

Dec. 22, 1942.

L. S. WALLE

2,306,235

CIRCUIT BREAKER

Filed Aug. 6, 1941

2 Sheets-Sheet 1

Fig. 1.

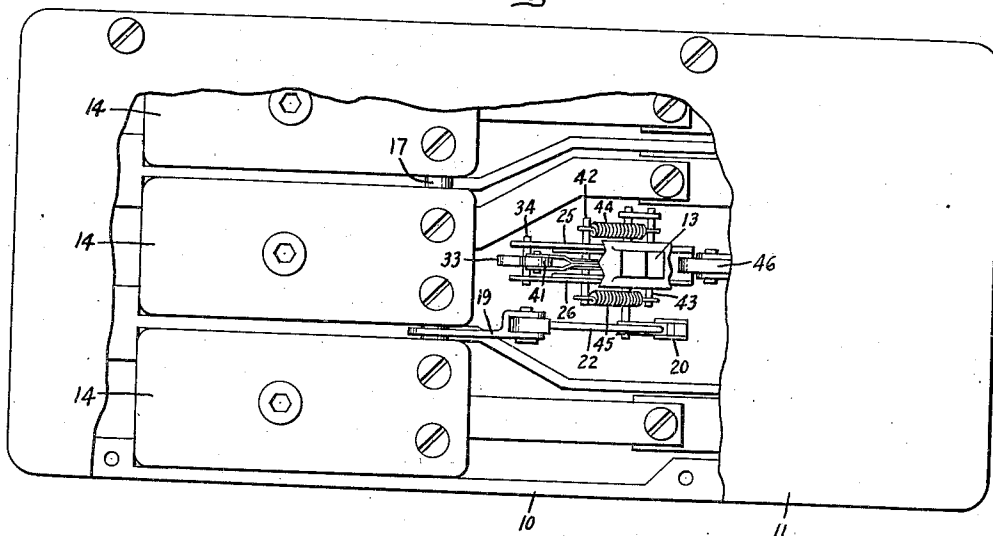
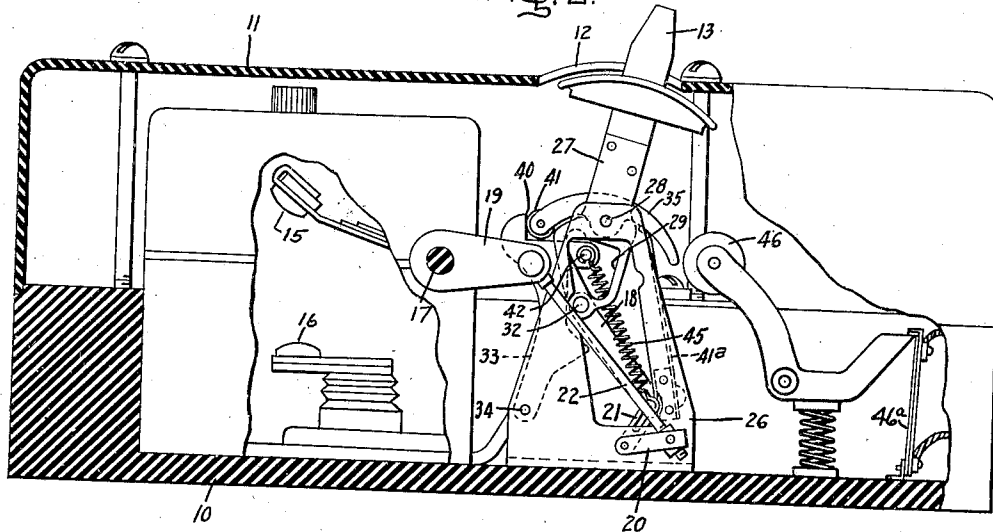


Fig. 2.



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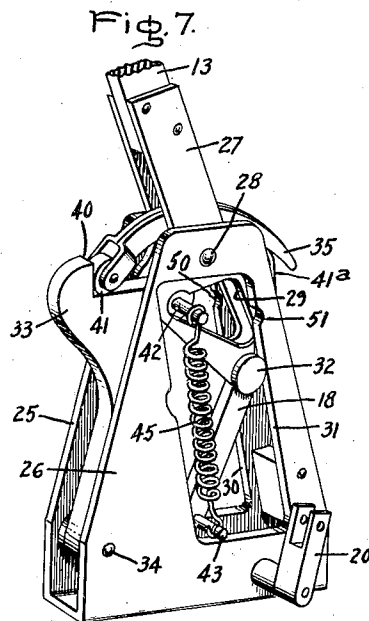
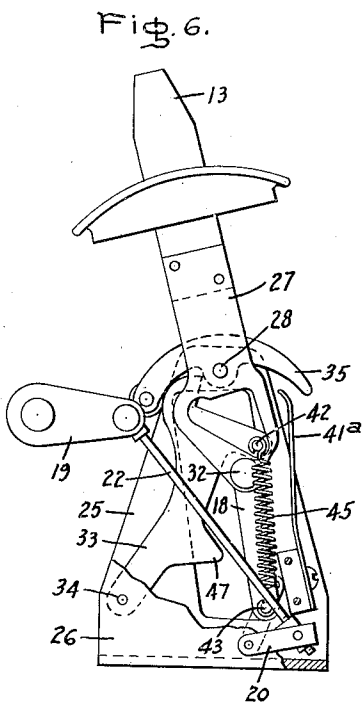
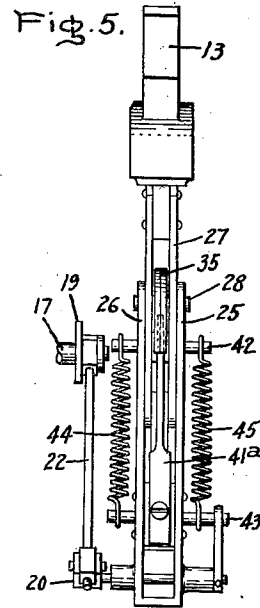
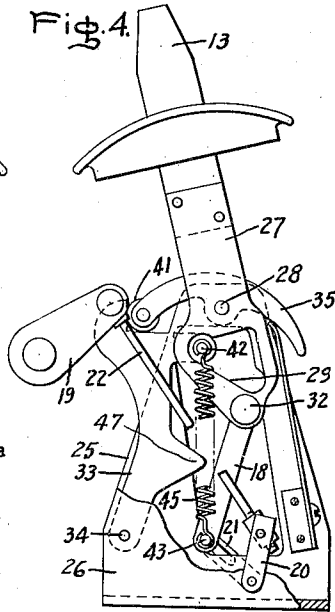
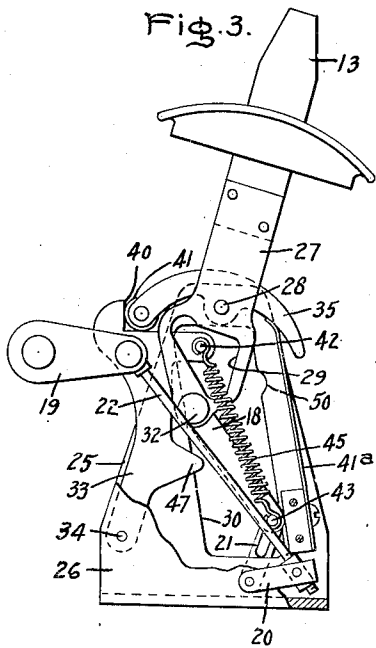
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CIRCUIT BREAKER

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,306,235

## CIRCUIT BREAKER

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New York

Application August 6, 1941, Serial No. 405,592

16 Claims. (Cl. 200—116)

My invention relates to circuit breakers and more particularly it relates to a new and improved operating mechanism for automatic circuit breakers of the type known as branch-circuit circuit breakers. These breakers are arranged to provide the protective features characteristic of a fuse in combination with a manually operated switch.

The principal object of my invention is to provide a simple and reliable manually operable current responsively tripped circuit breaker which is trip free in its automatic operation and which may be easily manufactured in large quantities and at low cost.

It is a further object of my invention to provide a manually operable current responsive circuit breaker mechanism having only single spring means for effecting quick make, quick break and trip-free automatic circuit breaking operation.

It is a specific object of my invention to provide a mechanism of the above character which shall include means for positively opening the breaker contacts to prevent welding thereof.

In carrying out my invention in one form, I provide an operating lever pivoted at a fixed point and provided at its one end with means for pivotally supporting a movable switch member. To free end of the movable switch member I connect an overcenter spring, the other end of which is anchored to the swingable end of a pivotally mounted carrier. The carrier is normally retained in a fixed position by a latch mechanism which is actuatable in conjunction with a suitable overcurrent device to release the carrier. In normal manual operation the free end of the movable switch member is moved over center in toggle fashion with respect to the spring by means of the pivotally mounted operating lever. To insure the positive breaking of any weld which may have formed at the contacts, the switch member is arranged for manual rotation about a normally-fixed fulcrum immediately prior to the operation of the overcenter spring. Upon the occurrence of an excessive current the pivotally mounted carrier is released by the latch mechanism and is moved by the spring so that its swingable end moves the end of the spring over center with respect to the pivotally mounted end of the movable switch member, thereby to move the switch member to circuit opening position. To insure positive movement of the switch member to circuit opening position so that welding of the contacts does not occur as the spring passes dead center, I also provide means on the

carrier for striking the switch member with a hammer blow upon release of the carrier.

To the attainment of the foregoing and other objects and advantages, my invention is preferably embodied in the detailed construction to be hereinafter more fully described and claimed, and is illustrated in the accompanying drawings in which Fig. 1 is a front view of an automatic circuit breaker embodying my invention; Fig. 2 is a side elevation, partly in section, of the device of Fig. 1 showing the contacts and the operating mechanism in the "off" position; Fig. 3 is a side view of the circuit breaker operating mechanism, partly in section, showing the mechanism in its "off" position; Fig. 4 is a view similar to that of Fig. 3 showing the mechanism in its "on" position; Fig. 5 is an end view of the operating mechanism in its "off" position; Fig. 6 is a view similar to those of Figs. 3 and 4 showing the mechanism in its "automatic trip" position; and Fig. 7 is a perspective view of the circuit breaker operating mechanism in its "on" position of Fig. 4.

Referring now to the drawings, one preferred form of my circuit breaker comprises a base 10 which is suitably formed of a molded insulating compound, and a cover 11 preferably formed of similar insulating material and apertured at 12 to provide access to a suitable operating handle 13. In the three-phase form of my circuit breaker, I mount three enclosed contact chambers 14 side by side upon the base 10. Each of the chambers 14 contains a movable contact 15 and a stationary contact 16 as shown at Fig. 2. The movable contacts in all the chambers are connected to be operated by a common rotatable operating shaft 17. The shaft 17 may be insulated from the movable contact 15 by any suitable means. By way of example I have shown the shaft 17 formed of insulating material. The operating shaft 17 is connected for operation to a movable switch member or toggle arm 18 by means of a crank lever 19 connected to the shaft 17, a bell crank 20, 21 connected to the movable switch arm 18 by a pin and slot connection, and a connecting rod 22 between the crank lever 19 and the arm 20 of the bell crank.

The operating mechanism itself is mounted upon a pair of supporting plates 25 and 26 which are fixedly attached to the base 10 in upright parallel spaced relation. A manually operable operating lever 27 is pivotally mounted intermediate its ends between the supporting plates 25, 26 by means of a fixed pivot pin 28 preferably located near the upper ends of the plates 25, 26. The operating lever 27 carries at its upper end

the operating handle 13 and is formed to provide beneath the pivot pin 28 a substantially triangular aperture 29 for the purpose which will be more fully described hereinafter. As is most clearly shown in Fig. 7 the supporting plates 25 and 26 are provided with substantially rectangular aligned apertures 30 and 31, respectively, adjacent the aperture 29 in the operating lever 27.

The movable switch arm 18 is pivotally connected at one end to the lower end of the operating lever 27 by a movable pivot pin. In the form shown the operating lever 27 comprises a pair of plates connected together in parallel spaced relation and the movable switch arm 18 is pivotally mounted between these plates. The movable pivot pin connecting the operating lever 27 with the movable switch arm 18 is provided with enlarged head portions 32 on either side thereof. The head portions 32 of the pivot pin are arranged in the same planes as the supporting plates 25, 26 so that the heads 32 engage the sides of the apertures 30, 31 to limit the movement of the operating lever 27.

A swingable carrier 33, mounted upon a fixed pivot 34 near the base of the side supporting plates 25, 26, is arranged to be normally latched in a predetermined fixed position by a latch lever 35 which is mounted upon the fixed pivot 28. The upper end of the carrier 33 is formed to provide a shoulder 40 which normally engages a roller 41 on the latch lever 35 to hold the carrier 33 in fixed position. The latch lever 35 is preferably biased to latching position by any suitable means such as a cantilever leaf spring 41a. The upper end of the carrier 33 extends between the apertured plates comprising the operating lever 27 and carries a transverse pin 42 which projects through the aperture 29 in the operating lever and beyond the side supporting plates 25, 26 through their respective apertures 30 and 31. A similar transverse pin 43 is connected to the free end of the movable switch member 18. Between the outer ends of the pins 42 and 43 are connected a pair of overcenter operating springs 44, 45. As illustrated at Fig. 5, the transverse pin 43 also serves to connect the free end of the movable switch member 18 to the slotted bell crank arm 21.

Any suitable means may be provided for actuating the latch lever 35 to disengage the roller 41 from the shoulder 40 upon the occurrence of an excessive current. Referring now to the drawings, particularly to Fig. 2, I have illustrated one such means as a spring pressed striker 46 adapted to be released by a current responsive element such as a bimetallic strip 46a and to strike the projecting end of the latch lever 35 with a hammer blow, thereby to disengage the roller 41 from the shoulder 40.

In circuit breakers which are tripped by an over-center spring mechanism upon the occurrence of an excessive current, welding of the contacts frequently occurs because of the fact that during the contact opening operation a point is reached where the contact pressure is zero. At this point in the operation even relatively small currents will frequently cause welding of the contacts. In order to overcome this difficulty, my invention includes means for delivering to the switch operating member a hammer blow in automatic tripping operation. Preferably this hammer blow is administered before the mechanism has reached dead center and therefore before the contact pressure has been reduced to

zero, thereby to drive the switch member positively and rapidly through the dead center position with the force of the blow. For this purpose I provide the swingable carrier 33 with a projection 47 intermediate its ends and positioned to strike the movable switch member 18 when the carrier is released in automatic tripping operation. The projection 47 extends sufficiently far to engage the toggle arm 18 before the upper end of the carrier has moved the springs 44, 45 over center with respect to the pivot pin heads 32.

In operation, when the circuit breaker is in the "off" position shown at Figs. 2 and 3, it may be moved to the "on" position by rotating the operating lever 27 about the fixed pivot 28 to the position shown in Fig. 4. By this movement the lower end of the operating lever 27 and the pivot pin are moved over center with respect to the operating springs 44, 45 so that the free end of the movable switch arm 18 is now biased to the left instead of to the right as viewed in the drawings. During this operation the upper ends of the overcenter springs 44, 45 remain fixed with respect to the supporting plates 25, 26, since the swingable carrier 33 is latched in fixed position.

Also, the movement of the switch arm 18 is limited and its "off" position is defined by engagement of the transverse pin 43 with the rear sides of the aligned apertures 30 and 31 in the supporting plates 25 and 26, as shown at Fig. 3. To insure a positive contact, the contact structure itself limits and defines the "on" position of the breaker mechanism from the "on" position of Fig. 4 to the "off" position of Fig. 3 is simply the reverse of the movement just described. During the latter movement the pin 42 serves as a stop engaging the forward sides of the apertures 30 and 31 to prevent counterclockwise rotation of the carrier 33, as viewed in Figs. 3 and 4. Thus, in manual operation of the switch, it will be evident that the springs 44, 45 act as simple overcenter springs having their upper ends fixed with respect to the support, while the toggle arm has one end attached to the springs and the other end movable over center with respect thereto by means of the operating lever 27.

The projection 47, previously described in connection with automatic tripping operation, also acts as a fixed fulcrum for the toggle arm 18 during manual opening operation, thereby to provide a positive opening and the breaking of any weld which may have formed at the contacts. Referring particularly to Fig. 4, it will be observed that the outer end of the projection 47 on the normally fixed carrier 33 lies on or very close to a line extending between the pivot pins 42 and 43. Consequently, immediately prior to the passage of the pivot pin heads 32 overcenter with respect to the springs 44, 45, the toggle arm 18 engages the projection 47 and pivots upon it as a fulcrum. It will be evident that during the instant when the switch arm 18 is pivoting upon the projection 47 the pivot pin 43, and consequently the bell crank 20, 21 and the operating shaft 17, are being positively moved by means of the operating handle 13. The pivoting of the switch arm 18 about the projection 47 also accelerates the over-center travel of the pivot pin heads 32, since the two ends of the switch arm are being moved in opposite directions. As soon as the overcenter travel is complete and any welds at the contacts are broken, the springs 44, 45 rapidly move the switch arm 18 to the position shown at Fig. 3.

Upon the occurrence of an excessive current the current responsive mechanism releases the striker 46 for actuation into engagement with the latch lever 35, thereby to disengage the roller 41 from the shoulder 40. This action will of course take place only when the mechanism is in its "on" position shown in Fig. 4. From Fig. 4 it will be observed that the overcenter springs 44, 45 not only bias the toggle arm 18 to the "on" position but also bias the swingable carrier 33 for clockwise rotation about the fixed pivot 34 as viewed in the drawings. Thus, upon disengagement of the shoulder 40 and the roller 41, the carrier 33 will rotate in a clockwise direction about the fixed pivot 34 under the influence of springs 44, 45. In this movement of the swingable carrier 33 the upper end of the carrier and the transverse pin 42, which forms an anchorage for the upper ends of the springs 44, 45, will be moved to the right, as viewed in the drawings, and over center with respect to the movable pivot pin, thereby to bias the free end of the switch arm 18 toward the right as shown at Fig. 6. Referring again to Fig. 4, it will also be observed that during the clockwise rotation of the swingable carrier 33 the projection 47 strikes the movable switch arm 18 with a hammer blow prior to the arrival of the springs 44, 45 at dead center. Thus the movable switch arm 18 is thrown to its switch opening position of Fig. 6 with a quick positive motion and is rapidly moved past the point where the contact pressure is zero, thereby to avoid welding of the contacts.

After the automatic tripping operation just described, the transverse pin 42 lies in the lower right corner of the triangular aperture 29 in the operating lever 27. It will be observed by comparison of Figs. 4 and 6 that the operating handle 27 does not move during the automatic tripping operation. This trip-free feature of my circuit breaker results from the fact that the transverse pin 42 is positioned within the triangular aperture 29 at the lower end of the operating handle. In automatic operation the movement of the swingable carrier 33 causes the transverse pin 42 to move from the upper left corner of the triangular aperture 29 to the lower right corner, as viewed in the drawings. In the "trip" position of the circuit breaker as shown in Fig. 6, the transverse pin 42 engages the lower right hand corner of the triangular aperture 29 to limit the movement of the carrier 33. In this respect attention is directed to the fact that the sides of the aligned substantially rectangular apertures 30 and 31 are preferably notched at 50 and 51, respectively, to accommodate the pin 42. Without such notches the pivot pin heads 32 and the transverse pins 42 and 43 would be positioned in a substantially straight line along the sides of the apertures 30 and 31 when the breaker is in its "trip" position. By notching the apertures 30 and 31 at 50 and 51 the pin 42 is allowed to move beyond dead center thereby to impart to the switch arm 18 a substantial switch opening bias. (Fig. 6). It will be understood, of course, that, while it is desirable to notch the supporting plates 25 and 26 as described so that the pins 42 can move beyond dead center, it is not material whether the pin 42 in its final position engages the edge of the aperture 29 or the notches 50 and 51 or both.

To reset the breaker mechanism after it has taken up its "trip" position of Fig. 6, the operating lever 27 must be rotated in a clockwise direction as viewed in the drawings about the fixed

pivot 28. By this movement the movable pivot pin at the lower end of the operating lever 27 is brought into engagement with the swingable carrier 33 at a point intermediate the transverse pin 42 and the projection 47, thereby to move the carrier 33 in a counter-clockwise direction against the bias of the operating springs 44, 45. During this resetting movement the movable pivot pin is not moved over center with respect to the operating springs 44, 45 so that the free end of the movable switch member 18 remains biased, and in fact is increasingly biased to its switch opening position. When the carrier 33 has been moved in a counter-clockwise direction sufficiently far to permit the roller 41 to fall into engagement with the shoulder 40 under the influence of the leaf spring 41a, the mechanism will be in the "off" position shown at Fig. 3 and may now be operated manually as previously described. Certain of the broader features of the switch mechanism herein disclosed are claimed in a copending application of W. L. Butler, Serial No. 390,644, filed April 28, 1941, and assigned to the same assignee as the instant application.

While I have shown and described a preferred form of my invention by way of illustration, many modifications will occur to those skilled in the art. I therefore wish to have it understood that I intend by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A circuit breaker comprising cooperating switch contacts, a pivotally mounted operating lever, a movable switch member having a free end connected to one of said contacts and another end pivotally connected to said operating lever, a pivoted carrier, latch means normally holding said carrier in a predetermined fixed position, an overcenter spring connected between said free end of said switch member and said carrier, said carrier being arranged when released by said latch means to move one end of said spring overcenter with respect to said switch member thereby to bias said switch member to a circuit opening position, and means operable upon release of said carrier by said latch to strike said switch member thereby positively to move said switch member to open said contacts.

2. A circuit breaker comprising a support, cooperating switch contacts, a movable switch arm operatively connected to one of said contacts, an operating lever pivotally supported at a fixed point in said support and having one end pivotally connected to one end of said movable switch arm, a swingable carrier pivoted at a second fixed point in said support, latch means for normally engaging said carrier to hold said carrier normally in a predetermined fixed position, an overcenter spring connected between the other end of said movable switch arm and the swingable end of said carrier for biasing said carrier to move said spring to a position to bias said movable switch arm to a switch opening position, and means operative in conjunction with said carrier to strike said movable switch arm upon release of said carrier thereby positively to move said switch arm to open said contacts.

3. An automatic circuit breaker comprising a support, cooperating switch contacts, a movable switch arm operatively connected to one of said contacts, an operating lever pivotally supported at a fixed point in said support and having one end pivotally connected to one end of said mov-

able switch arm, a swingable carrier pivotally mounted at a second fixed point in said support, latch means for normally engaging the swingable end of said carrier to hold said carrier normally in a predetermined fixed position, an overcenter spring connected between the other end of said movable switch arm and the swingable end of said carrier for biasing said carrier to move said spring to a position to bias said movable switch arm to a switch opening position, and means responsive to the current passing through said contacts for operating said latch means to release said carrier, said carrier being formed to provide a portion arranged to strike said movable switch arm upon release of said carrier thereby positively to move said switch arm overcenter with respect to said spring.

4. An automatic circuit breaker comprising a support, cooperating switch contacts, a manually operable operating lever pivoted at a fixed point in said support, one end of said operating lever being provided with an aperture and the other end of said lever being provided with an operating handle, a swingable carrier pivoted at one end in said support and provided at the other end with a transverse pin extending through said aperture, latch means arranged to engage said other end of said carrier normally to hold said carrier in a predetermined fixed position, a movable toggle arm having one end pivotally connected to said one end of said operating lever, means for connecting the other end of said toggle arm to one of said contacts, an overcenter spring connected between said transverse pin and said other end of said toggle arm for biasing said carrier to move said spring to a position to bias said toggle arm to a switch opening position, and means responsive to the current passing through said contacts for actuating said latch to release said carrier, said carrier being formed to provide a projection arranged to strike said toggle arm a hammer blow upon release of said carrier thereby positively to move said toggle arm to a switch opening position and to prevent welding of said contacts.

5. An automatic circuit breaker comprising a support, cooperating switch contacts, a carrier pivotally mounted upon said support, latch means engaging said carrier normally to hold said carrier in a predetermined fixed position, a movable switch arm having a free end operatively connected to one of said contacts, an overcenter spring connected between said carrier and said switch arm, a pivoted operating lever, pivotal means for connecting said switch arm at its other end to said operating lever for movement of said other end of said switch arm overcenter with respect to said spring, and means responsive to the current passing through said contacts for actuating said latch means to release said carrier for movement under the influence of said overcenter spring thereby to move said spring overcenter with respect to said pivotal means, said carrier providing means operative upon release of said carrier by said latch to strike said switch arm before said spring is moved over center with respect to said pivotal means, thereby positively to move said switch arm to open said contacts.

6. An automatic circuit breaker comprising cooperating switch contacts, a support, a carrier pivotally mounted upon said support, latch means engaging a swingable end of said carrier normally to hold said carrier in a predetermined fixed position, a movable toggle arm having a free end operatively connected to one of said

contacts, an overcenter spring connected between said swingable end of said carrier and said free end of said toggle arm, an operating lever pivotally mounted upon said support, pivotal means for connecting the other end of said toggle arm to said operating lever for movement over center with respect to said spring thereby to bias said free end of said toggle arm selectably to switch opening and switch closing positions, stop means associated with said toggle arm to limit its movement and define said switch opening and switch closing positions, and means responsive to the current passing through said contacts for actuating said latch means to release said carrier for rotation under the influence of said overcenter spring thereby to move said spring over center with respect to said pivotal means, said carrier being formed to provide a projection arranged to strike said toggle arm a hammer blow upon release of said carrier thereby positively to move said toggle arm over center with respect to said spring to open said contacts and to prevent welding of said contacts.

7. A circuit breaker comprising cooperating switch contacts, a pair of supporting plates mounted in parallel spaced relation, a manually operable operating lever mounted between said supporting plates on a fixed pivot, one end of said operating lever lying substantially wholly between said plates and being provided with an aperture, a movable switch arm having one end pivotally connected to said one end of said operating lever, a swingable carrier mounted between said plates and pivotally supported upon said plates at a fixed point, a transverse pin connected to the swingable end of said carrier and extending through said aperture, a latch lever mounted upon said fixed pivot and biased normally to engage the swingable end of said carrier to hold said carrier normally in a predetermined fixed position, an overcenter spring connected between the other end of said movable switch arm and said transverse pin for biasing said carrier to move said spring to a position to bias said switch arm to a switch opening position, and means responsive to the current passing through said contacts for actuating said latch lever to release said carrier, said carrier being formed to provide a projection intermediate its ends arranged to strike said movable switch arm upon release of said carrier by said latch lever.

8. An automatic circuit breaker comprising a base, cooperating switch contacts mounted upon said base, a pair of supporting plates mounted upon said base in upright parallel spaced relation, said supporting plates being provided with aligned apertures, a manually operable operating lever mounted between said plates upon a fixed pivot, the lower end of said operating lever lying between said aligned apertures and being provided with a substantially triangular aperture, a movable switch arm having one end connected to said lower end of said operating lever by a movable pivot pin, said movable pivot pin having head portions engageable with said supporting plates to provide stop means for said operating lever, a first transverse pin connected to the other end of said movable switch arm and extending through said aligned apertures in said supporting plates, said first transverse pin being engageable with the sides of said aligned apertures to define a switch open position of said switch arm, a swingable carrier pivotally mounted between said supporting plates, the swingable end of said carrier being formed to provide a

latch engaging shoulder and having connected thereto a second transverse pin extending through said triangular aperture and through said aligned apertures, a latch lever pivotally mounted upon said fixed pivot, said latch lever being biased to a normal position in engagement with said shoulder thereby to hold said carrier normally in a predetermined fixed position, a pair of overcenter springs connected between said first and second transverse pins, means responsive to the current passing through said contacts to operate said latch lever to release said carrier, and means formed upon said carrier intermediate its ends to strike said movable switch arm a hammer blow upon release of said carrier thereby positively to move said switch arm overcenter with respect to said spring to open said contacts.

9. A circuit breaker comprising cooperating switch contacts, a movable switch member operatively connected to one of said contacts, a pivoted operating lever providing means for pivotally supporting one end of said movable switch member, a pivoted carrier, latch means normally holding said carrier in a predetermined fixed position, an overcenter spring connected between the free end of said switch member and said carrier, and means operable upon movement of said operating lever to engage said switch member as a fulcrum intermediate its ends thereby to insure a positive opening of said contacts.

10. A circuit breaker comprising a support, cooperating switch contacts, a movable switch arm operatively connected to one of said contacts, a manually operable operating lever pivotally supported at a fixed point in said support and having one end pivotally connected to one end of said movable switch arm, a swingable carrier pivoted at a second fixed point in said support, latch means for normally engaging said carrier to hold said carrier normally in a predetermined fixed position, an overcenter spring connected between the other end of said movable switch arm and the swingable end of said carrier for biasing said carrier to move said spring to a position to bias said movable switch arm to a switch opening position, said operating lever being arranged to move said one end of said movable switch arm overcenter with respect to said spring thereby to open and to close said contacts, and means operative in conjunction with said carrier upon movement of said operating lever in a switch-opening direction to engage said movable switch arm as a fulcrum prior to movement of said one end of said movable switch arm overcenter with respect to said spring, whereby said contacts are separated by a positive linkage prior to operation of said overcenter spring.

11. An automatic circuit breaker comprising a support, cooperating switch contacts, a movable switch arm operatively connected to one of said contacts, a manually-operable operating lever pivotally supported at a fixed point in said support and having one end pivotally connected to one end of said movable switch arm, a swingable carrier pivotally mounted at a second fixed point in said support, latch means for normally engaging the swingable end of said carrier to hold said carrier normally in a predetermined fixed position, an overcenter spring connected between the other end of said movable switch arm and the swingable end of said carrier for biasing said carrier to move said spring arm to a position to bias said movable switch arm to a switch opening position, and means responsive to the current passing through said contacts for operating said

latch means to release said carrier, said carrier being formed to provide a portion arranged to engage said movable switch arm upon manual movement of said operating lever or upon release of said carrier by said latch means.

12. An automatic circuit breaker comprising a support, cooperating switch contacts, a manually operable operating lever pivoted at a fixed point in said support, one end of said operating lever being provided with an aperture and the other end of said lever being provided with an operating handle, a swingable carrier pivoted at one end in said support and provided at the other end with a transverse pin extending through said aperture, latch means arranged to engage said other end of said carrier normally to hold said carrier in a predetermined fixed position, a movable toggle arm having one end pivotally connected at one end of said operating lever, means for connecting the other end of said toggle arm to one of said contacts, an overcenter spring connected between said transverse pin and said free end of said toggle arm for biasing said carrier to move said spring to a position to bias said toggle arm to a switch opening position, and means responsive to the current passing through said contacts for actuating said latch to release said carrier, said carrier being formed to provide a projection arranged to engage said switch arm and to serve as a fulcrum therefor upon manual movement of said operating lever thereby positively to move said contacts to open position and to break any weld formed between said contacts.

13. A circuit breaker comprising cooperating switch contacts, a pair of supporting plates mounted in parallel spaced relation, said supporting plates being provided with aligned apertures, a manually operable operating lever mounted between said supporting plates on a fixed pivot, one end of said operating lever lying substantially wholly between said plates and being provided with a third aperture, a movable switch arm having one end pivotally connected to said one end of said operating lever, a swingable carrier mounted between said plates and pivotally supported upon said plates at a fixed point, a transverse pin connected to the swingable end of said carrier and extending through said aligned apertures and said third aperture, a latch lever mounted upon said fixed pivot and biased normally to engage the swingable end of said carrier to hold said carrier normally in a predetermined fixed position, an overcenter spring connected between the other end of said movable switch arm and said transverse pin for biasing said carrier to move said spring to a position to bias said switch arm to a switch opening position, and means responsive to the current passing through said contacts for actuating said latch lever to release said carrier, said carrier being formed to provide a projection intermediate its ends to engage said switch arm intermediate its end prior to the operation of said overcenter spring upon manual movement of said operating lever and upon release of said carrier, said transverse pin engaging said aligned apertures to provide a stop for said carrier during said manual movement of said operating lever, whereby said contacts are positively disengaged in both manual and automatic operation prior to their further separation by said overcenter spring.

14. A trip-free circuit breaker comprising a stationary contact, a movable contact, a movable switch member for operating said movable contact between closed and open circuit positions,

a carrier member, a spring having one end connected to said carrier member and its other end connected to said switch member, latch means normally holding said carrier member in a predetermined position against the force applied by said spring, and means responsive to the current passing through said contacts for actuating said latch means to release said carrier member, said carrier member being arranged when released to move said one end of said spring overcenter with respect to said switch member and to engage said switch member thereby to move said switch member to its open circuit position.

15. A trip-free circuit breaker comprising a stationary contact, a movable contact, a movable switch member for operating said movable contact between closed and open circuit positions, a carrier member, a spring having one end connected to said carrier member and its other end connected to said switch member, latch means normally holding said carrier member in a predetermined position against the force applied by said spring, means actuable in response to the current passing through said contacts for actuating said latch means to release said carrier member, said carrier member being arranged when released to move said one end of said spring overcenter with respect to said switch member and to engage said switch member thereby to move said switch member to its open circuit po-

sition, and means for moving said switch member about said carrier as a pivot to its open circuit position.

16. A circuit breaker comprising a stationary contact, a movable contact, a pivoted switch member having a pivoted end and a free end movable to operate said movable contact between closed and open circuit positions, a pivoted carrier member, a spring having one end connected to said carrier member and its other end connected to said free end of said switch member, latch means normally holding said carrier member in a predetermined position against the force applied by said spring, means responsive to the current passing through said contacts for actuating said latch means to release said carrier member, means for moving said pivoted end of said switch member thereby to cause said spring to snap said free end from one position to another, and a projection on said carrier member arranged when said carrier member is released by said latch means to engage said switch member and to move said switch member to its open circuit position, said projection being also arranged to be engaged by said switch member and to form a pivot therefor when said pivoted end of said switch member is moved to operate said switch member to its open circuit position.

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