

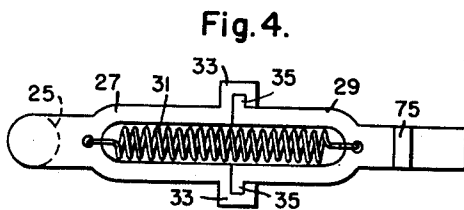
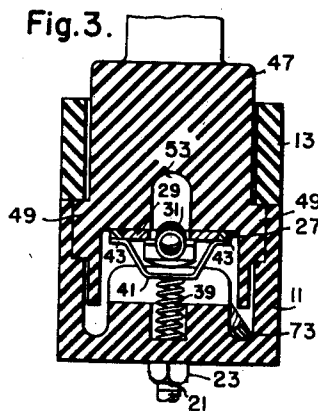
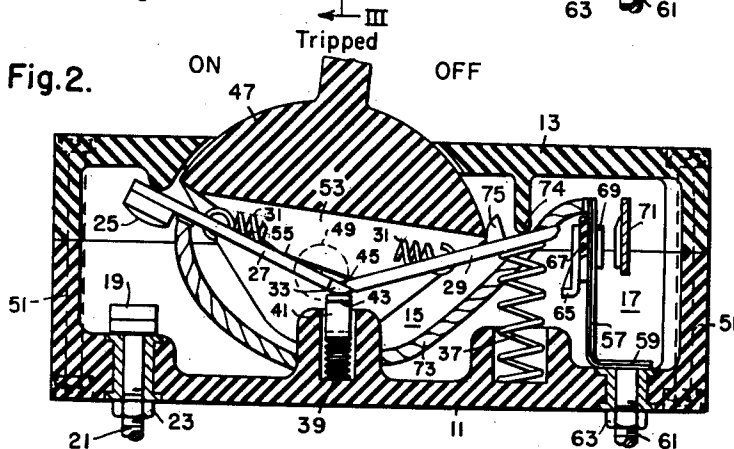
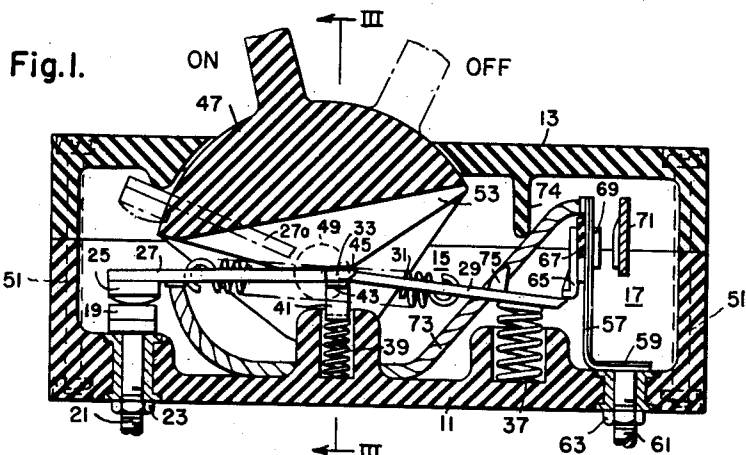
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CIRCUIT BREAKER

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WITNESSES:

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CIRCUIT BREAKER

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This invention relates to circuit breakers and more particularly to circuit breakers which are manually operable to open and close the circuit and which are automatically operated to open the circuit in response to abnormal circuit conditions.

An object of the invention is to provide a circuit breaker in which a contact member and a releasable member are disposed end to end to form a toggle, the knee of which toggle is movable over center to effect opening and closing of the circuit.

Another object of the invention is to provide a circuit breaker according to the preceding paragraph, in which the toggle formed by the contact carrying member and the releasable member is manually operated to open and close the circuit.

Another object of the invention is to provide a circuit breaker in which a switch arm and a releasable member are disposed end to end with an overcenter spring connected therebetween, the members forming a toggle which is movable over center to open and close the circuit.

Another object of the invention is to provide an improved circuit breaker which requires a minimum number of parts.

Another object of the invention is to provide an improved circuit breaker construction that is simple, reliable in operation and 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 one form thereof, when read in conjunction with the accompanying drawing.

In said drawing:

Figure 1 is a vertical sectional view of a circuit breaker embodying the principles of the invention, the circuit breaker being shown in the closed position,

Fig. 2 is a view similar to Fig. 1 but showing the circuit breaker in the tripped open position,

Fig. 3 is a vertical sectional view taken on line III—III of Fig. 1 and looking in the direction indicated by the arrows, and

Fig. 4 is a detail plan view of the operating toggle and the overcenter spring.

Referring to the drawing, the circuit breaker comprises generally a base 11 and a cover 13 of molded insulating material, operating mechanism indicated generally at 15 and a trip device

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indicated generally at 17. A stationary contact 19 is mounted on the inner end of a terminal 21 which extends through an opening in the base 11 and is secured thereto by means of a nut 23 threaded into the terminal.

A cooperating movable contact 25 is carried on a movable switch member 27 which, together with a releasable member 29, forms an operating toggle. An overcenter spring 31 is connected under tension between the switch member 27 and the releasable member 29 as is more clearly shown in Fig. 4. The members 27 and 29 are bifurcated at their inner ends and the overcenter spring 31 is disposed between the legs of each of the members, as shown in Fig. 4.

Formed outwardly from the right-hand end of the switch member 27 are projections 33 having pivot recesses formed therein for receiving trunnions 35 on the releasable member 29 to form a knee pivot for pivotally connecting the two toggle members 27 and 29 together. The releasable member 29 of the toggle is releasably restrained by the trip device 17 and is biased for movement by means of a spring 37 compressed between the releasable member 29 and a spring seat in the base 11. The knee of the toggle 27—29 is biased to an overset position by means of a spring 39 compressed between a spring seat in the base 11 and a U-shaped member 41, the legs of which are formed outwardly and terminate in ears 43 with bias upwardly against the knee of the toggle. This biases the knee of the toggle 27—29 upwardly against eccentric portions 45 of a manual operating handle 47. The handle is constructed of insulating material and is provided with trunnions 49 disposed in bearing recesses in the side walls of the base 11 to pivotally support the handle. The handle is held in place against the bias of the springs 39 and 37 by the side walls of the cover 13 which is secured to the base 11 by any suitable means such, for instance, as bolts 51. The handle 47 has a channel 53 therethrough to accommodate the overcenter spring in the open position of the toggle 27—29.

The circuit breaker is opened manually by clockwise movement of the handle 47 from the "on" position to the "off" position shown in dot and dash lines in Fig. 1. During this movement of the handle 47, the eccentric portions 45 thereof move the knee of the toggle downwardly against the bias of the spring 39. As soon as the knee of the toggle passes below the center line of the overcenter spring 31, which normally biases the switch arm 27 to close position, the force of the

spring 31 biases the switch member 27 clockwise about the knee of the toggle and suddenly snaps the switch member 27 to the open position in which it is shown in dot and dash lines at 27a in Fig. 1. The releasable member 29 remains latched during a manual operation.

The contacts are closed by reverse movement of the handle 47, that is, counterclockwise from the "off" to the "on" position. During this movement of the handle, second eccentric portions 55 of the handle engage the switch member 27 and move it toward the closed position. At the same time, the eccentric portions 45 move away from the knee of the toggle which, under the influence of the spring 39 moves upwardly with the eccentric portions 45. At a predetermined time during the closing movement, the knee of the toggle passes above the line of action of the overcenter spring 31 whereupon the spring acts to move the switch member 27 to the closed position with a snap action.

The circuit breaker is tripped open automatically in response to overload currents by means of the strip device 17. The trip device comprises a bimetal element 57 having a mounting foot 59 formed thereon mounted on the inner end of a terminal 61 extending through the base 11 and secured thereto by means of a nut 63. A latch 65 is mounted on the bimetal element 57 but is insulated therefrom by a piece of insulating material 67. Also mounted on the bimetal element 57 is an armature 69 for cooperating with a fixed magnet yoke 71 rigidly supported in the side walls of the housing. The upper end of the bimetal element 57 is connected by means of a flexible conductor 73 to the switch member 27 adjacent to the movable contact 25.

The circuit breaker is tripped open in response to overload currents below a predetermined value of, for instance, 10 times normal rated current. Upon the occurrence of such an overload current, the bimetal element 57 becomes heated, and, when heated a predetermined amount, bends toward the right causing the latch 65 to release the releasable member 29 whereupon the spring 37 immediately snaps the releasable member to the position in which it is shown in Fig. 2 against a stop 74. During this movement, the releasable member 29 pivots about the knee of the toggle 27—29 and carries the right-hand end of the spring 31 over center above the knee of the toggle, whereupon the force of the spring biases the switch member 27 in opening direction and moves it to the open position with a snap action. As the switch member 27 moves to the open position, it rotates the handle 47 to an intermediate indicating position as shown in Fig. 2 which illustrates the parts of the breaker in the tripped open position.

Before the contacts may be closed following an automatic opening operation, it is necessary to reset and relatch the releasable member 29 of the operating toggle. This is accomplished by moving the handle 47 clockwise to the full "off" position during which movement the handle engages and moves the releasable member 29 clockwise about the knee of the toggle. Near the end of the resetting movement the end of the releasable member wipes by the latch 65 slightly bending the bimetal element 57 which then springs back to its normal position with the latch 65 in the restraining position. The contacts are then closed in the previously described manner by counterclockwise movement of the handle to the "on" position.

When an overload current above the predetermined value of 10 times normal rated current

on a short circuit current occurs, the electromagnetic means 69—71 is energized sufficiently to cause the magnet yoke 71 to attract and move the armature 69. This causes bending of the bimetal element 57. This effects release of the releasable member 29 and instantaneous opening of the breaker. The mechanism is reset and the contacts are closed following an instantaneous tripping operation in the manner previously described.

Means is provided to maintain the proper latch overlap during a resetting operation. As the latch end of the releasable member 29 wipes by the latch 65 during a resetting operation, the force of the bimetal element might cause the toggle 27—29 to slide toward the left which, upon relatching, would decrease the latch overlap and thus change the calibration of the trip device. To overcome this tendency, a projection 75 on the releasable member 29 is engaged by the handle 47 to prevent leftward movement of the releasable member 29 during the resetting and relatching movement.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications in the structural details thereof may be made without departing from some of the essential features of the invention.

I claim as my invention:

1. A circuit breaker comprising relatively movable contact means, a switch member movable to effect opening and closing of said contact means, a releasable member having one end pivotally connected to one end of said switch member, said switch member and said releasable member forming a toggle, an overcenter spring connected to said switch member and to said releasable member, an operating handle movable to an "on" and to an "off" position for effecting manual opening and closing of said contact means, spring means biasing the knee of said toggle against said handle, and said handle when moved to said "off" position moving the knee of said toggle over center to permit said overcenter spring to move said switch member to open position.

2. A circuit breaker comprising relatively movable contact means, a toggle comprising a switch member for opening and closing said contact means and a releasable member operable when released to effect opening movement of said switch member, means pivotally connecting said switch member and said releasable member to form a knee pivot for said toggle, an overcenter spring for operating said toggle, a manual operating handle, spring means biasing the knee pivot of said toggle against said operating handle, cam means on said handle operable when said handle is moved to the "off" position to engage and move the knee pivot of said toggle over center to permit said overcenter spring to move said switch member to open position, and said handle when moved to the "on" position engaging and moving said switch member to the closed position.

3. A circuit breaker comprising relatively movable contacts, a toggle comprising a switch member and a releasable member operable to open and close said contacts, means forming a knee pivot for said toggle pivotally connecting said switch member and said releasable member, an overcenter spring connected under tension between said switch member and said releasable member and normally biasing said switch member closed, an operating handle movable to an "on" and an "off" position and having a cam

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surface thereon, spring means biasing the knee pivot of said toggle to an overset position in engagement with said cam portion, said handle when moved to said "off" position causing said cam portion to move the knee pivot of said toggle over center against the bias of said spring to permit said overcenter spring to move said switch member to open position.

4. A circuit breaker comprising relatively movable contacts, a toggle comprising a switch member and a releasable member operable to open and close said contacts, trip means releasably restraining said releasable member and operable to release said releasable member, means forming a knee pivot for said toggle pivotally connecting said switch member and said releasable member, an overcenter spring connected under tension between said switch member and said releasable member and normally biasing said switch member closed, an operating handle being movable to an "on" and an "off" position and having a cam surface thereon, a first spring means biasing the knee pivot of said toggle to an overset position in engagement with said cam portion, said handle when moved to said "off" position causing said cam portion to move the knee pivot of said toggle over center to permit said overcenter spring to move said switch member to open position, and a second spring means operable upon release of said releasable member to cause operation of said toggle and automatic opening of said contact means.

5. A circuit breaker comprising stationary and movable contacts, a pair of members pivotally connected to form a toggle operable to open and close said contacts, an overcenter spring for operating said toggle, one of said toggle members having said movable contact mounted thereon for cooperating with said stationary contact, an operating handle movable to an "on" and to an "off" position, biasing means biasing said toggle to an overset position in engagement with said handle, said handle when moved to said "off" position moving said toggle over center to effect opening of said contacts, trip means releasably restraining the other of said toggle members and operable to release said other toggle member, and spring means operable upon release of said other toggle member to cause automatic operation of said toggle and opening of said contacts.

6. A circuit breaker comprising stationary and movable contacts, a pair of members pivotally connected to form a toggle operable to open and close said contacts, an overcenter spring for operating said toggle, one of said toggle members having said movable contact mounted thereon for cooperating with said stationary contact, an operating handle movable to an "on" and to an "off" position, biasing means biasing said toggle to an overset position with the knee of said toggle in engagement with said handle, said handle when moved to said "off" position moving the knee of said toggle over center to effect opening of said contacts, trip means including a latch engaging and releasably restraining the other of said toggle members and operable to release said other toggle member, and spring means operable upon release of said other toggle member to cause automatic operation of said toggle and opening of said contacts, said handle when moved to said "off" position engaging and resetting said other toggle member, and means on said other toggle member engageable by said handle to position said other toggle member relative to said latch.

7. A circuit breaker comprising an enclosing

housing, stationary and movable contacts, a toggle comprising a pair of members pivotally connected and extending longitudinally in said housing, one of said toggle members carrying said movable contact, an overcenter spring connected between said toggle members normally biasing said contacts closed, an operating handle separate from said toggle and movable to an "off" and to an "on" position, spring means biasing said toggle to an overset position into engagement with said handle, movement of said handle to said "off" position moving the knee of said toggle over center to effect operation of said toggle by said overcenter spring and opening of said contacts.

8. A circuit breaker comprising an enclosing housing, stationary and movable contacts, a toggle comprising a contact carrying member and a releasable member pivotally connected together and disposed substantially longitudinally in said housing, an overcenter spring connected between said toggle members for operating said toggle, biasing means biasing said toggle to an overset position, an operating handle movable to an "on" and to an "off" position and having a pivot disposed adjacent the point of connection of said toggle members, said handle normally limiting the overset position of said toggle and operable when moved to said "off" position to move said toggle over center and permit said overcenter spring to operate said toggle and open said contacts, trip means releasably restraining said releasable toggle member and operable in response to abnormal circuit condition to release said releasable toggle member, and spring means operable upon release of said releasable toggle member to cause automatic overcenter movement of said toggle and automatic opening of said contacts.

9. A circuit breaker comprising an enclosing housing, stationary and movable contacts, a toggle comprising a contact carrying member and a releasable member pivotally connected together and disposed substantially longitudinally in said housing, an overcenter spring connected between said toggle members for operating said toggle, biasing means biasing said toggle to an overset position, an operating handle movable to an "on" and to an "off" position and having a pivot disposed adjacent the point of connection of said toggle members, said handle normally limiting the overset position of said toggle and operable when moved to said "off" position to move said toggle over center and permit said overcenter spring to operate said toggle and open said contacts, trip means releasably restraining said releasable toggle member and operable in response to abnormal circuit condition to release said releasable toggle member, and spring means operable upon release of said releasable toggle member to cause automatic overcenter movement of said toggle and automatic opening of said contacts, and said toggle members upon automatic overcenter movement of said toggle engaging and moving said handle to an intermediate indicating position.

10. A circuit breaker comprising relatively movable contacts, a switch member having one end supported on a laterally movable pivot and movable about said pivot to open and close said contacts, a releasable member, an overcenter spring connected between said switch member and said releasable member, a pivoted operating handle having a pivot disposed adjacent the laterally movable pivot for said switch member and

movable to an "on" and to an "off" position, a spring biasing the laterally movable pivot of said switch member against said handle, said handle when moved to the "off" position moving the laterally movable pivot for said switch member overcenter relative to said overcenter spring to permit said overcenter spring to move said switch member to open position, and a portion of said handle upon movement thereof to the "on" position engaging and moving said switch member to the closed position.

11. A circuit breaker comprising relatively movable contacts, a switch member having one end pivoted on a laterally movable pivot and the other end movable about said pivot to open and close said contacts, a releasable member, an overcenter spring connected between said switch member and said releasable member, a pivoted operating handle having an eccentric portion adjacent its pivot, a spring biasing the laterally movable pivot of said switch member against said eccentric portion of said handle, said handle when moved to the "off" position moving the laterally movable pivot of said switch member overcenter to permit said overcenter spring to move said switch member to open position, and a portion of said handle upon movement thereof to the "on" position engaging said switch member at a point near said other end to move said switch member to closed position.

12. A circuit breaker comprising relatively movable contacts, a switch member having one end supported on a laterally movable pivot and the other end movable about said pivot, said switch member being movable to open and close said contacts, a releasable member, a trip device releasably restraining said releasable member, said releasable member being positioned opposite the pivoted end of said switch member in the closed position of said breaker, an overcenter spring connected between said switch member and said releasable member, a pivoted operating handle movable to an "on" and to an "off" position having a cam portion disposed adjacent the pivot thereof, a spring biasing said laterally movable pivot of said switch member against said cam portion, movement of said operating handle to said "off" position causing said cam portion to move the laterally movable pivot of said switch member overcenter to permit said overcenter spring to move said switch member to

open position, said trip device being operable in response to overload currents to release said releasable member, and spring means operable upon release of said releasable member to actuate said releasable member and cause automatic opening movement of said switch member.

13. A circuit breaker comprising relatively movable contacts, a switch member having one end pivotally supported on a laterally movable pivot, said switch member being movable about said laterally movable pivot to open and close said contacts, a releasable member, a trip device releasably restraining said releasable member, said releasable member being positioned opposite the pivoted end of said switch member in the closed position of said breaker, an overcenter spring connected between said switch member and said releasable member, a pivoted operating handle movable to an "on" and to an "off" position having a cam portion disposed adjacent the pivot thereof, a spring biasing said laterally moving pivot of said switch member against said cam portion, movement of said operating handle to said "off" position causing said cam portion to move the laterally movable pivot of said switch member overcenter to permit said overcenter spring to move said switch member to open position, said trip device being operable in response to overload currents to release said releasable member, spring means operable upon release of said releasable member to actuate said releasable member and cause automatic opening movement of said switch member, and said handle having spaced portions thereon, one of said portions being engageable with said releasable member to reset said releasable member and the other of said portions being engageable with said switch member to move said switch member to closed position.

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