

Aug. 27, 1929.

H. K. KRANTZ

1,726,233

MOTOR STARTING SWITCH

Filed Nov. 26, 1924

3 Sheets-Sheet 1

Fig. 1.

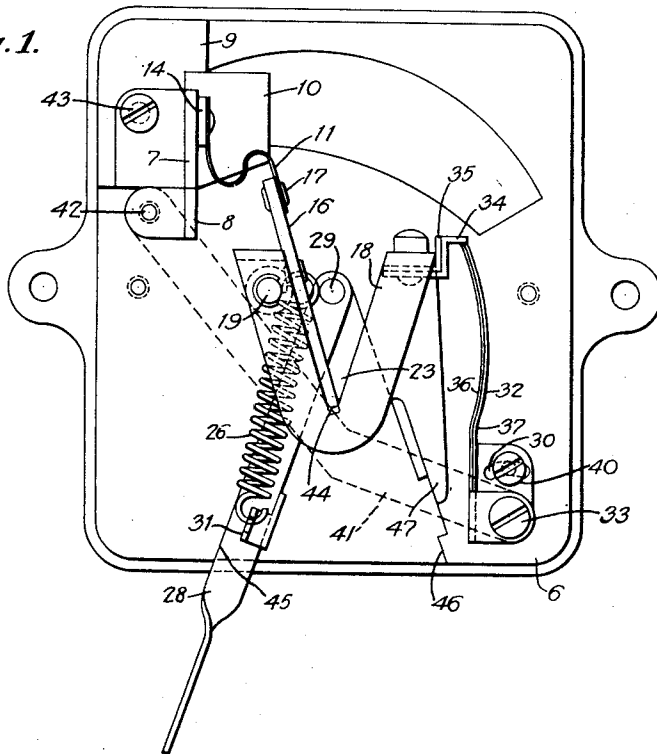
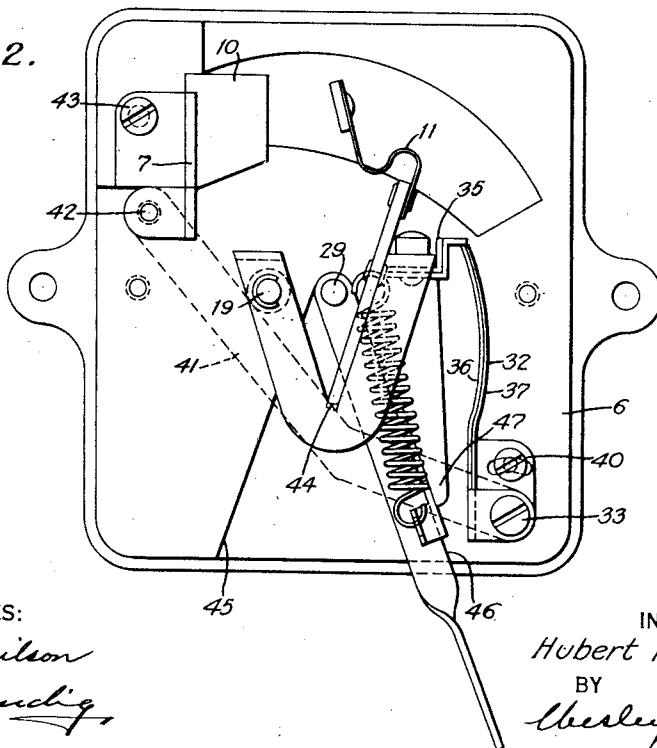


Fig. 2.



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3 Sheets-Sheet 2

Fig. 3.

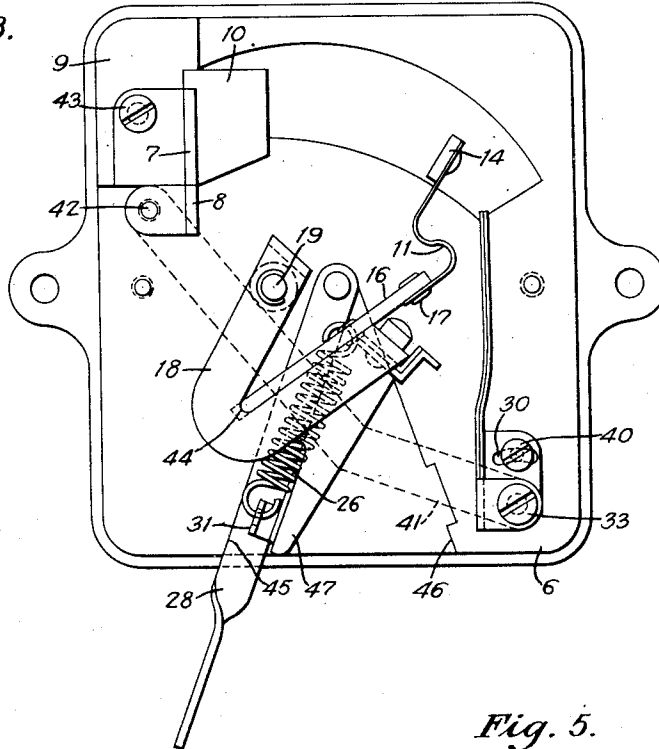


Fig. 4.

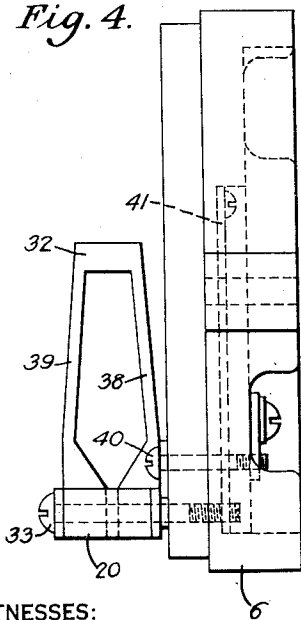
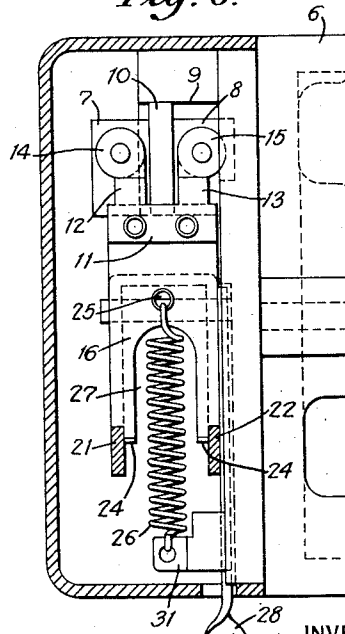


Fig. 5.



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3 Sheets-Sheet 3

Fig. 6.

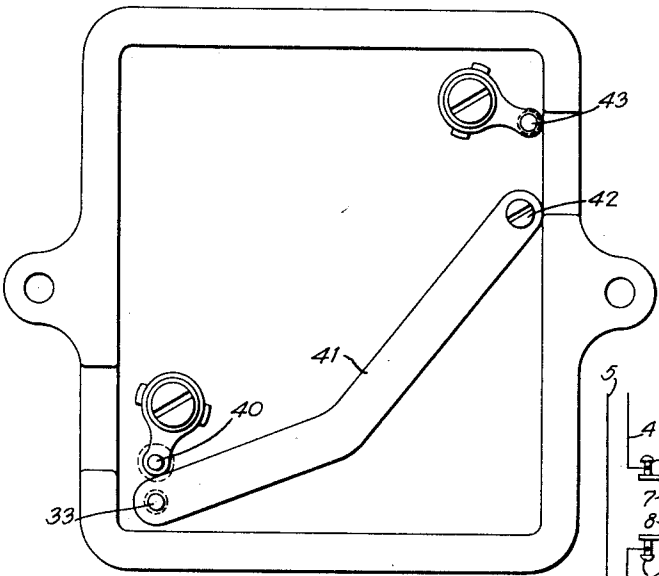


Fig. 8.

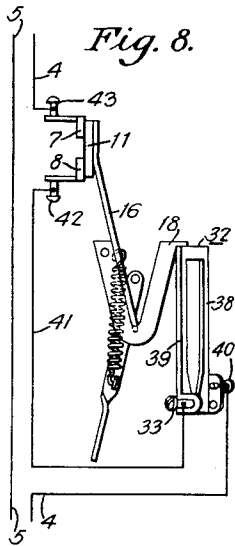
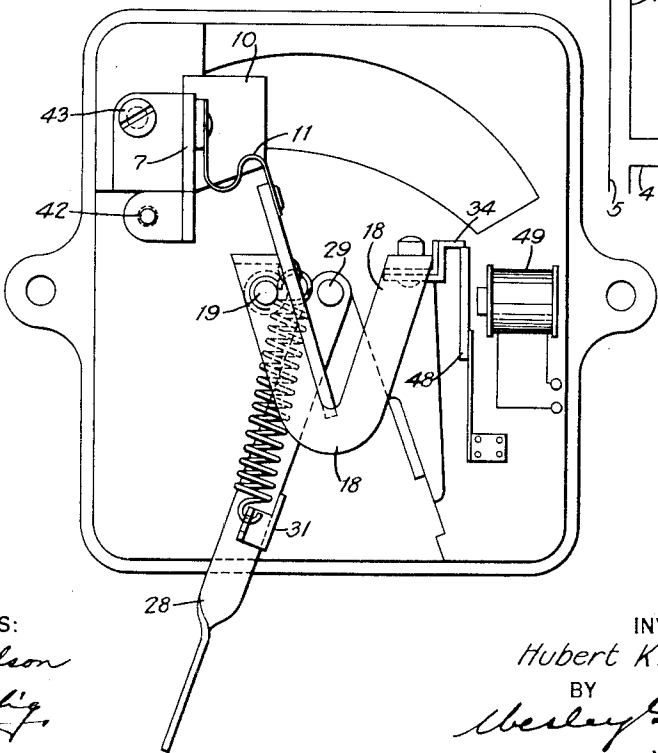


Fig. 7.



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MOTOR-STARTING SWITCH.

Application filed November 26, 1924. Serial No. 752,336.

My invention relates to electric switches and particularly to motor-starting switches having means for protecting the circuit and apparatus therein against overload and short-circuit conditions.

One object of my invention is to provide a motor-starting switch having a manually-operated switch that is automatically tripped to open position in response to overload conditions of the circuit after a predetermined period.

Another object of my invention is to provide a motor-starting switch that is trip-free of the handle; in other words, a switch that may be tripped to open position in response to predetermined current conditions, irrespective of the position of the operating handle.

Another object of my invention is to provide a motor-starting switch that may be manually reclosed and which will open independently of the operating handle in case of persistence of the overload or abnormal condition causing the switch to open.

Another object of my invention is to provide a motor-starting switch wherein the switch member is moved to open and closed positions with a snap action when actuated either manually or automatically and wherein the switch may be reset for normal operation by first moving the operating handle to the open position, thus insuring an open position of the switch at the time the switch is reset.

Another object of my invention is to provide a switch having the above-noted characteristics that has but one control handle which serves to reset the switch and to operate the switch to open and closed positions.

A further object of my invention is to provide a motor-starting switch that has a minimum number of parts that may readily be assembled to constitute a compact, efficient and durable switch unit.

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

Figure 1 is a plan view of the switch

mechanism embodying features of my invention, with the cover removed and showing the switch in closed position;

Fig. 2 is a plan view similar to that of Fig. 1, showing the switch in open position;

Fig. 3 is a plan view similar to Fig. 1, showing the switch in the open position it occupies when it has been automatically tripped;

Fig. 4 is a side elevational view of the base and thermal-responsive device shown in Figs. 1, 2 and 3;

Fig. 5 is a side elevational view of the switch mechanism with the thermal device removed; the movable switch support and the cover being shown in vertical section;

Fig. 6 is a bottom plan view of the base shown in Figs. 1, 2 and 3;

Fig. 7 is an elevational view of a modified means for rendering the switch responsive to predetermined current conditions; and Fig. 8 is a diagrammatic view of the circuit of an electric motor that is controlled by a switch embodying my invention.

Referring to the drawings, the switch mechanism includes an insulating base member 6 that may be made of molded insulating material and upon which the switch apparatus is mounted. A pair of stationary contact members 7 and 8 are mounted upon an insulating projection 9 and are disposed on opposite sides of an insulating barrier 10. The contact members 7 and 8 constitute terminals of a circuit that is to be closed by a bridging switch member 11 that comprises a bent metal plate having two projecting contact arms 12 and 13 provided with contact members 14 and 15, which respectively engage the stationary contact members 7 and 8, when the switch member 11 is moved into the position shown in Fig. 1.

The switch member 11 is secured to an insulating switch arm 16 by means of rivets 17, and the switch arm 16 is pivotally mounted for oscillation upon a metal support member 18 that is, in turn, pivotally mounted for oscillation on a shaft 19 that is secured to the base member 6. The supporting member 18 and the switch arm 16 may be considered as an articulated switch member, one portion of which is oscillated for

opening and closing the switch for normal operations and both portions of which are movable to open the switch automatically in response to predetermined current conditions in the circuit controlled by the switch.

The supporting member 18 is stamped from a sheet metal plate that is so formed that two similar portions 21 and 22 are provided that are joined at their upper ends and in which deep notches 23 of V-shape are provided, for receiving the switch arm 16 that is pivotally mounted for oscillation within the notches as indicated in Figs. 1, 2 and 3. The lower end of the switch arm 16 is provided with extensions 24 that are disposed on the inner side portions 21 and 22 of the support member 18, and which serve to prevent lateral displacement of the switch arm 16 with respect to the support member 18. The switch arm 16 is provided with a perforation 25 for receiving one end of an operating spring 26 and the switch arm is also provided with a clearance slot 27 for permitting the switch arm to oscillate between open and closed positions without interfering with the spring.

The other end of the spring 26 is pivotally attached to an operating handle 28 that is pivotally attached to the base member 6 by means of a shaft 29 secured to the base. The operating handle 28 is provided with an offset extension or bracket 31 for pivotally receiving the lower end of the spring 26 and for supporting the spring in parallel relation to the base and in central relation to the portions 21 and 22 of the support member 18.

The supporting member 18 is retained in operative position as shown in Figs. 1 and 2, by means of a thermal responsive bimetallic element 32, that is adjustably attached at one end to the base by means of a screw 33. The free end of the thermal element 32 engages, under normal operating conditions, a metal stop member 34 that is carried by, and insulated from, the support member 18, the fastening screw and stop member 34 being separated from the support member by a suitable insulating plate 35.

The bimetallic thermal-responsive element comprises a flat member made of two sheets 36 and 37 that are welded together, the sheet 36 having a greater coefficient of expansion than the sheet 37, thereby causing the element 32 to move outwardly or away from the stop member 34 when the temperature of the element is raised to a predetermined degree. The thermal element is of inverted U-shape, having two leg portions 38 and 39 that are separated at their attached ends by means of an insulating spacer 20 through which the attaching screw 33 extends. The element is heated by current in the circuit 5, Fig. 8, entering the switch through the terminal screw 40 that is connected to one end of the conductor 4, and passing through

the legs 38 and 39, Figs. 4 and 8, of the thermal element 32 through the attaching screw 33 of the thermal element and thence to a conducting strap 41 extending across the bottom of the base to the retaining screw 42 of the contact member 8. Current passes from the contact member 8 to the contact member 7 through the bridging switch member 11 and thence to the terminal screw 43 that is connected to the other end of the conductor 4.

Adjustment of the end of the thermal element 32 with respect to the stop member 34 for varying the time required for release of the support 18 under overload condition, may be made by loosening the screws 33 and 40 and adjusting the angular position of the element. The slot 30 permits limited adjustment thereof.

During the normal operation of the switch, current flows, therefore, through the thermal element and through the switch contact member 11 to complete the circuit controlled by the switch. The contact arm 11 is normally held in engagement with the contact members 7 and 8 by the over-center spring 26, which continues to hold it in closed contact until the operating handle has moved the spring pivot point of the bracket 31 past a center line traversing the point of engagement of the spring 26 with the arm 16 and the pivot point 44, about which the switch arm 16 oscillates. The instant that the spring pivot point of the bracket 31 passes the said center line, the over-center spring 26 causes the switch member 16 to be moved to the open position shown in Fig. 2 with a snap action. A return movement of the operating handle will cause the switch member 16 to be moved with a snap action to closed position shown in Fig. 1 as soon as the spring pivot point of the bracket 31 passes the line traversing the pivot points previously referred to. The movement of the handle is limited by stop faces 45 and 46 provided in the insulating base. Normal opening and closing operation of the switch is accomplished by simply moving the operating handle to the desired corresponding positions which may be indicated by legends suitably placed on the cover.

When an overload condition exists in the circuit, the thermal element 32 will be heated by the abnormal current and the free end thereof will be moved out of engagement with the stop member 34 on the support member 18. The spring 26, irrespective of its position, exerts a pressure on the support member 18, tending to move it to its inoperative or open position shown in Fig. 3. The instant that the stop member 34 clears the end of the thermal element 32, the support member 18 is moved downwardly by the spring 26, carrying with it the switch arm 16. During the downward movement of the

support member 18, the direction of application of force of the spring 26 on the switch arm 16 is shifted to move the arm to its extreme open position with respect to the support member 18, as shown in Fig. 3. This combined bodily and angular movement of the switch arm and the angular movement of the support member 18 causes an instantaneous separation of the switch contact member 11 from the contact members 7 and 8, the distance of separation being greater under such conditions than the normal separation when the switch is actuated manually.

The wider separation of the switch contact from the stationary contacts is desirable and advantageous during the interruption of the circuit due to abnormal current conditions when the current values are relatively high and destructive. The opening movement of the support member 18 is entirely independent of the position of the operating handle and, consequently, the circuit will be interrupted in response to overload conditions even though the handle be held in its closed position by the hand of the operator. The switch, therefore, is trip-free of the operating handle and the operator can in no manner interfere with the automatic opening of the switch.

After the switch has been tripped to open position automatically, it may be restored or reset to normal operating position by moving the operating handle to open position, as shown in Fig. 2. The bracket 31 on the operating handle 28 engages an extension 47 on the portion 22 of the support member 18 and causes the support member to be moved to its operative position as shown in Figs. 1 and 2 when the handle is moved to open position. The bracket 31 also serves to limit the movement of the support member 18 when the said member is moved to its inoperative position.

By reason of the construction above described, a single spring serves to open the switch under overload conditions or when the switch is actuated manually and the device is rendered trip free of the handle without the necessity of providing latches and triggers for connecting the operating handle with the switch member.

While I have shown the trip device in the form of a thermal-responsive element, it is obvious that other means may be employed for rendering the switch responsive to current conditions such as an electromagnet, illustrated in Fig. 7, wherein a yieldingly supported armature 48 serves to releasably retain the support member 18 in operative position. When an overload or short-circuit condition exists, the armature 48 is drawn out of engagement with the stop member 34 by means of the electromagnet 49 that is connected in the circuit controlled by the motor.

While I have illustrated but two embodi-

ments 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. Switch mechanism comprising a switch member movable to open and closed positions, a support for the switch member that is movable to an inoperative position for moving the switch member to open position, a movable operating member for the switch member and a spring operatively connecting the operating member to the switch member.

2. Switch mechanism comprising a switch member movable to open and closed positions, a support for the switch member that is movable to an inoperative position for moving the switch member to open position, a movable operating member for the switch member and a spring operatively connecting the operating member to the switch member, for moving the switch member in response to movement of the operating member and for moving the supporting member to inoperative position.

3. Switch mechanism comprising a switch member movable to open and closed positions, a support for the switch member that is movable to an inoperative position for moving the switch to open position, a movable operating member for the switch member, means for releasably retaining the support in operative position and yielding means operatively connecting the operating member to the switch member for moving the switch member independently of the support and for moving the support to inoperative position when released.

4. Switch mechanism comprising a switch member movable to open and closed positions, a support for the switch member that is movable to an inoperative position for moving the switch member to open position, means for releasably retaining the support in operative position, a movable operating member for the switch member, and a single spring operatively connecting the operating member and the switch member, for moving the switch member independently of the support and for moving the support to inoperative position when released.

5. Switch mechanism comprising a switch member movable to open and closed positions, a support for the switch member movable to an inoperative position for moving the switch member to open position, current-responsive means for releasably retaining the support in operative position, and yielding means for actuating the switch member to either open or closed position when the support is in operative positions and for permitting opening movement of the switch

member irrespective of the position of said actuating means when the support is released.

6. Switch mechanism comprising a fixed contact member an articulated switch member having a contact portion for engaging the fixed contact member and a current-responsive portion for effecting opening movement of the contact portion in response to predetermined current conditions, the said contact portion being movable to open or closed position independently of the current-responsive portion, and an overcenter spring for moving the contact portion to open or closed positions and for actuating the current-responsive portion.

7. Switch mechanism comprising an articulated switch member having a movable supporting portion and a contact portion movable independently thereof, manually operable means including an overcenter spring for actuating the contact portion, and means for releasably retaining the supporting portion in operative position.

8. Switch mechanism comprising an articulated switch member having a contact portion and a current-responsive portion for effecting opening movement of the contact portion in response to predetermined current conditions, and means independent of the current-responsive portion and including an overcenter spring for moving the contact portion to open and closed positions.

9. Switch mechanism comprising an articulated switch member having a contact portion movable to open and closed positions and a supporting portion that is movable to operative and inoperative positions and which, when moved to inoperative position, moves the contact portion to open position, current-responsive means for releasably retaining the supporting portion in operative position, and means including an overcenter spring for actuating the contact portion independently of the supporting portion.

10. Switch mechanism comprising a pivotally mounted support member, means for releasably retaining the support member in operative position, a contact member pivotally mounted on the support member and movable to open and closed positions, a pivotally mounted operating handle, an overcenter spring connecting the handle to the contact member for actuating the contact member in response to predetermined movements of the operating handle and for moving the support member to inoperative position to cause opening movement of the contact member irrespective of the position of the operating handle.

11. Switch mechanism comprising a base member, a contact member mounted thereon, a movable support member pivotally mounted on the base member, automatically-actuated means for releasably retaining the sup-

port member in operative position, a switch contact member pivotally mounted on the support member and movable into and out of engagement with the contact member, the said support member being movable to inoperative position for bodily moving the switch member out of engagement with the contact member, an operating member for the switch contact member movable to open and closed positions, and a spring for connecting the operating member and the switch contact member for biasing the switch member in open or closed positions when the operating member is in open and closed positions, respectively, and for biasing the support member toward its inoperative position irrespective of the position thereof.

12. Switch mechanism comprising a movable support, a fixed contact member, an overcenter spring, a switch member carried by the support and movable by the said spring independently of the support into and out of engagement with the contact member, and movable with the support out of engagement with the contact member.

13. Switch mechanism comprising a fixed contact member, a switch member movable into engagement therewith and a movable support for the switch member adapted when in operative position to support the switch member in either open or closed position and when moved to inoperative position to move the switch to open position and an overcenter spring for biasing the switch member and the support toward the said positions.

14. A switch mechanism comprising a movable contact member, a support therefor that is movable relatively thereto whereby said contact member may occupy an operative position only when said support is in a certain position and may occupy an inoperative position independently of the position of said support, and an overcenter spring for actuating the contact member independently of the support and for simultaneously actuating the contact member and the support.

15. A switch mechanism comprising a movable contact member, a support therefor that is movable relatively thereto whereby said contact member may occupy an operative position only when said support is in a certain position, and may occupy an inoperative position independently of the position of said support, and an operating member including an overcenter spring for imparting movement only to the contact member when the support is in one position and for operating the support when the latter is in another position.

16. Switch mechanism comprising a base member, a movable support of U-shape having recesses in each leg thereof of substantially V-shape, a switch member pivotally mounted for movement in the recess to open and closed positions, an operating member

for the switch member, an over-center spring disposed between the legs of the support and attached at one end to the switch member and at the other end to the operating member, whereby the switch is moved to open or closed positions when the operating member is moved to corresponding respective positions, and a current-responsive member for releasably retaining the support in operative position.

17. Switch mechanism comprising a base member, a movable support, pivoted at one end to the base member and releasably supported at its free end, a switch pivoted to the support intermediate the ends thereof and provided adjacent its free end with a contact member, an operating member pivoted to the base member, and an over-center spring connecting the switch member and the operating member, and biasing the support toward an operative position and the switch member to either open or closed position.

18. Switch mechanism comprising a base member, a movable support having a recess of substantially V-shape and having one end pivoted to the base member, a current-responsive latch for engaging the free end of the support and normally retaining it in operative position, a fixed contact member, a movable switch member having one end provided with a contact member for engaging the fixed contact member, and its other

end pivotally mounted in the apex of the said recess, and means for biasing the support toward inoperative position and for biasing the switch member to either open or closed position.

19. Switch mechanism comprising a base member, a contact member mounted thereon, a movable support member pivotally mounted on the base member, automatically-actuated means for releasably retaining the support member in operative position, a switch contact member pivotally mounted on the support member and movable into and out of engagement with the contact member, the said support member being movable to inoperative position for bodily moving the switch member out of engagement with the contact member, an operating member for the switch contact member movable to open and closed positions, and a spring having one end connected to the switch contact member and the other end connected to the movable operating member for biasing the switch member in open or closed positions when the handle is in open and closed positions, respectively, for biasing the support member toward its inoperative position, irrespective of the position thereof.

In testimony whereof, I have hereunto subscribed my name this 25th day of November, 1924.

HUBERT K. KRANTZ.