said handle, and each of said bimetal elements being operable when heated a predetermined amount to release the associated biased member to thereby effect automatic opening of the related contacts.

7. A circuit breaker for selectively controlling a plurality of circuits comprising a set of separable contacts related to each circuit, a single switch member movable from a neutral open position in either direction from said open position to closed positions to selectively close said sets of contacts, operating mechanism for said switch member including a handle for moving said switch member to selectively close either set of contacts, a plurality of biased members each operable when released to effect movement of said handle to cause automatic opening of said contacts, and a plurality of bimetal elements, there being a separate bimetal element heated in response to each of the circuits, said sets of separable contacts and said separate bimetal elements all being substantially in line along the plane of movement of said handle, each of said bimetal elements being operable when heated a predetermined amount to release the associated biased member, and spring means for moving said switch from either closed position to the neutral open position.

8. A circuit breaker for selectively controlling a plurality of circuits comprising a plurality of sets of separable contacts, a switch member having a central open position, said switch member being movable from said open position in one direction to close one of said sets of contacts and movable in another direction from said open position to close the other set of contacts, manual means operable to move said switch member in either direction to selectively close said contacts, a plurality of actuators operable to effect movement of said manual means to cause automatic opening of said contacts, a current responsive element connected in each circuit and operatively related to the associated actuators, each current responsive element being responsive to the current of its related circuit and operable to release the related actuator to thereby effect opening of the corresponding set of contacts and all of said parts being substantially in line along the plane of movement of said manual means.

9. In a circuit breaker, the combination of stationary contact means, a switch member, movable contact means on said switch member for cooperating with said stationary contact means, releasable means for causing automatic opening of said contact means, current responsive means operable in response to abnormal conditions to release said releasable means, operating mechanism including an operating handle for opening and closing said contact means, said operating handle having two positions in which said contact means are closed, said handle when in one of said two positions maintaining said contacts closed irrespective of the current responsive means and being operable by said releasable means when in the other of said two positions to cause automatic opening of said contact means.

10. In a circuit breaker, the combination of relatively movable contact means, a switch member operable to open and closed positions for opening and closing said contact means, operating means for said switch member including an operating handle having two positions in which said switch member is in closed position, releasable means for engaging and operating said handle to effect automatic opening movement of said switch member, and thermostatic means operable in response to predetermined abnormal conditions to release said releasable means, said handle when in one of said two positions maintaining said switch member in closed position irrespective of operation of said releasable means and being operable by said releasable means when in the other of said two positions to cause automatic movement of said switch member to open position.

11. In a circuit breaker, the combination of stationary contact means, a single switch member, movable contact means on said switch member for cooperating with said stationary contact means, operating mechanism for said switch member including an operating handle having two positions in which the contact means are closed, actuating means pivoted coaxially with said handle and releasable to engage and operate said handle to cause automatic opening of said contact means, said stationary contact means and said single switch member and said actuating means all being substantially in line along the plane of movement of said handle, and thermostatic means operable in response to overload currents to release said actuating means, said handle when moved to close said contact means resetting the actuating means.

12. A circuit breaker for selectively controlling either one of two circuits comprising two sets of separable contacts, a single switch actuating member having a central open position and movable in either direction from said open position to closed positions for selectively closing said sets of contacts, an operating handle for moving said switch actuating member to manually open and close said sets of contacts, means for restraining said switch actuating member in the selected closed position, a plurality of releasable members operable to cause said restraining means to release said switch actuating member, said sets of separable contacts and said single switch actuating member and said plurality of releasable members all being substantially in line with the plane of movement of said operating handle, and a thermostatic element related to each circuit and disposed to be heated by the current of its related circuit, and each thermostatic element being operable when heated a predetermined amount to release the corresponding releasable member.

13. In a circuit breaker, the combination of stationary contact means, a switch member having a V-shaped cam thereon and provided with locking recesses, movable contact means on said switch member for cooperating with said stationary contact means, operating mechanism for said switch member including an operating handle having a central open position and having a roller thereon cooperating with said V-shaped cam, said handle having two positions in which the contact means are closed and in which the roller engages said locking recesses to restrain said switch member in closed position, spring means biasing said switch member to open position and through said switch member biasing said handle to said central open position said spring means also applying contact pressure when said contacts are closed, actuating means releasable to engage and operate said handle to cause automatic opening of said contact means, and electro-responsive means operable in response to overload currents to release said actuating means.

14. In a circuit breaker, the combination of relatively movable contacts, a switch member movable to open and close said contacts, said switch member being provided with a V-shaped cam having a locking recess at each end thereof, operating mechanism including an operating handle having an operating roller thereon engaging said cam, said handle having a central open position and movable to two positions to operate said switch member to close said contacts, said roller in each of said two positions engaging a locking recess to restrain said switch member and said handle in closed position, an actuating member releasable to engage and operate said handle to effect automatic opening of said contacts, and electro-responsive means operable in response to overload currents to release said actuating member.

15. In a circuit breaker, the combination of stationary contact means, a switch member having means for receiving a roller thereon, movable contact means thereon for cooperating with said stationary contact means, operating mechanism for said switch member comprising a pivoted operating handle, a roller carried by said handle cooperating with said switch member, spring means providing pressure engagement of said switch member and said roller, a releasable trip member biased to tripping position and operable when released to operate said handle and cause automatic opening of said contact means, and electroresponsive means normally restraining said trip member and operable in response to overload currents to release said trip member.

16. In a circuit breaker, the combination of stationary contact means, a floating switch member having a portion thereof formed to receive a roller, movable contact means thereon for cooperating with said stationary contact means, operating mechanism for said switch member comprising a pivoted operating handle, a roller carried by said handle cooperating with the formed portion of said switch member, spring means biasing said switch member to the open position and providing contact pressure when said switch member is closed, a releasable trip member biased to tripping position and operable when released to operate said handle and cause automatic opening of said contact means, and electro-responsive means normally restraining said trip

member and operable in response to overload currents to release said trip member, said handle when moved to close said contact means resetting said trip member.

17. In a circuit breaker, the combination of stationary contact means, a switch member having a V-shaped cam surface thereon, movable contact means on said switch member for cooperating with said stationary contact means, operating mechanism for said switch member comprising a pivoted operating handle, a roller on said handle cooperating with said V-shaped cam surface for moving said switch member to open and close said contact means, spring means for providing a pressure engagement of said roller with said V-shaped cam surface and for providing contact pressure when said contact means is closed, actuating means pivoted coaxially with said

handle and releasable to operate said handle to effect automatic opening of said contact means, spring means biasing said actuating means to operated position, and current responsive means normally restraining said actuating means and operable in response to overload currents to release said actuating means.

GERALD J. FREESE.

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