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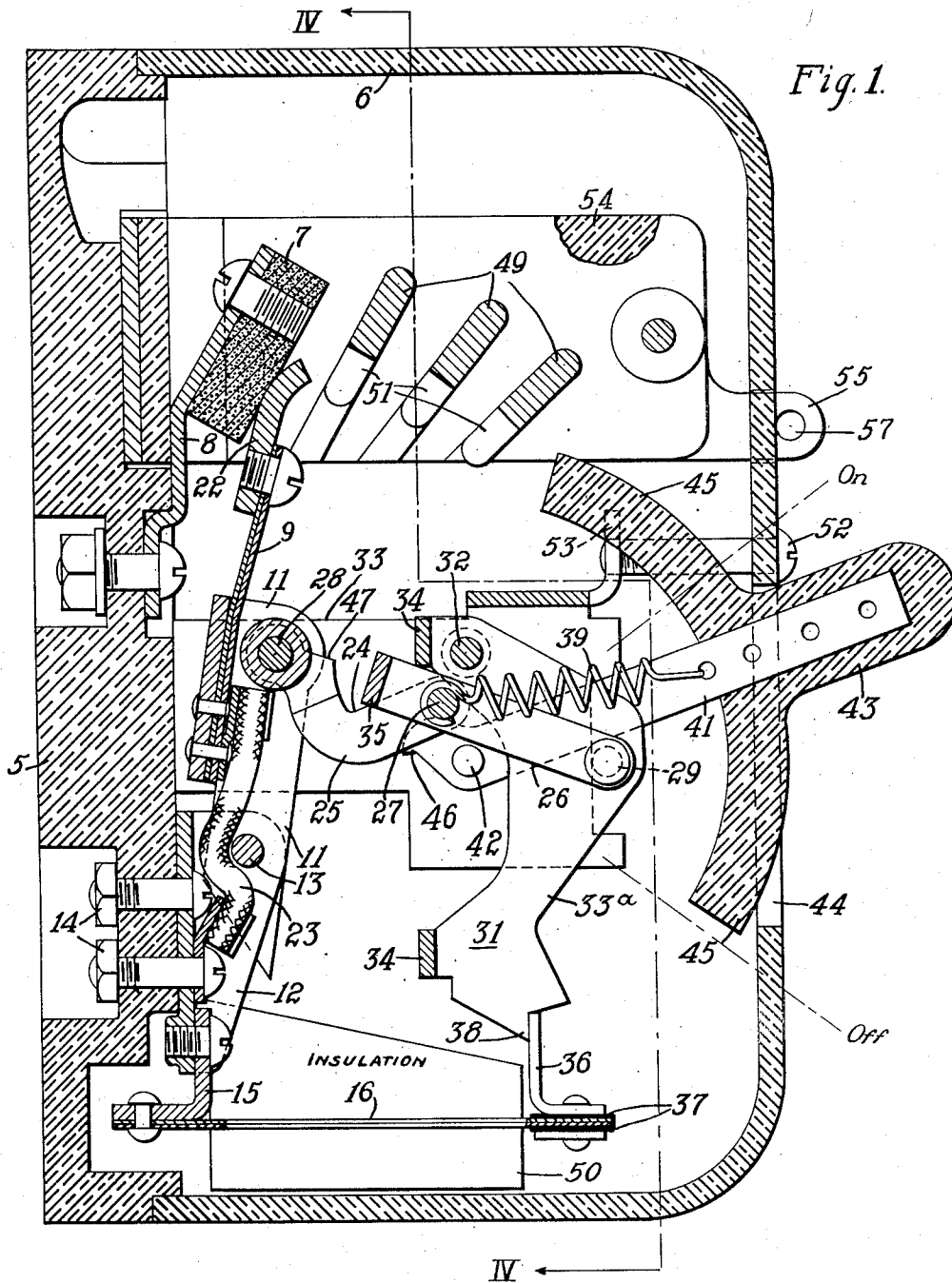
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1,786,796

CIRCUIT BREAKER

Filed Aug. 11, 1927

4 Sheets-Sheet 1



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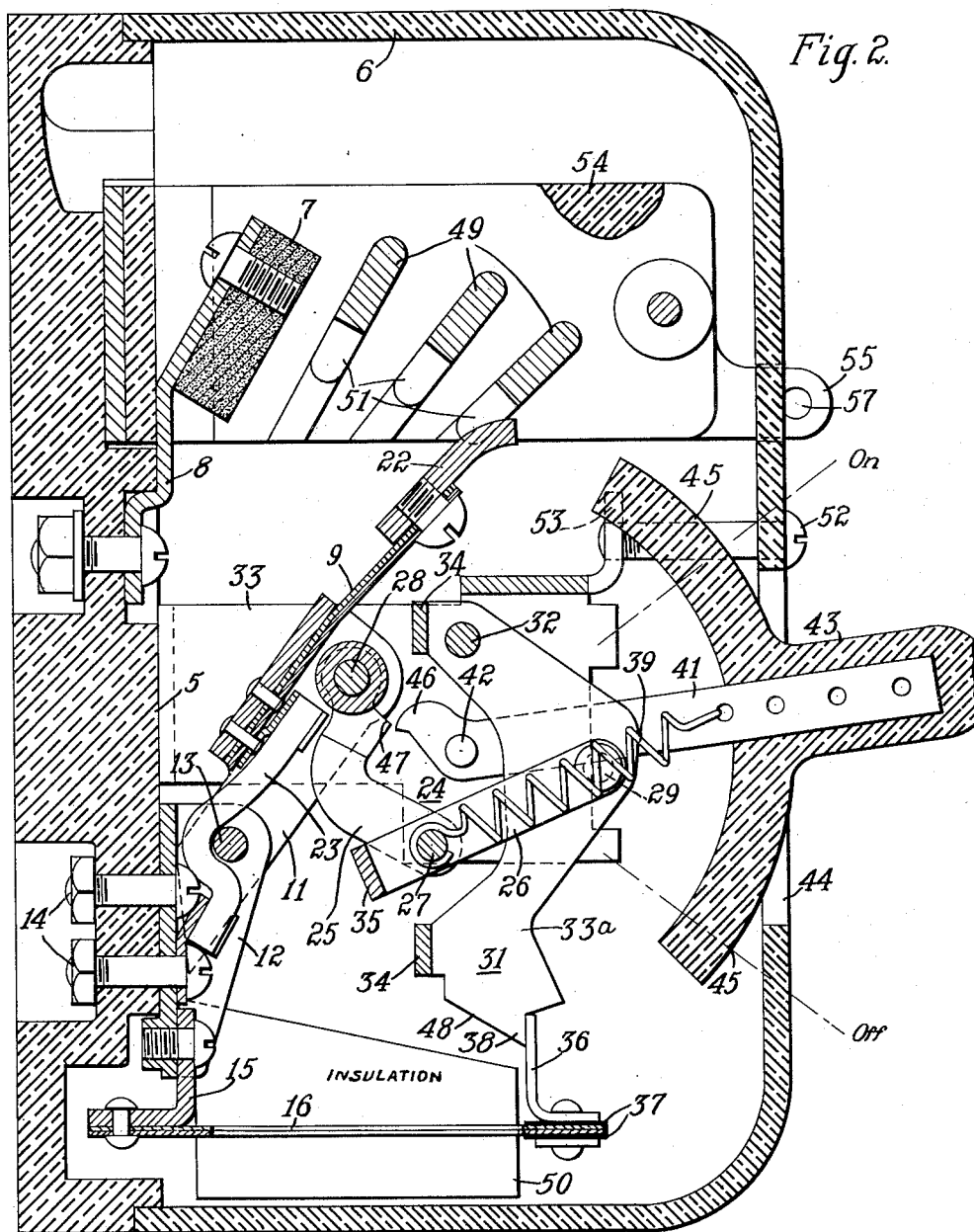
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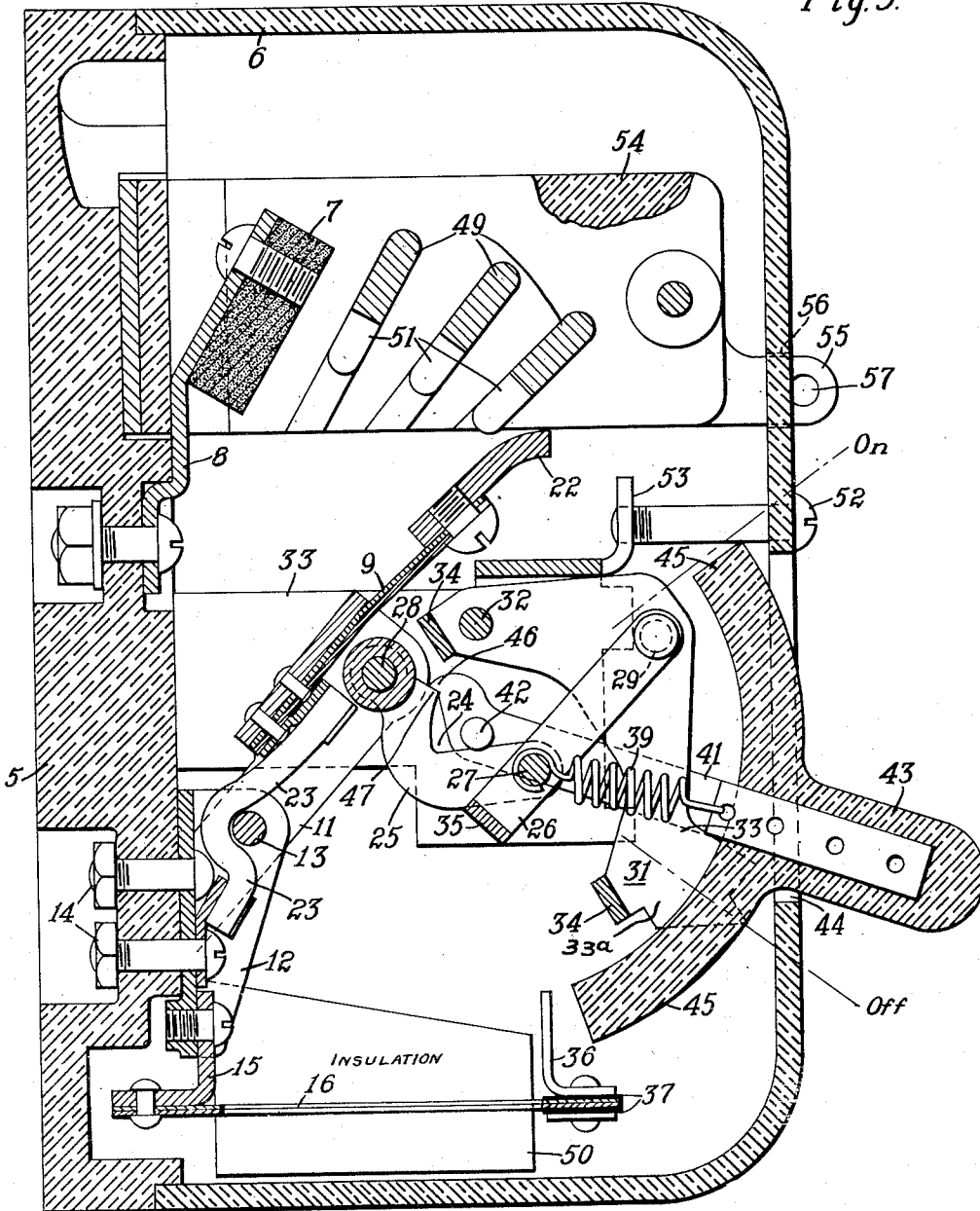
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Fig. 3.



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CIRCUIT BREAKER

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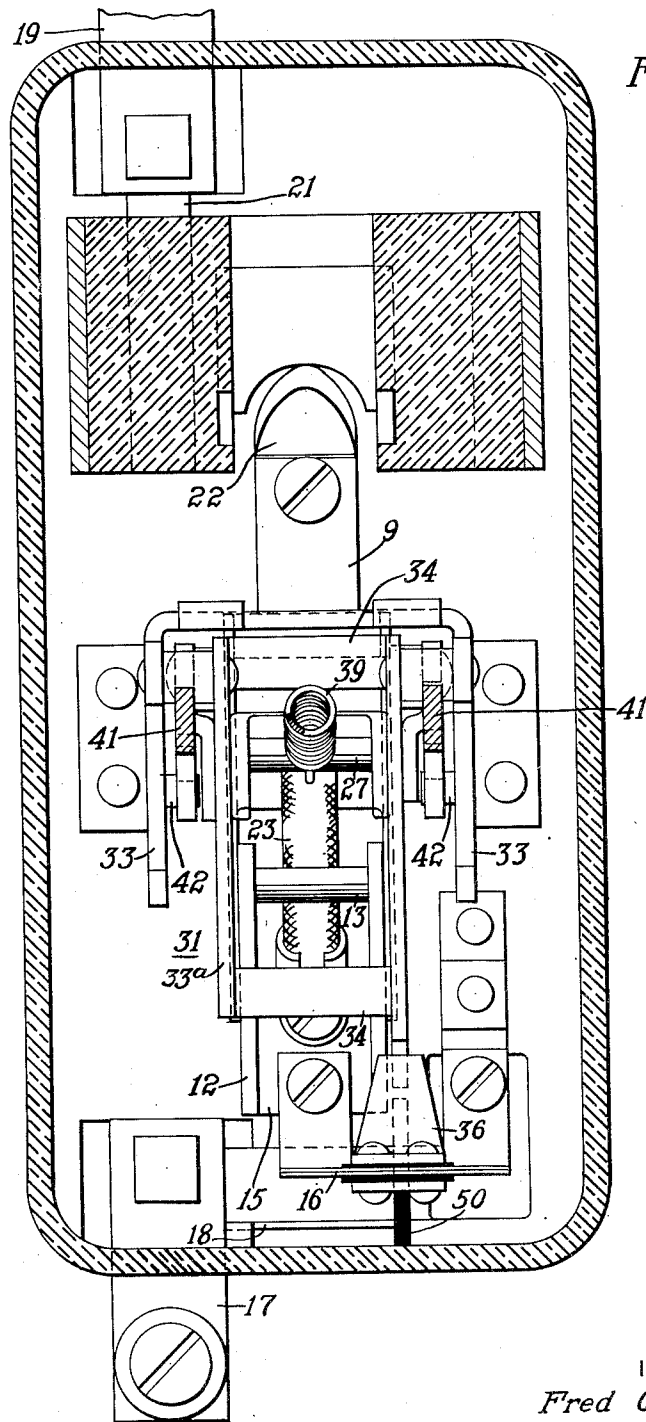


Fig. 4.

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CIRCUIT BREAKER

Application filed August 11, 1927. Serial No. 212,288.

My invention relates to circuit breakers and particularly to automatic circuit breakers for use in controlling house and apartment lighting circuits. Heretofore, it has been customary to provide an enclosed entrance switch and a fuse for controlling the main circuit of the house lighting circuit, or in the case where a distributing panel is used, a main switch and a plurality of branch line switches and fuses were provided.

An object of my invention is to provide a circuit breaker that will take the place of the usual entrance switch and fuse or main panel switch and the branch line fuses. In the case of a distributing panel a main circuit breaker will be provided in a housing and the branch circuits are controlled by circuit breakers of smaller capacity than the main circuit breaker thereby eliminating the fuses from the circuit, the circuit breaker, in each case, being of such character that it will interrupt the circuit under overload and short circuit conditions and which enables restoration of the circuit by a simple movement of the operating handle.

Another object of my invention is to provide a circuit breaker that opens the circuit automatically under overload and short circuit conditions and which has a trip-free operating handle.

Another object of my invention is to provide a circuit breaker wherein the movable contact is held in engagement with the stationary contact by a toggle, thereby causing the contact to be maintained in closed position under a relatively great pressure.

A further object of my invention is to provide a circuit breaker having the above-noted characteristics wherein the toggle is supported upon a movable carrier that is retained in set or operative position by a current responsive element that releases the carrier to cause separation of the contacts in response to overload and short circuit conditions.

A further object of my invention is to provide a circuit breaker wherein the movable contact is actuated by a toggle that moves the contact to open position when the toggle is collapsed and wherein the toggle is sup-

ported in such manner that it is moved bodily under short circuit and overload conditions to cause separation of the contacts prior to the collapse of the toggle thereby obtaining instantaneous and rapid separation of the contacts without moving through a point where the contact pressure is materially reduced prior to actual separation of the contacts, as is the case with the usual toggle or over-center spring actuated contact member.

A further object of my invention is to provide a circuit breaker wherein the contacts are separated at relatively high velocity and wherein the contacts are separated a greater distance under overload or short circuit conditions than is necessary for normal opening and closing of the circuit.

A further object of my invention is to provide a circuit breaker wherein arc quenching barriers are provided for extinguishing the arc, thus increasing the rupture capacity of the circuit breaker.

These and other objects that will be made apparent throughout the further description of my invention are attained by the circuit breaker apparatus hereinafter described and illustrated in the accompanying drawing wherein:

Figure 1 is a vertical section through a circuit breaker embodying features of my invention showing certain details in side elevation and the parts in closed position.

Fig. 2 is a vertical sectional view similar to that of Fig. 1 showing the circuit breaker contact in open position,

Fig. 3 is a vertical sectional view similar to that of Fig. 1 showing the parts in the full open position which they occupy as a result of an overload or short circuit condition, and

Fig. 4 is a transverse section through the circuit breaker apparatus taken on the broken line IV—IV of Fig. 1.

Referring to the drawings the apparatus includes an insulating base 5 that is provided with an insulating cover 6 for enclosing the circuit breaker apparatus that is mounted upon the base 5. The circuit breaker comprises a stationary contact 7 that is secured to the terminal 8 mounted on the insulating base. A movable switch arm 9 of resilient ma-

terial, such as laminations of phosphor bronze, is attached to a bracket 11 that is pivoted to a clip 12 by means of a pivot shaft 13, the clip 12 being secured to the insulating base by bolts 14. The clip 12 also serves to support a terminal 15 which carries a bimetal element 16 of U-shape, one leg of the bimetal element 16 being connected to a terminal strap 17 through the medium of a connector strap 18. The contact terminal 8 is connected to a terminal strap 19 by means of a connector strap 21.

Current passes through the circuit breaker from the terminal strap 19, and through the connector 21, terminal 8, contact 7, contact plate 22 of the switch arm 9, flexible shunt 23 connecting the switch arm 9 and the terminal 15 through the medium of the clip 12, bimetal element 16, connector strap 18 to the terminal strap 17.

The switch arm 9 is actuated by means of a toggle 24 comprising links 25 and 26 that are pivoted to one another by a knee pivot 27, the link 25 being pivoted to the switch arm bracket 11 by a pivot shaft 28 and the link 26 being pivoted by a shaft 29 to a carrier 31 that is pivoted for rotation about a shaft 32 mounted on a frame 33 that is attached to the insulating base 5.

The carrier 31 is of U-shape and the side plates 33a thereof are connected by integral cross bars 34. The side plates 33a are spaced apart and permit of the operation of the toggle links 25 and 26 between them. The link 26 is also of U-shape and the side plates thereof are connected by an integral cross bar 35. The carrier 31 is releasably maintained in the set position shown in Figs. 1 and 2 by means of a latch 36 that is riveted to the bimetal and insulated therefrom by insulating washers 37.

The latch 36 engages a shoulder 38 on the free end of the carrier and retains it in closed position so long as normal current is flowing through the contacts of the circuit breaker. When an overload or short circuit condition exists in the circuit, the bimetal element 16 is heated thereby and deflected downwardly and causes the latch 36 to move out of engagement with the shoulder 38 on the carrier 31, thus releasing it for movement to an inoperative position shown in Fig. 3.

When the toggle links are in the "made" position illustrated in Fig. 1, the movable contact 22 is yieldingly pressed into engagement with the stationary contact 7. At this time the contact arm 9 is flexed, thus holding the contacts in engagement under tension. Since the knee pivot 27, at this time is slightly overcenter of the center line connecting the shafts 28 and 29, and since the link 26 is abutting against the cross bar 34 of the carrier 31, the contact 22 is releasably retained in closed position.

It is an object of my invention to provide a

circuit breaker wherein the contacts are moved to open and closed position with a snap action and I, therefore, provide an overcenter spring 39 that is attached at one end to the knee pivot 27 of the toggle and at the other end to an operating lever 41 that is pivoted upon a shaft 42 secured to the bracket 33. The outer end of the lever 41 is provided with an insulating operating handle 43 that projects through a slot 44 in the cover 6 and which is provided with arcuate extensions 45 for closing the opening 44 in all positions of the operating handle.

When the parts are in the position shown in Fig. 1, wherein the contacts are in closed position, the switch may be manually operated to open position by turning the operating handle 43 clockwise or downward. When the end of the spring attached to the lever 41 passes the center line connecting the knee pivot 27 and the pivot shaft 29, the tension of the spring will be exerted on the lower side of the toggle which causes the knee pivot 27 to move downward past the center line connecting the shafts 28 and 29, whereupon the toggle will collapse and move the switch contact 22 to the open position shown in Fig. 2 with a snap action. The spring 39 will also move the operating handle to the "off" position shown in Fig. 3.

The switch may be closed by simply moving the operating handle to the position shown in Fig. 1, wherein the toggle will be moved to "made" position, this movement also taking place with a snap action after the end of the spring attached to the lever 41 is moved above the center line connecting the knee pivot 27 and the pivot shaft 29 or slightly above the position shown in Fig. 2.

When an overload or short circuit occurs the bimetal 16 deflects and releases the carrier 31, upon which, one end of the toggle is pivoted. Since the spring 39 is at all times under tension, the carrier 31 is normally biased thereby toward inoperative position shown in Fig. 3. When the carrier is released, the spring 39 pulls directly upon the knee pivot 27 and causes the toggle to move bodily with the carrier, thus causing instantaneous separation of the contact 22 from the contacts 7, prior to the actual collapse of the toggle. By reason of this construction, the contacts are instantly separated at high velocity, thus facilitating quenching of the arc incident to the separation of contacts.

In the usual overcenter spring actuating mechanism for a pivoted switch arm, there is a condition wherein the contact pressure is almost reduced to zero before separation of the contacts occurs. During the time in which one end of the overcenter spring is passing overcenter, such a condition causes chattering of the contacts and incident arcing prior to the actual separation of the contacts which results in burning thereof. A

switch arm of this character also has the disadvantage that the contacts rebound at the time the circuit is closed. The contacts actually rebound out of contact and draw an arc which burns the surfaces thereof. This difficulty has been obviated by using a toggle for retaining the contact in engagement, the pressure being increased due to the greater leverage of the toggle mechanism. Contact is substantially maintained positive due to the locking action of the toggle. Therefore, when the toggle is moved to the "made" position, the moving contact is positively held in engagement with the stationary contact and there can be no rebound, due to the locking action of the toggle. When the toggle is released by a bodily movement thereof, as in the case of an overload or short circuit condition, to the position shown in Fig. 3, there is no appreciable reduction in contact pressure prior to the time of separation of the contacts. The contacts operated by a toggle are, therefore, capable of carrying relatively large currents and are satisfactory for use as a main circuit breaker for house lighting circuits.

In the apparatus shown in an application, Serial No. 752,336 filed November 26, 1924, by Hubert K. Krantz, issued August 27, 1929, Patent No. 1,726,233 and assigned to the Westinghouse Electric & Manufacturing Company, and disclosing an overcenter spring actuated circuit breaker, the operating handle is moved to a neutral or intermediate position in response to an overload or short circuit condition. In order to close the circuit breaker, it is first necessary to move the operating handle to the "off" position to pick up the carrier and then move the operating handle to the "on" position to close the circuit breaker.

It is an object of my invention to provide a circuit breaker wherein the carrier is returned to its set position with one movement of the operating handle to the "on" position. In order to accomplish this, I provide an extension 46 on the pivoted end of the operating lever 41, that is adapted to engage a shoulder 47 on the toggle link 25.

The extension 46 and the shoulder 47 constitute a ratchet mechanism, the shoulder 47 ratcheting across the extension 46 when the parts move to the position shown in Fig. 3. It will be seen that when the operating handle 43 is moved upward or rotated counter-clockwise, the extension 46 engages the shoulder 47 and causes clockwise rotation of the link 25. This movement of the link causes clockwise rotation of the carrier 31 to the position shown in Fig. 2. The shoulder 38 of the carrier is inclined at 48 which causes displacement of the bimetal element 16 and permits the shoulder 38 to latch behind the latch 36, as indicated in Fig.

2. At this time, the extension 46 passes over the corner of the shoulder 47 and permits the toggle to move to the "made" position with a snap action in response to the contraction of the spring 39. It will be apparent from the foregoing that the simple closing movement of the operating handle first, returns the carrier to "set" position and subsequently permits the spring 39 to move the toggle to "made" position wherein the contacts are retained in "closed" position.

In order to facilitate quenching of the arc incident to separation of the contact, I have provided metal arc quenching barriers 49 that are spaced apart and insulated from one another and which are provided with notches 51 through which the outer end of the contact 22 passes in moving to "open" position. The barriers have deionizing characteristics which tend to quench the arc and also facilitate quenching by reason of the cooling action thereof.

The bimetal element is so constructed that the thin portions of the legs thereof, fuse under severe short circuit conditions in the event that the contacts fail to separate due to the freezing or other causes. An insulating barrier 50 is disposed between the legs of the bimetal to prevent arcing across from one to the other and to lengthen the path of the arc so that it will be readily extinguished.

As illustrated in the drawings, the cover 6 is retained in "closed" position by means of a screw 52 that is threaded into a bracket 53 secured to the frame 33. The barriers 49 are supported on spaced plates 54, one of which is provided with an extension 55 that extends through a slot 56 in the cover. The extension 55 is provided with an opening 57 for receiving a seal or lock hasp for preventing unauthorized access to the mechanism within the cover.

While I have illustrated but one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim as my invention:

1. A circuit breaker comprising a contact member, a movable contact member comprising a multiple link toggle, an overcenter spring for moving the toggle to collapsed and made positions and means for moving the said spring.

2. A circuit breaker comprising a contact member, a movable contact member comprising a multiple link toggle, an overcenter spring for moving the toggle to collapsed and made positions, a carrier for the toggle, movable to operative and inoperative positions for moving the movable contact out of closed position without collapsing the toggle, and a

current responsive element for releasably retaining the carrier in operative position.

3. The combination with a multiple link toggle switch actuated by an overcenter spring, of a carrier for the toggle movable to set and inoperative positions adapted to be actuated by the said spring for moving the toggle bodily and breaking the contact thereof before collapse of the toggle.

4. The combination with a multiple link toggle switch actuated to collapsed and made positions by an overcenter spring, of a carrier for supporting the toggle switch and movable to set and inoperative positions and normally biased to inoperative position and a current responsive element for releasably retaining the carrier in set position.

5. A circuit breaker comprising a carrier movable to set and inoperative positions, and normally biased to inoperative position, a contact member, a movable contact member, an operating member therefor comprising a multiple link toggle for maintaining the movable contact in engagement with the said contact member when in the "made" position and for moving the movable contact to open position when collapsed, the said toggle being supported upon the carrier and movable to made and collapsed positions when the carrier is in the set position and movable bodily to separate the contacts when the carrier is moved to inoperative position, means for yieldingly moving the toggle to made and collapsed positions, and current responsive means for releasably retaining the carrier in set position.

6. A circuit breaker comprising a carrier movable to set and inoperative positions, and normally biased to inoperative position, a contact member, a movable contact member, an operating member therefor comprising a multiple link toggle for maintaining the movable contact in engagement with the said contact member when in the made position and for moving the movable contact to open position when collapsed, the said toggle being supported upon the carrier and movable to made and collapsed positions when the carrier is in the set position, and movable bodily to separate the contacts when the carrier is moved to inoperative position, means for yieldingly moving the toggle to made and collapsed positions, current responsive means for releasably retaining the carrier in set position, manually operable means for actuating the toggle moving means and for returning the carrier to set position.

7. A circuit breaker comprising a yielding contact member, a multiple link toggle for moving the contact member, a carrier for the toggle movable to set and inoperative positions and normally biased to inoperative position, a current responsive element for releasably retaining the carrier in set position, and means for actuating the toggle.

8. A circuit breaker comprising a yield-

ing contact member, a toggle for moving the contact member, a carrier for the toggle movable to set and inoperative positions and normally biased to inoperative position, a current responsive element for releasably retaining the carrier in set position, means for actuating the toggle to close the contact member and for returning the carrier to set position with one movement thereof.

9. A circuit breaker comprising a contact member, a movable carrier, a current responsive element for releasably retaining the carrier in operative position, a movable contact for engaging the said contact member comprising a multiple link toggle mounted on the carrier and movable to open and closed positions, and an overcenter spring for moving the toggle.

10. A circuit breaker comprising a contact member, a movable carrier, a current responsive element for releasably retaining the carrier in operative position, a movable contact for engaging the said contact member comprising a multiple link toggle mounted on the carrier and movable to open and to closed positions, and an overcenter spring for moving the toggle and for moving the carrier and the toggle when the carrier is released.

11. A circuit breaker comprising a contact member, a movable contact member including a multiple link toggle adapted to maintain the movable contact member in closed position when the toggle is in made position and to move the movable contact member to open position when the toggle is broken, an overcenter spring for actuating the toggle to made and broken positions, a movable carrier for the toggle movable to open and closed positions and a current responsive element for releasably maintaining the carrier in closed position.

12. The combination with a circuit breaker having a movable current responsive controlling element therefor of U-shape and adapted to fuse in the event of failure of the circuit breaker to open the circuit, of an insulating barrier disposed between the legs thereof and permitting free movement of the element, for preventing arcing across from one leg to the other upon fusion of the said element.

In testimony whereof, I have hereunto subscribed my name this 3rd day of August, 1927.

FRED G. VON HOORN.