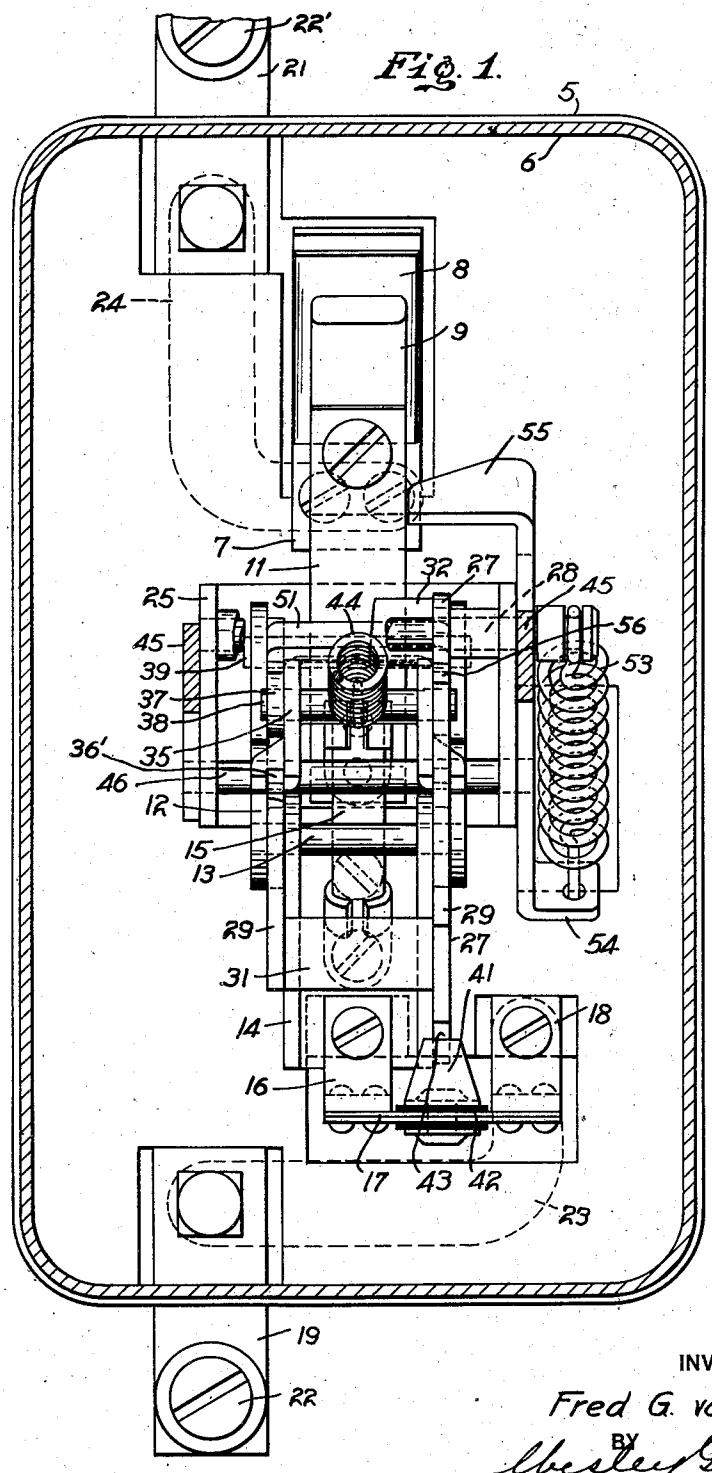
Dec. 30, 1930. F. G. VON HOORN 1,786,797

CIRCUIT BREAKER

Original Filed Aug. 11, 1927 4 Sheets-Sheet 1

Fig. 1.



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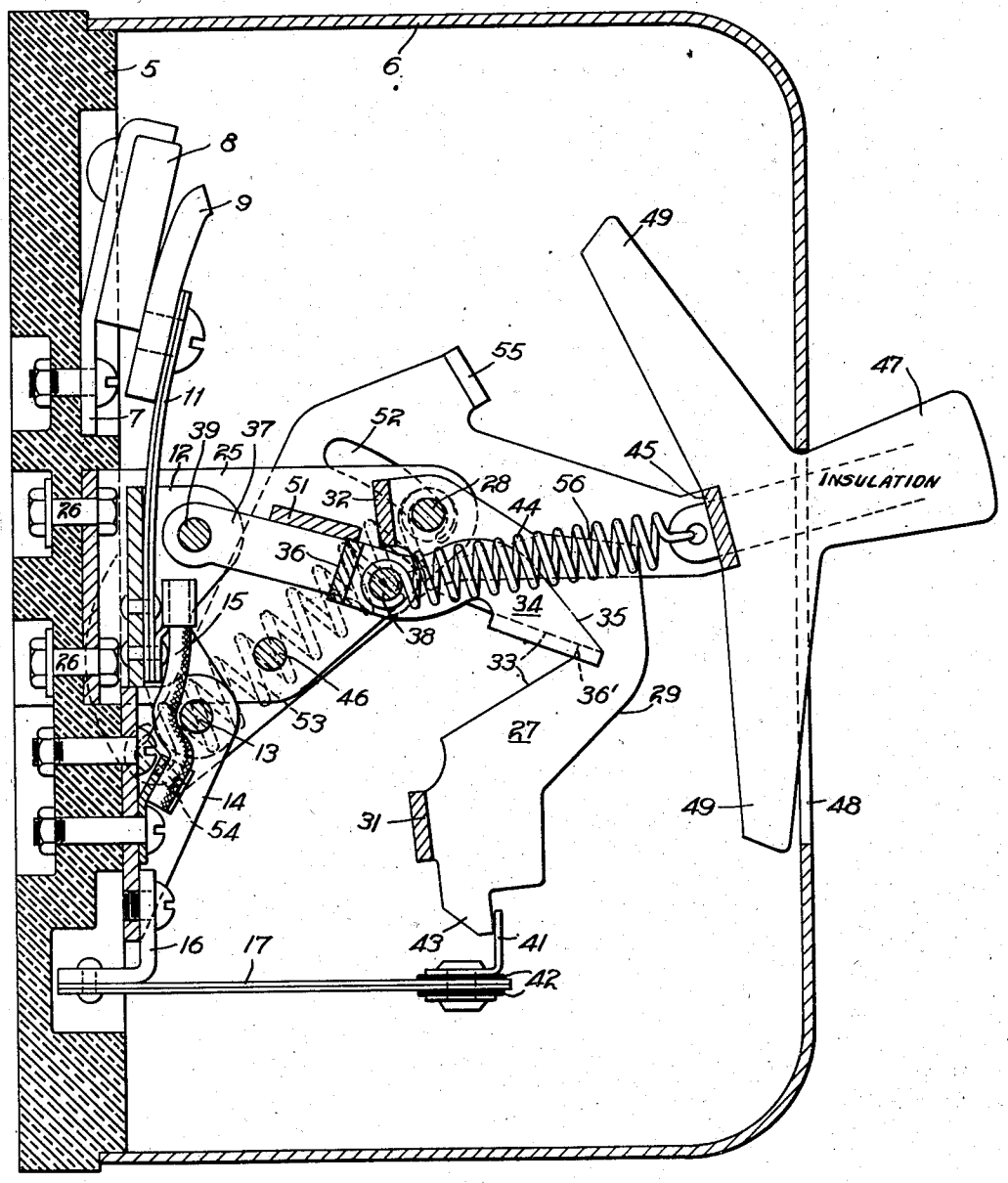
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CIRCUIT BREAKER

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Fig. 2.



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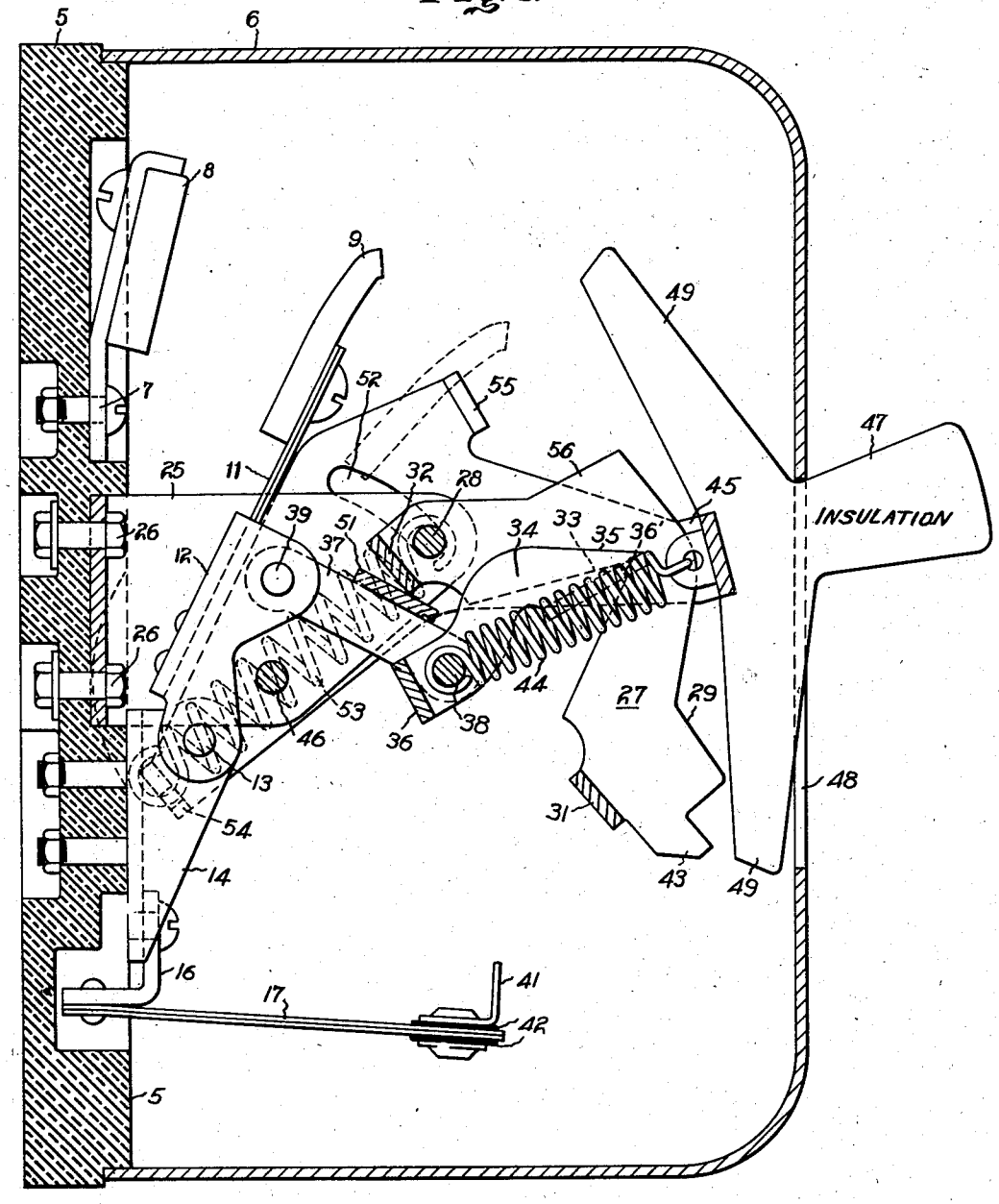
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CIRCUIT BREAKER

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Fig. 3.



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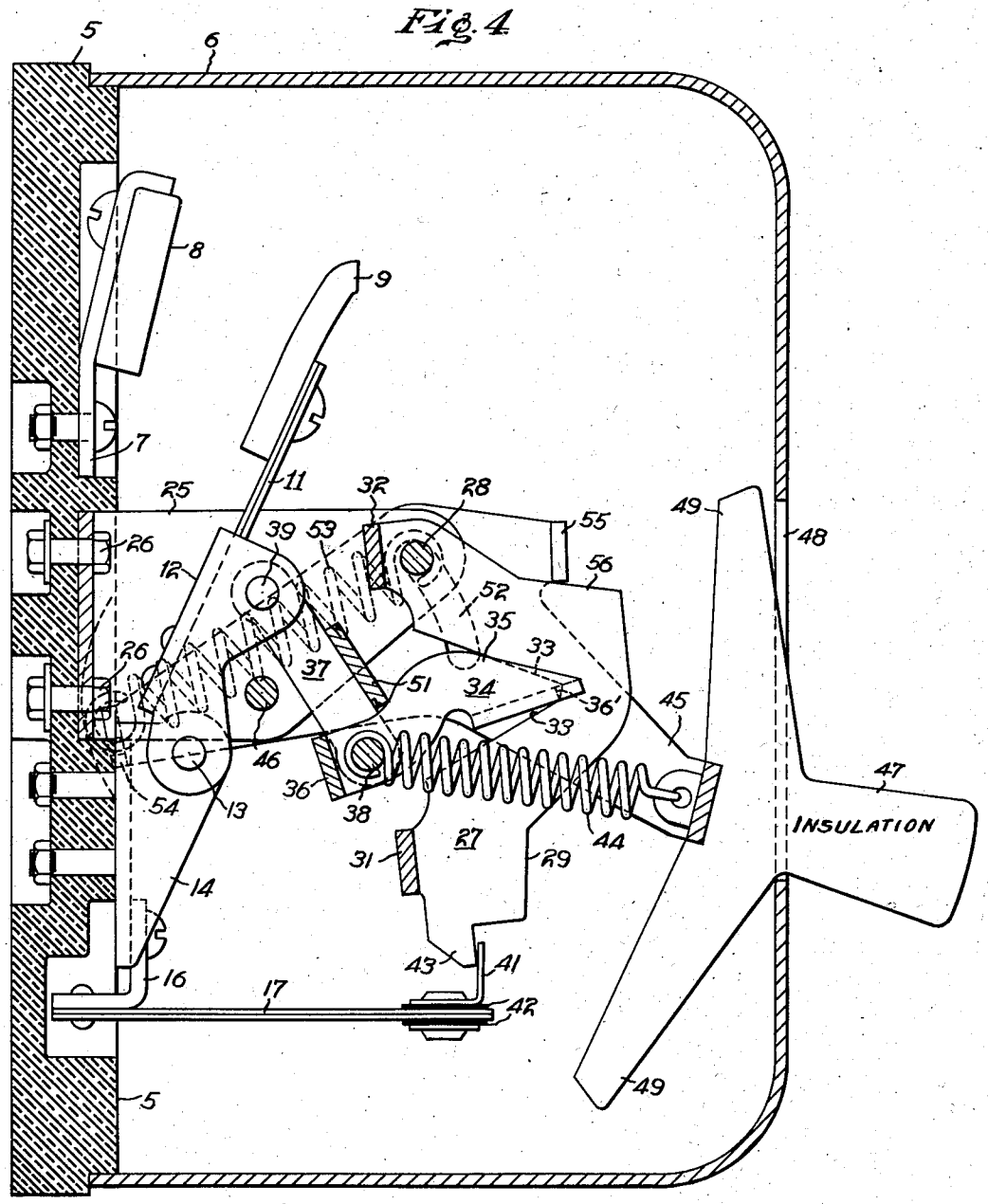
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CIRCUIT BREAKER

Original Filed Aug. 11, 1927 4 Sheets-Sheet 4

Fig. 4



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UNITED STATES PATENT OFFICE

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CIRCUIT BREAKER

Application filed August 11, 1927, Serial No. 212,289. Renewed July 16, 1930.

My invention relates to circuit breakers and particularly to circuit breakers for controlling lighting and small-motor circuits.

An object of my invention is to provide a circuit breaker that shall be adapted for use in distributing panels to take the place of the usual switch and fuses or which may be used to control domestic-appliance motors and the like.

A further object of my invention is to provide a circuit breaker that shall be trip free from the operating handle and which shall be compact and relatively inexpensive to manufacture.

A further object of my invention is to provide a circuit breaker wherein the switch contact is retained in closed position by a toggle in order to secure maximum contact pressure and to reduce the heating of the switch contact.

A further object of my invention is to provide a circuit breaker having the above-noted characteristics, wherein the toggle is supported by a carrier controlled by a current-responsive element, and wherein the switch contacts are caused to be separated by overload or short-circuit conditions.

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

Figure 1 is a sectional view of the circuit breaker showing, in plan view, the circuit-breaker apparatus.

Fig. 2 is a vertical section through a circuit breaker, showing parts thereof in side elevation, the circuit-breaker parts being in the closed position.

Fig. 3 is a view, similar to that of Fig. 2, with the parts shown in an intermediate operating position, and

Fig. 4 is a view, similar to that of Fig. 2, showing the parts of the circuit breaker in the open position.

Referring to the drawings, the circuit breaker includes an insulating base 5 that is provided with a pressed-metal cover 6 for enmounted upon the base 5. The circuit breaker comprises, principally, parts stamped from sheet metal which are inexpensive to manufacture and which may be readily assembled. A stationary contact terminal 7 is provided with a contact plate 8 which is adapted to be engaged by a movable contact plate 9 that is carried upon a flexible arm 11 secured to a bracket 12 that is pivoted upon a shaft 13. The shaft 13 is mounted in a bracket 14 that is attached to the insulating base 5. A flexible shunt 15 conductively connects the flexible arm 11 to the terminal 16 which supports one leg of a bimetal thermal element 17 of U-shape. The other leg of the bimetal element is supported upon a terminal 18.

The insulating base is provided with a pair of terminals 19 and 21 having terminal screws 22 and 22′ thereon for receiving the line conductors. The terminal 18 is connected to the terminal 19 by a strap 23 disposed on the under side of the insulating base 5. Current enters the circuit breaker through the terminal 19, strap 23 and terminal 18, and passes through the bimetal thermal element 17, switch arm 11, switch contact 9, stationary contact plate 8 and terminal 7 that is connected to the terminal 21 by a strap 24. The feed conductor, may, however, be connected to the terminal 21.

The circuit-breaker operating mechanism is mounted upon a supporting bracket 25 of U-shape that is attached to the insulating base 5 by means of bolts 26. A toggle carrier or cradle 27 is pivotally mounted upon the bracket 25 and rotates about the pivot shaft 28 that is secured in the free ends of the side plates of the bracket 25. The carrier or cradle 27 is of U-shape and is stamped from sheet material and comprises a pair of side plates 29 that are connected by integral cross bars 31 and 32. The side plates 29 are each provided with a notch 33 of V-shape which is adapted to receive the free end of a toggle link 34 which is also of U-shape and comprises a pair of side plates 35 that are connected by an integral cross bar 36. Each side plate 35 of the toggle link 34 is forked, at [illegible] which

engage the apices of the notches 33 of the carrier 27, the apices of the notches serving as pivot points for the outer end of the toggle link 34.

A toggle link 37 of U-shape is pivotally connected to the link 34 by means of a knee pivot shaft 38, the side plates thereof being disposed on opposite sides of the link 34 and connected by an integral cross bar 51. The free ends of the side plates of the link 37 are pivotally connected to the switch arm 11 by means of the pivot shaft 39 that is secured to the side plates of the bracket 12 that is also of U-shape.

The toggle carrier or cradle 27 is releasably retained in the set position shown in Figs. 2 and 4 by means of the bimetal thermal element 17 that is provided with a metal latch 41 insulated from the bimetal element by means of insulating washers 42.

The bimetal thermal element 17 is so designed that it will move downwardly when heated by an excess current, such as is incident to an overload or short-circuit condition. When the latch 41 clears the shoulder 43 on the carrier or cradle 27, the cradle is free to rotate counter-clockwise in response to the tension exerted thereon by an over-center spring 44 that is pivoted, at one end, to the knee pivot shaft 38 of the toggle and, at the other end, to an operating handle member 45 that is pivotally mounted upon a shaft 46 carried by the bracket 25. The handle member is provided with an insulating handle 47 that extends through a slot 48 in the cover 6, the handle being provided with extensions 49 within the cover 6 for closing the slot 48 in all positions of the operating handle.

From the foregoing, it is apparent that the carrier or cradle 27 is normally biased in a counter-clockwise direction by the spring 44 which, in the position shown in Fig. 2, serves to hold the toggle in the made or closed position, wherein the knee pivot shaft 38 is slightly above a line connecting the pivot shaft 39 and the apex of the notch 33 about which the free end of the toggle link 34 pivots.

The spring 44, as above stated, tends to normally bias the carrier or cradle 27 in a counter-clockwise direction and to move the switch arm 11 to open position. The latch 41, carried by the bimetal element 17, retains the carrier in the set position until it is released by an overload or short-circuit condition. In order to open and close the switch contact arm 11, it is necessary to move the operating handle 47. When the contact members are in the closed position shown in Fig. 2, the circuit breaker may be opened manually by moving the operating handle 47 downward to the position shown in Fig. 4. When the outer end of the spring 44 is carried past the center line connecting the shaft 39 and the apex of the notches 33 in the carrier, the knee shaft or pivot 38 of the toggle will be moved downward and over-center, thus causing the toggle to collapse and permitting the spring 44 to move the contact arm 11 to the open position shown in Fig. 4.

To close the circuit breaker, the operating handle 47 is moved to the position shown in Fig. 2, which will cause the spring 44 to move the toggle links to the made position and thereby move the switch arm 11 into the closed position shown in Fig. 2.

Under short-circuit or overload conditions, the bimetal thermal element 17 will be withdrawn to the position shown in Fig. 3 wherein it releases the carrier or cradle 27. The spring 44 immediately contracts and breaks the toggle and moves the switch arm 11 toward open position, the ultimate open position of the switch contact 9 being indicated in dotted lines in Fig. 3. When the toggle links have moved to the position shown in Fig. 3, movement of the link 37 is arrested by engagement of the cross bar 51 with the cross bar 32 of the cradle 27. Further contraction of the spring 44 will cause clockwise rotation of the operating member 45 and handle 47, such movement being permitted by reason of the arcuate slot 52 provided in the side plates of the operating member 45. The pivot shaft 28 extends through the slots 52 and serves as a guide for the outer end of the operating member 45.

A carriage or cradle-resetting spring 53 is pivotally connected to the shaft 28 at one end and, at the other end, to an arm 54 on the inner end of the operating member 45.

As illustrated in Fig. 3, when the operating arm and handle are in the closed positions shown in Figs. 2 and 3, the end of the spring attached to the arm 54 lies slightly below a line connecting the centers of the pivot shafts 46 and 28. The spring 53 is an over-center spring and, therefore, serves to yieldingly retain the operating handle in the closed position. When the operating member 45 and handle 47 are turned in a clockwise direction by the spring 44, the end of the spring attached to the arm 54 of the operating member 45 is moved above the center line connecting the shafts 46 and 28 and immediately causes clockwise rotation of the operating member 45 and operating handle 47.

A lug 55 on the operating arm 45 engages a shoulder 56 on the carrier or cradle 27 and moves the cradle with the operating arm to the position shown in Fig. 4, thus resetting the cradle in set position while the switch arm remains in the open postion and while the operating arm and handle occupy the open position, as shown in Fig. 4, which indicates that the circuit breaker has opened. When the operating arm is moved to the upper position, the switch contacts will be moved to closed position in the manner previously described.

Since the carrier or cradle 27 will be drawn

to the opened position shown in Fig. 3 regardless of the position of the operating handle 47, the circuit breaker may open under short circuit and overload conditions while the operator is holding the operating handle 47. The circuit breaker is, therefore, trip-free of the handle and cannot be retained in closed position under overload or short circuit conditions by the operator. If a short-circuit condition prevails after the circuit has been interrupted and the operator attempts to reclose the circuit, the bimetal thermal element will instantly release the cradle when the contact 9 is moved into engagement with the contact member 8.

It will be noted that there is but one latch employed in the structure, that being the latch 41 carried by the bimetal thermal element. The major portion of the parts of the circuit breaker are stamped from sheet metal and are, therefore, inexpensive to manufacture. The parts may be readily assembled and the number of operating parts is reduced to a minimum.

The circuit breaker may be rendered "trouble indicating" by eliminating the resetting spring 53, in which event the operating handle will be moved to an intermediate position when the cradle 27 is released by the bimetal element.

While I have illustrated only 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. The combination with a switch contact supported in closed position by a releasable carrier controlled by a current-responsive element and movable relative to the carrier to open and closed positions, of means for automatically returning the carrier to set position after the latter has been released by the said element.

2. The combination with a switch contact supported in closed position by a releasable carrier and movable relative to the carrier to open and closed positions, the said carrier being retained in set position by a current-responsive element and causing opening movement of the switch contact when released, of means for automatically returning the carrier to set position after the latter has been released by the said element.

3. The combination with a switch contact supported in closed position by a releasable carrier that is retained in set position by a current-responsive element and which causes opening movement of the switch contact when released, and an operating means for moving the switch contact to open and closed positions while the carrier is in set position, of means for automatically returning the carrier to set position after it has been released by the current-responsive element.

4. The combination with a switch contact supported in closed position by a releasable carrier that is retained in set position by a current-responsive element and which causes opening movement of the switch contact when released, and an operating means for moving the switch contact to open and closed positions while the carrier is in set position, of means resettable by the operating means for automatically returning the carrier to set position after it has been released by the current-responsive element.

5. A circuit breaker comprising a contact member movable to open and closed positions, a carrier movable to set and released positions, a current-responsive means for releasably retaining the carrier in set position, a toggle having one end supported by the carrier and the other end connected to the contact member for releasably retaining the contact member in closed position when the carrier is in set position, an operating member, an over-center spring connecting the toggle and operating member, for making and breaking the toggle for causing closing and opening movements, respectively, of the contact member, and an over-center spring for actuating the operating member and automatically returning the carrier to set position after the current-responsive means has released it.

6. A circuit breaker comprising a contact member movable to open and closed positions, a carrier movable to set and released positions, a current-responsive means for releasably retaining the carrier in set position, a toggle having one end supported by the carrier and the other end connected to the contact member for releasably retaining the contact member in closed position when the carrier is in set position, an operating member, an over-center spring connecting the toggle and operating member, for making and breaking the toggle for causing closing and opening movements, respectively, of the contact member, and means for automatically returning the carrier to set position after it has been released by the current-responsive element.

7. A circuit breaker comprising a contact member movable to open and closed positions, a pivotally mounted carrier movable to set and released positions, a current-responsive means for releasably retaining the carrier in set position, a toggle having one end pivotally connected to the carrier and the other end pivotally connected to the contact member for releasably retaining the contact member in closed position when the toggle is in the made position, a pivotally mounted operating handle, an over-center spring connecting the knee of the toggle and

the operating handle, for making and breaking the toggle pivot causing closing and opening movements, respectively, of the contact member, an over-center spring for releasably retaining the operating handle in either open or closed position, and for automatically returning the carrier to set position after the latter has been released by the current-responsive means.

8. The combination with a switch contact supported in closed position by a releasable carrier controlled by a control element and movable relative to the carrier to open and closed positions, of means for automatically returning the carrier to set position after the latter has been released by the said element.

9. The combination with a switch contact supported in closed position by a releasable carrier that is retained in set position by a control element and which causes opening movement of the switch contact when released, the said switch being movable relative to the carrier to open and closed positions, of means for automatically returning the carrier to set position after the latter has been released by the said element.

In testimony whereof, I have hereunto subscribed my name this 6th day of July, 1927.

FRED G. VON HOORN.