Jan. 24, 1956 F. A. TALBOT 2,732,453

CONTACTOR RESISTING OPENING IN RESPONSE TO CURRENT SURGES

Filed Feb. 29, 1952 2 Sheets-Sheet 1

Fig. 1.

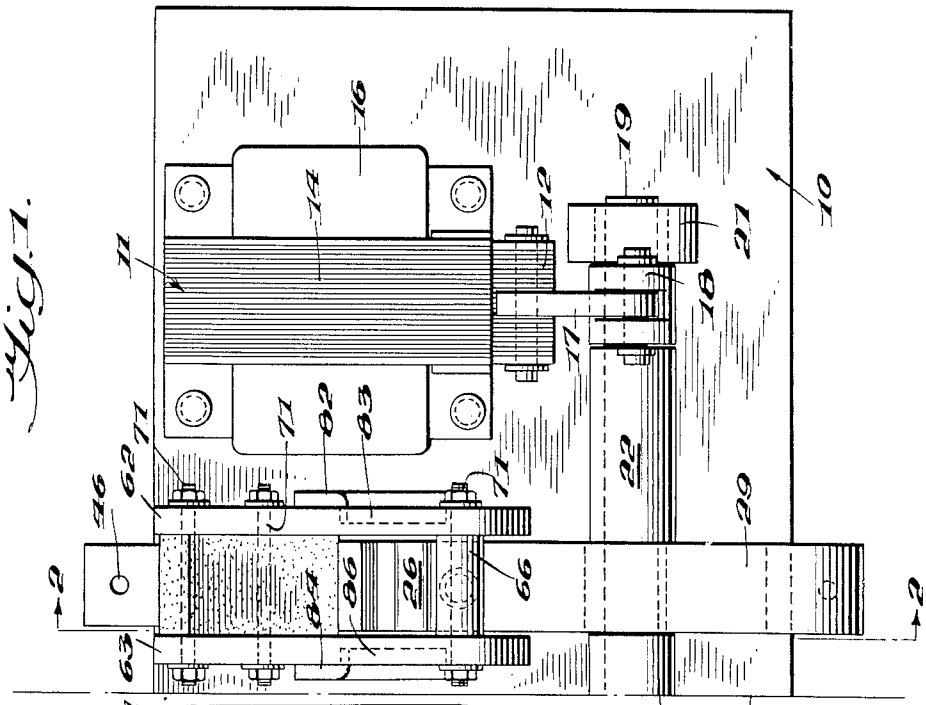
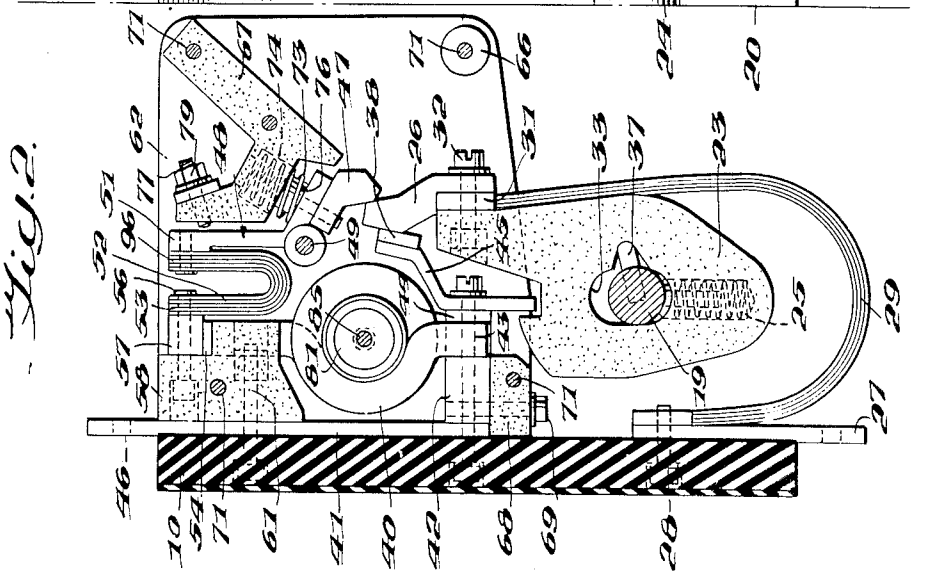


Fig. 2.



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Filed Feb. 29, 1952 2 Sheets-Sheet 2

Fig. 4.

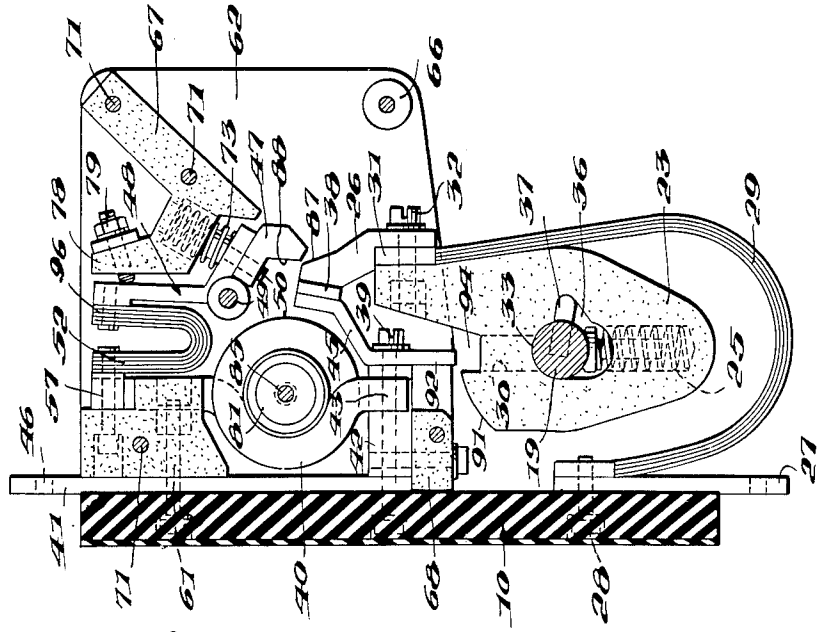


Fig. 3.

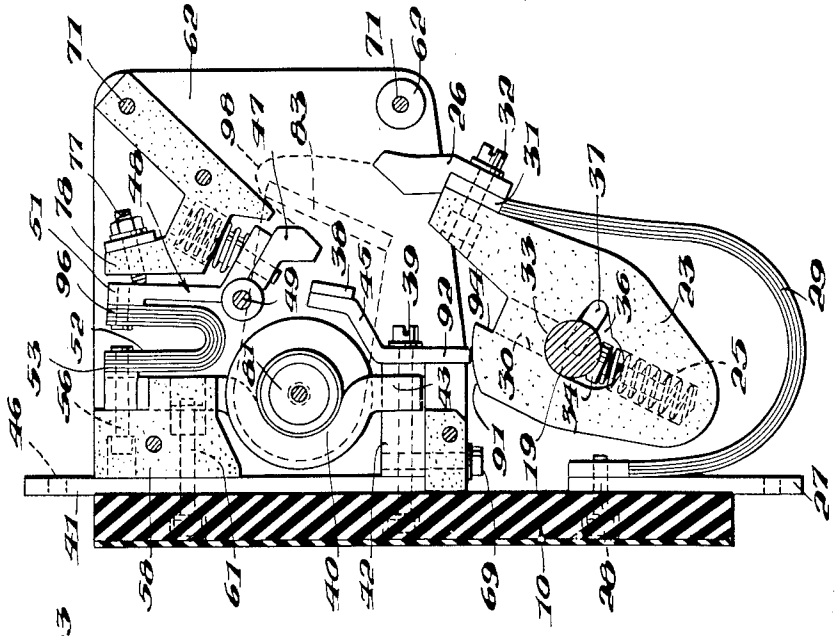
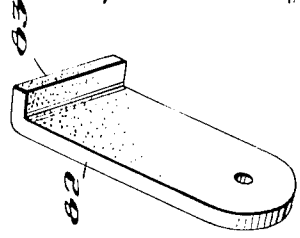


Fig. 5.



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CONTACTOR RESISTING OPENING IN RESPONSE TO CURRENT SURGES

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9 Claims. (Cl. 200—87)

The present invention relates to a circuit making and breaking device of the type adapted to be closed by remote control and the invention more specifically pertains to such a switch mechanism wherein the contacts are releasably maintained in a closed position and so constructed that surges in the load current assist in maintaining the contacts in a closed position.

In a conventional contactor the closed contacts often open when relatively large current surges pass through the closed contacts. A marked and rapid increase in the current sets up an intense magnetic field in the presence of the contacts and the flux often reacts in such a manner as to move the contacts to an open position.

An object of the present invention is to provide a contactor wherein the movable contact in closing first engages a stationary contact and then is moved linearly into engagement with another contact which serves as a detent to maintain the movable contact in engagement with the stationary contact and to thereby prevent inadvertent opening of the contacts as a result of a heavy current surge.

Another object of the invention is to provide a detent arrangement for releasably maintaining the movable contact of the switch in engagement with the stationary contact including means for increasing the holding action in response to sudden increases in the current flowing through the closed contacts.

A further object of the invention is to provide a shock resistant remote control contactor wherein one contact first engages another and then slides therealong to insure good electrical contact between the engaged contacts and to provide a loop circuit for the load current so that the flux set up thereby reacts in such a manner as to assist in maintaining the contacts in the closed position.

A still further object of the invention includes means for insuring proper closing of the contacts in the event of failure of one of the elements employed in normal closing of the contacts.

Other objects and features of the invention will be readily appreciated and become apparent to those skilled in the art as the present disclosure proceeds and upon consideration of the accompanying drawings and the following detailed description wherein an exemplary embodiment of the invention is disclosed.

In the drawings:

Fig. 1 is a front elevational view of a contactor exhibiting the invention.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 showing the parts in the fully closed position of the switch mechanism.

Fig. 3 is a similar sectional view showing the elements in the fully open position of the contacts.

Fig. 4 is a similar sectional view showing the parts in an intermediate position between the open and closed positions of the contacts.

Fig. 5 is a perspective view of an element of the magnetic blow-out assembly.

The contactor is adapted to be mounted on a board 10

formed of insulating material such as employed in switch boards or the like. A mechanism for moving the contacts to a closed position is shown generally at 11 in Fig. 1 which includes a magnetic core 14 mounted on the board 10 and a coil 16 therefor and an armature 12. A link 17 is connected to the armature and extends downwardly therefrom. The link 17 is pivotally connected at its lower end to a horizontally disposed arm 18 rigidly secured to a shaft 19. The shaft 19 is journalled for rotation in bearings carried by the mounting board 10 one of which is shown at 21. The shaft 19 may be utilized for actuating any number of contactor units mounted on the board 10 in side-by-side relationship. One of such units only is shown in the drawings. In Fig. 1 the mounting board is shown broken at 20 but may be extended at this end to accommodate additional contactor units all actuated by the shaft 19. A sleeve 22 is provided surrounding the shaft 19 between the arm 18 and an actuating member 23 for the first contactor unit. A similar sleeve 24 (shown in part) embraces the shaft 19. One end of the sleeve 22 abuts against one side of the actuating member 23 and an end of the sleeve 24 engages the other side face of the member 23 to maintain the actuating member 23 in a substantially fixed position axially of the shaft 19.

The actuating member 23 is preferably formed of insulating material and provides means for supporting and carrying a movable contact element 26. One terminal for the switch mechanism is shown at 27 which may be secured to the board 10 by means of a screw 28. A flexible conductor 29 is maintained in electrical circuit relationship with the terminal strip 27 by means of the screw 28. The flexible conductor 29 may be formed of laminations as illustrated or may be of any other type having flexible characteristics. The upper end of the conductor 29 carries a rigid conductive portion 31 which is arranged under and in engagement with the contact 26. The contact 26 and the end of the conductor 29 are secured in this position and mounted on the actuating member 23 by means of a bolt 32.

The actuating member 23 is provided with an elongated or generally elliptical shaped opening for receiving the shaft 19. The upper portion is circular shaped as indicated at 33 and is struck about a horizontal axis having a radius substantially equal to that of the shaft 19. The lower portion of the elongated opening is also arcuate shaped as indicated in Fig. 3. The axis about which the lower arcuate edge of the elongated slot is struck is spaced below the axis about which the curved surface 33 is generated. A lateral slot 36 is also provided in the actuating member 23 which is in open communication with an intermediate portion of the elongated opening. A key 37 carried by the shaft 19 extends into the lateral slot 36. The slot 36 is provided with angular converging side walls as will be evident upon consideration of Fig. 2. A recess is provided in the actuating member 23 below the opening for the shaft 19 for accommodating a helical spring 25. The lower end of the spring 25 abuts against the closed end of the recess. A shoe 34 is engaged by the upper end of the spring 25. The shoe has a concave surface for engaging the periphery of the shaft 19. The spring may be introduced into the recess through an aperture 30 indicated in dotted lines in Figs. 3 and 4.

A stationary contact which serves as a fixed abutment is shown at 38. An electrically conductive arm 45 supports the contact 38. The arm 45 is secured to the board 10 by means of a screw 39. A circuit is established from the stationary contact 38 to a terminal strip 41 through a conductive spacer element 42 and one terminal 43 of a blow-out coil 40 and a washer or the like 44 interposed between the supporting arm 45 and the terminal end 43 of

the blow-out coil. These parts are maintained in rigid assembled relationship to establish a good electrical circuit between the contact 38, the terminal end 43 of the blow-out coil and the terminal strip 41 by the screw 39. The upper end of the terminal strip 41 is provided with an opening 46 for connecting an electric conductor thereto.

A detent is provided for the purpose of releasably retaining the movable contact 26 in engagement with the contact 38. The detent includes a contact element 47 which is rigidly secured to one arm of a bell crank lever 48 by means of a screw 50 and a cylindrical shaped spacer element 76. The lever 48 is mounted for pivoting movement about a pin 49 carried by the side boards 62 and 63 of an arc shield assembly. The bell crank lever 48 is formed of a metal having good electrical conductive characteristics and the upper end 51 is rigidly secured to one end of a flexible U-shaped loop 52. The other end 53 of the U-shaped loop 52 is maintained in a fixed position and electrically connected to another terminal 57 of the blow-out coil 40. The upper end 53 of the U-shaped loop 52 is maintained in a fixed position by means of a bolt 56 which extends through the laminations and through the terminal end 57 of the blow-out coil. The bolt 56 is anchored in a block of insulating material 58 rigidly secured in position by means of a bolt 61.

The arc shield side boards 62 and 63 are formed of heat resistant material. These side boards are arranged at opposite sides of the contacts and maintained in spaced relationship. One spacer element for this purpose is shown at 66. Another spacer element 67 is bar-shaped and formed of insulating material. The block 58 also serves as a spacer element for the side boards and a block 68 formed of insulating material serves as a further spacer element. The block 68 is secured to the conductive member 42 by means of a screw 69. A plurality of bolts 71 extend through the various spacer elements and nuts at the outer faces of the side boards 62 and 63 hold them in position to provide arc shields at the sides of the contacts.

The bar shaped insulating member 67 is rigidly secured between the side boards 62 and 63 by two bolts 71. The member 67 serves as an abutment for a spring 73 which cooperates with the contact 47. The upper end of the spring 73 extends into a cylindrical shaped recess formed in the insulating member 67. The spring 73 at its lower end engages the upper face of one arm of the bell crank lever 48 and thus tends to rotate this lever in a clockwise direction about the pivot pin 49. Such pivoting movement of the bell crank lever 48 is limited by means of an adjustable abutment screw 77 carried by an extension 78 of the insulating block 67. The position of the end of the abutement screw 77 may be adjusted and fixed by means of the lock nut 79.

The blow-out coil 40 is provided with a magnetic core 81. This core extends through openings (not shown) in the side boards 62 and 63. A plate 82 lies in flat engagement with one end of the core 81 and extends along the outer face of the side board 62. The free end 83 is bent inward and extends into a notch formed in the side board 62. A similar plate 84 lies in flat engagement with the other end of the magnetic core 81 and extends along the outer face of the side board 63. The free end 86 of the plate 84 extends into a notch in the side board 63. The plates 82 and 84 are formed of magnetic material and the free ends 83 and 86 are turned inwardly to provide a relatively narrow air gap for stretching the arc in a conventional manner upon the opening of the contacts. The plates 82 and 84 may be secured to opposite ends of the core 81 by screws one of which is shown at 85.

In operation and when the switch is in the open position shown in Fig. 3 energization of the coil 16 will cause the armature 12 to move upwardly and rotate the shaft 19 in a counter-clockwise direction from that shown in Fig. 3. In this position the spring 25 will maintain the actuating member 23 in a lower position so that the arcuate edge 33 will be in engagement with the periphery of the shaft 19. Counter-clockwise rotation of the shaft 19 will cause the key 37 to engage the upper edge of the lateral slot 36 so that the actuating member 23 is then rotated in a counter-clockwise direction. The movable contact 26 is thus moved into engagement with the fixed contact 38. This position is shown in Fig. 4.

The contact 38 thereafter serves the further function of acting as an abutment preventing further counter-clockwise rotation of the contact 26. Further counter-clockwise rotation of the shaft 19 is possible because of the particular disposition of the key 37 and such rotation will cause the actuating member 23 to move upwardly from the position shown in Fig. 4 so that the contact 26 while being pressed into engagement with the contact 38 slides therealong to further develop good electrical contact. The face 87 of the contact 26 is angularly disposed with respect to the surface engaging the contact 38 and during upward movement the face 87 engages the face 88 of the substantially stationary detent contact 47. During such linear movement of the actuating member 23 from the position of Fig. 4 to the position shown in Fig. 2 the spring 25 is compressed so that the shaft 19 then enters the lower portion of the elongated opening in the actuating member 23. The contact 26 is thus urged into firm engagement with the detent contact 47 and counter-clockwise swinging of the contact 47 is resisted by the spring 73 and the resilient characteristics of the U-shaped loop 52. A circuit is thus established from the terminal 27 through the flexible conductor 29, the contact 26, the contact 47, the bell crank lever 48, the U-shaped loop 52, the blow-out coil 40, the spacer element 42, and the terminal strip 41. Another circuit is established from the contact 26 through the contact 38 and the washer 44 and the element 42 to the terminal strip 41.

The invention includes auxiliary means to insure closing of the contactor in the event of breakage or failure of the spring 25. An arcuate edge 91 is provided on the actuating member 23 as shown in Fig. 3. This edge is struck about an axis defined by the center of the shaft 19 when the parts are in the position shown in Fig. 3. The radius of the surface 91 is such that it clears the lower end of an extension 92 of the conductive arm 45 which supports the stationary contact 38. Thus the arcuate end 33 of the elongated opening in the actuating member 23 is maintained in engagement with the periphery of the shaft 19 during initial swinging movement of the actuating arm 23 towards the closed position from that shown in Fig. 3. A notch 94 is provided in the upper portion of the actuating member 23 to permit upward movement thereof after the movable contact 26 engages the fixed contact 38 and when the parts are in the position shown in Fig. 4. Thus closing of the contactor is assured even though there is a failure of the spring 25.

The operation of opening the contactor involves de-energization of the coil 16. The armature 12 then moves downwardly so that the shaft 19 rotates in a clockwise direction from the position shown in Fig. 2. The key 37 first moves the actuating member 23 downwardly and the contact 26 slides downwardly along the face of the stationary contact 38. The upper end of the contact 26 thereby escapes from under the detent contact 47. Further clockwise rotation of the shaft 19 will then permit the actuating member to swing to the open position shown in Fig. 3.

The switch mechanism has particular utility in resisting inadvertent opening of the contacts upon the occurrence of heavy surges in the load current passing through the closed contacts. The latch arrangement as provided by the detent contact 47 may be sufficient to prevent separation of the contacts 26 and 38 and the contacts 47 and 26. The detent characteristics of maintaining the contacts in a closed position is further supplemented by the action of the current flowing through the U-shaped

loop 52. A heavy surge current passing through this U-shaped conductor sets up a flux in one leg of the U-shaped member which opposes the flux set up around the other leg. The upper end 96 of the U-shaped member is thus moved to the right as a result of this magnetic field which tends to straighten the conductor. Accordingly the bell crank lever 48 is turned in a clockwise direction about the pin 49. Thus the detent contact 47 is moved downwardly to more positively maintain the movable contact 26 in engagement with the stationary contact 38. The area of overlapping is increased and the pressure of engagement is also increased.

When the contacts open under load the field set up by the blow-out coil 40 provides flux linking the free ends 83 and 86 of the magnetic plates associated with the blow-out coil. Thus the arc is stretched from the contact 47 to the contact 26 as shown in a dotted line 98 in Fig. 3. Such elongation and stretching of the arc is accomplished in a well-known manner for the purpose of minimizing the burning of the contacts.

While the invention has been shown and described with reference to specific structural features and in connection with one general organization for biasing a detent contact to a position to further prevent the separation of the contacts it will be appreciated that changes may be made in the elements as well as the overall assembly. Such modifications and others may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. In an electrical switch, a stationary abutment contact, a swingable arm carrying a movable contact adapted to swing to a position engaging said abutment contact, a shiftable detent contact engaging said movable contact on a side substantially opposite said abutment contact, a flexible U-shaped electrically conductive member mechanically connected to said detent contact and in circuit relationship therewith to shift the detent contact into more positive engagement to cause increased contact pressure beween the movable contact and said abutment contact upon the occurrence of current surge through the U-shaped conductive member.

2. In a remote control contactor, a stationary contact, a rotatable shaft, an actuating member having an elongated opening therein receiving said shaft, means resiliently urging the actuating member radially of the shaft, a second contact on said actuating member, a key carried by the shaft projecting into a slot extending from the elongated opening swinging the actuating member upon initial rotation of the shaft and moving the second contact into engagement with the stationary contact, said key being disposed to move the acuating member radially of the shaft in opposition to said resilient means upon further rotation of the shaft to shift the second contact linearly along the staionary contact, and a detent engaged by the second contact while maintaining engagement with the stationary contact.

3. In a remote control switch, a fixed contact, a rotatable shaft, an actuating member mounted on said shaft having an elongated opening therein, a spring urging the actuating member radially of the shaft so that one end of the elongated opening engages the periphery of the shaft, a second contact carried by said actuating member, a key secured to the shaft extending into a slot in the actuating member to turn the actuating member upon initial rotation of the shaft and move the second contact into engagement with the fixed contact, said key being so arranged to move the actuating member radially of the shaft in opposition to the spring upon further rotation of the shaft to shift the second contact linearly along the stationary contact while being pressed there against, and a detent engaged by the second contact afer predetermined linear movement thereof.

4. In a remote control contactor, a stationary contact, a rotatable shaft, an actuating member having an elongated opening therein receiving said shaft, resilient means urging the actuating member radially of the shaft, a second contact on said actuating member, a key carried by the shaft to turn the actuating member upon initial rotation of the shaft and move the second contact into engagement with the stationary contact, said key moving the actuating member radially of the shaft in opposition to said resilient means upon further rotation of the shaft to shift the second contact linearly over the stationary contact, a detent contact mounted for pivoting movement and adapted to be engaged by the second contact after a predetermined linear movement thereof, a U-shaped electrically conductive loop having one end mounted in a fixed position, an electrically conductive lever connected to the other end of the U-shaped loop and to the detent contact so that flux set up by U-shaped loop pivots the detent contractor into further engagement with the second contact.

5. In an electrical switch, a stationary contact forming a fixed abutment, a rotable shaft, a rigid actuating member mounted on said shaft to rotate therewith and movable radially with respect to the shaft, a contact carried by said actuating member adapted to engage the stationary contact upon predetermined rotation of the shaft and swinging movement of the actuating member, means operated by the shaft moving the actuating member radially with respect to the shaft upon further rotation thereof to urge the movable contact into engagement with the stationary contact and to shift the movable contact linearly along the stationary contact, a detent contact engaged by the movable contact after a predetermined linear movement thereof, a U-shaped flexible conductive loop in circuit relationship with the detent contact and mechanically connected thereto to urge the detent contact to a position further overlying said movable contact in response to current surges passing through the U-shaped loop.

6. In an electrical switch, a stationary contact, a movable contact engaging the stationary contact, a detent contact engaging and overlying a portion of said movable contact holding it in engagement with said stationary contact, a U-shaped flexible conductive loop in circuit relationship with said detent contact and mechanically connected thereto to urge the detent contact to a position causing a greater overlap of said portion of the movable contact in response to current surges passing through the U-shaped conductive loop.

7. In an electrical switch, an abutment contact, a rigid swingable arm carrying a movable contact thereon adapted to move in a circular path to swing the movable contact to a position engaging said abutment contact, a pivotally mounted bell crank lever, a detent contact carried by an arm of the bell crank lever overlying and engaging said movable contact holding it in engagement with said abutment contact, a flexible U-shaped electrically conductive loop having one leg electrically and mechanically connected to another arm of the bell crank lever, means providing a rigid support for a second leg of the U-shaped conductive loop, a circuit extending from the second leg of the U-shaped loop whereby the bell crank lever is pivoted to shift the detent contact to a position increasing the overlying engagement of the detent contact with the movable contact and increasing the pressure between the movable contact and the abutment contact upon occurrence of a current surge through the U-shaped loop.

8. In an electric switch, a stationary contact, a rotatable shaft, an actuating member mounted on said shaft for rotation therewith, a second contact carried by the actuating member movable into engagement with the stationary contact upon rotation of the shaft and swinging movement of the actuating member, said actuating member having an opening therein elongated radially of the shaft, an arcuate surface on the actuating member concentric with the axis of said shaft, fixed means adjacent said arcuate surface preventing radial shifting of the actu-

ating member relative to the shaft during the swinging movement of the second contact into engagement with the stationary contact, means for moving the actuating member radially of the shaft and shifting the second contact linearly along the stationary contact, and a detent engaged by the second contact after a predetermined linear movement thereof.

9. In an electric switch, a stationary contact, an actuating member mounted to rotate about one axis, a second contact carried by the actuating member movable in an arcuate path into engagement with the stationary contact upon swinging movement of the actuating member about said axis, said actuating member being movable transversely of said axis, an arcuate surface on the actuating member concentric with said axis, means adjacent said arcuate surface preventing shifting of the actuating member transversely of said axis during said swinging movement of the second contact into engagement with the stationary contact, means for moving the actuating member transversely of said axis while pressing the second contact into engagement with the stationary contact and shifting it linearly thereover, and a detent engaged by the second contact after a predetermined linear movement thereof.

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