July 4, 1944. H. L. VAN VALKENBURG 2,352,815

ELECTRIC SWITCH

Filed July 12, 1941 2 Sheets-Sheet 1

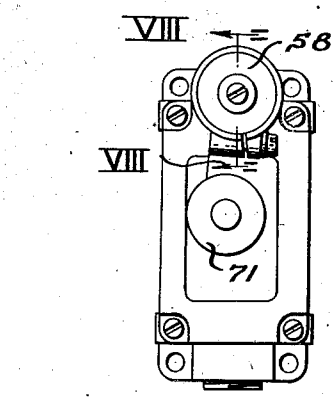


Fig. 1.

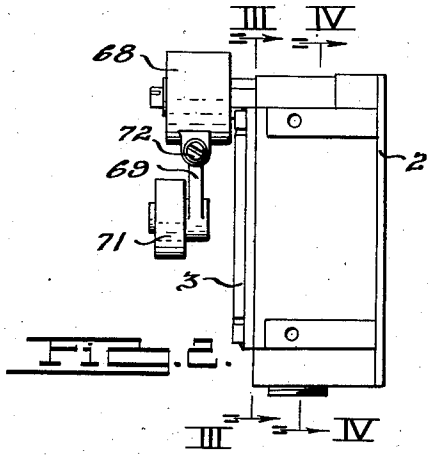


Fig. 2.

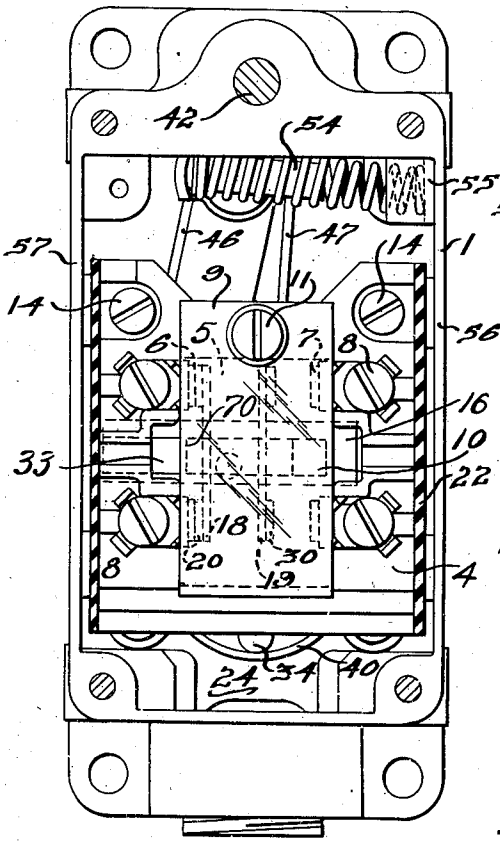


Fig. 3.

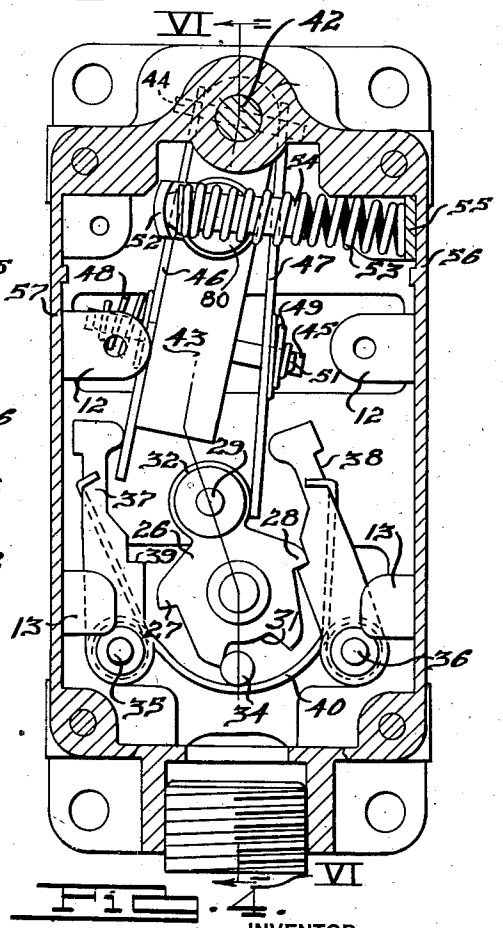


Fig. 4.

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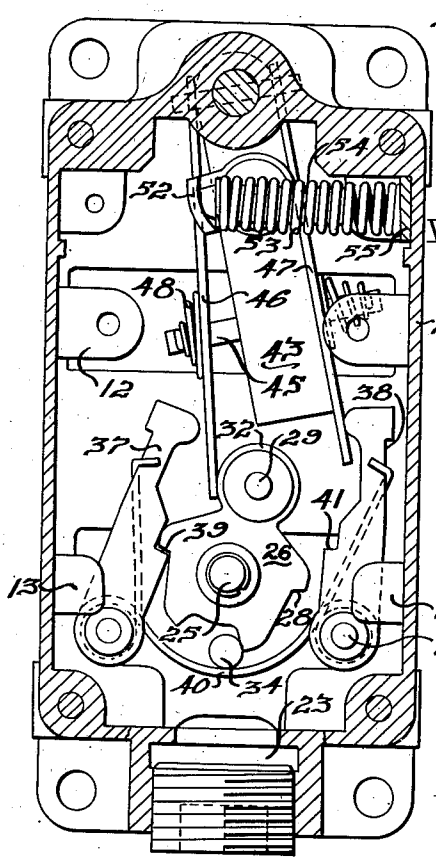


Fig. 5.

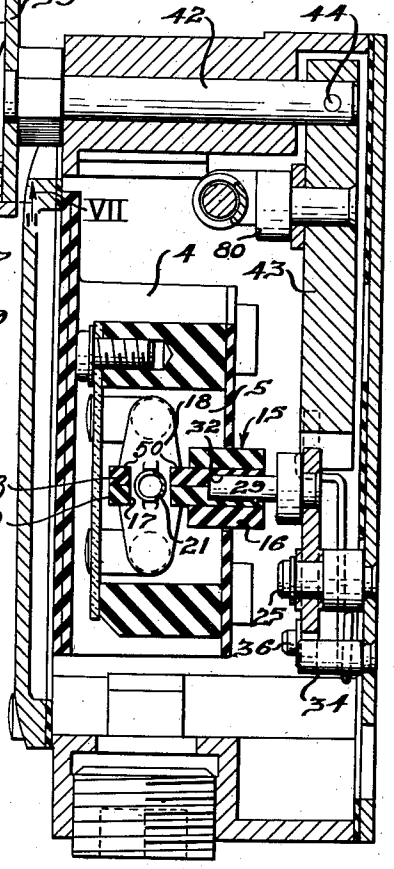


Fig. 6.

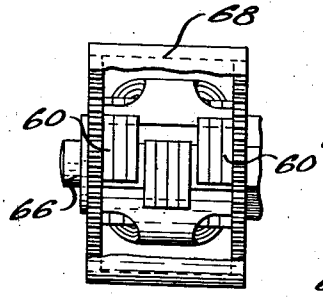


Fig. 7.

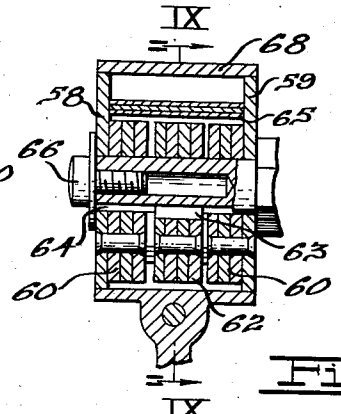


Fig. 8.

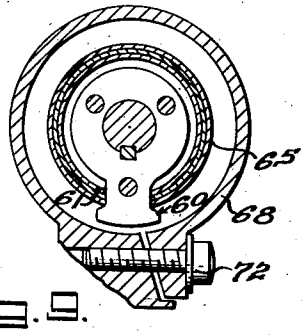


Fig. 9.

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UNITED STATES PATENT OFFICE

2,352,815

ELECTRIC SWITCH

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Application July 12, 1941, Serial No. 402,055

10 Claims. (Cl. 200—70)

This invention relates to electric snap switches and more particularly to electric control switches of the type known as limit switches.

One object of the present invention is to provide an electric snap switch of an improved and economical construction.

Another object of the present invention is to provide an electric switch having improved means for effecting quick make and break of an electrical circuit.

Another object of the present invention is to provide a limit switch in which a substantial emergency over-travel of the operator is permitted.

Another object of the present invention is to provide a limit switch having an improved form of operating handle.

Other objects and features of the invention will be readily apparent to those skilled in the art from the specifications and appended drawings illustrating certain preferred embodiments in which:

Figure 1 is a front elevational view of the limit switch according to the present invention.

Figure 2 is a side elevational view of the limit switch.

Figure 3 is a vertical sectional view taken on the line III—III of Figure 2.

Figure 4 is a vertical sectional view taken on the line IV—IV of Figure 2.

Figure 5 is a view similar to Figure 4 but with the operating parts disposed in the opposite direction.

Figure 6 is a vertical sectional view taken on the line VI—VI of Figure 4.

Figure 7 is a horizontal sectional view taken on the line VII—VII of Figure 6, with the hub broken away to show the parts as stressed by an over-travel of the operator.

Figure 8 is a vertical sectional view taken on the line VIII—VIII of Figure 1.

Figure 9 is a vertical sectional view taken on the line IX—IX of Figure 8.

The switch, according to the present invention comprises a substantially rectangular casing 1 open at front and back. A supporting plate 2 secured to the back of the casing, and a cover 3 mounted at the front thereof, seal off these openings. Gaskets disposed at the junctures of the supporting plate 2 and mounting cover 3 with the rectangular body 1 provide an oil and dust tight enclosure. A contact block 4 having an opening 5 therethrough is received within the enclosure 1. Pairs of spaced contacts 6 and 7 are mounted at opposite sides of the opening 5. Terminal studs 8 mount the stationary contacts 6 and 7 in place upon the contact block and serve to secure the terminals of lead in wires to the contact block. A transparent plastic guard plate 9 secured to the contact block 4 by a stud 11 closes opening 5 and prevents interference from the wiring with the contact assembly disposed within the opening. The contact block 4 rests upon brackets 12 and 13 provided by opposite sides of enclosure 1 and spaced from the supporting plate 2. Screws 14 passing through the contact block 4 secure the block to the brackets 12 to maintain it in spaced relation to the supporting plate 2.

A movable contact assembly 15 is disposed within the opening 5 in the contact block 4 and comprises an insulating block 16 to which a second insulating block 10 is rigidly joined in any well known manner. The portion of block 10 extending beyond the upper surface of block 16 is of an inverted T shape, the leg of which comprises a rectangular portion 33 which is of smaller outline than the outline of block 16, as shown in Figure 3. The rectangular portion 33 is adapted to engage opposite sides of opening 5 to thereby define the extent of movement of the contact assembly 15 within the opening 5. Block 10 is further provided with a rectangular opening 17 located substantially centrally of that portion of block 10 above block 16. A pair of spaced conducting plates 18 and 19, having contact elements 20 and 30 mounted thereon upon opposite faces and at either end thereof are provided within the opening 17 in contact block 10 to cooperate with the oppositely mounted stationary contacts 6 and 7. The plates 18 and 19 are mounted on block 10 by inserting them endwise through opening 17 and then turning them on edge so that shoulder portions 50 thereof closely embrace the lateral sides of block 10 as shown in Figure 6, which figure shows a section as passing through the opening 17 and between contact plates 18 and 19. A spring 21 disposed between the conducting plates 18 and 19 normally maintains the plates in spaced relationship and with their faces normally disposed against opposite defining surfaces of the opening 17. The pair of movable contacts 20 are normally biased for bridging engagement with stationary contacts 6 in a manner to be hereinafter described. A flexible insulating lining 22 is wrapped about the contact block 4 and insulates the live parts and the wiring from the operating mechanism and the casing 1. Casing 1 has an opening 23 provided at the bottom thereof and leading into a wiring trough 24 disposed adjacent to the contact block 4. This construction simplifies wiring of the contact block 4.

Pivotally mounted upon a pin or post 25 carried by the supporting plate 2 is a switching member 26 having two catch portions 27 and 28 provided thereon at opposite sides thereof. The switching member is notched as at 31 at one end, and supports a pin member 29 at its opposite end 32. The pin 29 is adapted to be loosely

received within an opening provided by contact block 16 to effect a support for the movable contact assembly 15 and to maintain it within opening 5 in contact block 4. The pin 29 is of sufficient length that contact assembly 15 when supported thereon will be in proper operating position within recess 5 to permit the ready engagement and disengagement of the movable contacts with the stationary contacts mounted at the sides of the opening 5. A stop pin 34 mounted upon the supporting plate 2 cooperates with the notch 31 to limit the movements of the switch member 26 in opposite directions. Pivotally supported upon spaced pin members 35 and 36 provided by supporting plate 2 adjacent to the pivotal switch member 26 and on either side thereof are latch members 37 and 38 having ledges 39 and 41 thereon adapted to engage respectively with catches 27 and 28 of the switching member 26. A resilient wire 40 wound around the pins 35 and 36 and having the ends thereof engageable with the latch members 37 and 38 biases these members for movement toward each other and toward the pivotal switching member 26 whereby the ledges 39 and 41 will be normally biased for engagement with the catches 27 and 28.

An actuating shaft 42 passing through an opening provided in the top of casing 1 carries an operating member 43 at the inner extremity thereof and rigidly secured thereto for movement thereby. A pair of pins 44 and 45 are mounted upon the operating member 43 with the upper pin 44 passing through both the operating member 43 and the shaft 42. Carried at opposite sides of the operating member 43 are flat elongated lever members 46 and 47 each having a pair of openings therethrough adapted to receive the pins 44 and 45 to support the levers 46 and 47. A pair of conical springs 48 and 49 are mounted one at either extremity of the lower pin 45 and between a lever member and a cotter pin 51. Both of the lever members 46 and 47 extend beyond the lower extremity of the operating member 43 and lie one at either side of the portion 32 of the pivotal switching member 26 and are engageable therewith for a purpose to be hereinafter described.

Rotatably secured to the operating member 43 and upon the upper face thereof is a generally L shaped member 52. A retaining stud 80 maintains member 52 on operating mechanism 43. A coil spring 53 having a spring guide pin 54 inserted in one end thereof is interposed between a leg of the L shaped member 52 and a slidable member 55 disposed against a side wall 56. The spring 53 normally biases the operating member 43 for movement in a clockwise direction as viewed in the drawings. This spring force is also exerted through lever 47 upon switching member 26 and through the switching member 26 upon the contact block 16 to normally bias movable contacts 20 into engagement with stationary contacts 6. In this position, conducting plate 18 carrying contacts 20 will be spaced from the defining surface 70 of opening 17 with which it is normally in contact, and is moved to this position against the bias of spring 21 to thereby provide a substantial contact pressure between contacts 6 and 20.

The operating member 43 may be biased for movement in the opposite or counter-clockwise direction in the following manner: The slidable member 55 can be moved outwardly from within the enclosure 1 to disengage the coil spring 53 from the L shaped member 52. The L shaped member 52 may then be rotated 180° upon the operating member 43 and made to face in the opposite direction. The slidable member 55 is then disposed against the opposite wall 57 of the casing and the coil spring 53 is fitted into position between the leg of the L shaped member 52 and the slidable member 55.

The outer extremity of the shaft 42 carries a pair of spaced knurled discs 58 and 59, to each of which there is secured as by riveting a plurality of elements 60 notched at opposite sides thereof to provide a shank portion 61. Each of the assemblies comprising the knurled discs and the notched elements secured thereto are adapted to rotate upon the shaft 42. Mounted upon the shaft and between the movable assemblies are a group of notched elements 62 substantially similar to the notched elements 60, and also riveted together to form a unit. The notched elements 62 differ from elements 60 in that they are provided with key portions 63 adapted to be received within a longitudinal slot 64 provided in the shaft 42. Disposed about the notched elements 60 and 62 and lying between the knurled discs 58 and 59 are the resilient elements 65 having the ends thereof receivable within the oppositely disposed notches of the elements 60 and 62. A stud 66 threaded into the end of the shaft 42 maintains the knurled discs 58 and 59 and the elements contained therebetween in position upon the shaft. An operating lever or handle 67 comprising a split hub portion 68 and an extended portion 69 carrying a roller 71 at an extremity thereof is adapted to actuate the shaft 42. The hub 68 is adapted to clamp upon the knurled discs 58 and 59 and to be tightened into fixed engagement therewith by a stud 72 whereby the discs and the operating lever 67 may move as a unit. Since the notched elements 60 are in engagement with the resilient elements 65, movement of the discs 58 and 59 by the operating lever 67 will apply a force upon the resilient elements which force will be directed upon the notched elements 62, and since the elements 62 have a fixed engagement with the shaft 42 by reason of the key and slot connection therebetween, the applied force will act to rotate the shaft.

The operation of the device will now be described:

Limit switches are particularly adapted for use in the control circuits of automatic controllers for motors used in connection with machine tools, conveyors, hoists and similar equipment to stop the motor at its limits of travel in one direction or both directions with provisions for overtravel protection in case the motor or machine travels past its normal limits.

Upon application of force to the roller 71 by the drive shaft of the machine to be controlled to effect rotation of the operating arm 67, rotation of shaft 42 will be effected. As viewed in Figure 4, shaft 42 is to be rotated in a counterclockwise direction to effect a like movement of the operating member 43 against the bias of spring 53 and into engagement with lever 47 to carry it against latch 38 which, as shown, is in engagement with catch 28 of the pivotal switching member 26, to move the latch out of engagement therewith. This movement of the operating member 43 will also effect movement of the lever member 46, which will be carried by member 43 into engagement with portion 32 of the switching member 26 before lever 47 has disengaged latch 38 and while operating member 43 is moving lever 47 to disengage latch 38, lever

46 is restrained from movement through this engagement with switching member 26, and switching member 26 is restrained from movement through its engagement with latch 38. With lever 46 in restrained position, movement of the operating member 43 will carry the lower pin 45 through the opening in member 46 to compress spring 48 against the back face of the member 46. When latch 38 has been moved by the operating member 43 and the lever member 47 out of engagement with the pivotal switch member 26, the force of the compressed spring 48 is free to react through the lever 46 to quickly move the switch member 26 in a clockwise direction to bring the opposite catch 27 into position to engage with latch 37 which has been biased into latching position by the resilient element 40. This quick movement of the switch member 26 will effect a snap movement of the block 16 through its connection therewith by pin 29 to carry the contact elements 20 quickly out of engagement with their cooperating stationary contacts 6 and to carry movable contacts 30 into engagement with the oppositely disposed set of stationary contacts 7. Stop 34 will engage the edge of notch 31 of switch member 26 to limit the extent of movement of the switch member.

Upon the release of force from the roller 72, the coil spring 53 will act as a return spring to apply force upon the operating member 43 for rotation thereof in the reverse direction to effect reverse operation of the parts and a snap movement of the contacts 20 and 30 into their normal position as viewed in Figure 3.

With the construction of the actuating means for the shaft 42 as above described, a substantial emergency overtravel of the operating handle 67 is readily obtainable. If an unusual force or excess movement should be applied to roller 71, the operating lever 67 will effect movement of shaft 42 to move the switch operating parts and the switch elements and will then move relative to the shaft 42 to take up the excess force. The resilient elements 65 are adapted to be compressed by the notched elements 60 to allow this movement of the operating lever 67 relative to the shaft 42.

While certain preferred embodiments of this invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a pivotal switching member supported within said enclosure and movable to move said movable contact into and out of engagement with said stationary contact, means providing a pivot for said switching member, a pair of pivoted latches adapted to alternately engage with said pivotal switching member, a spring means biasing said latches toward said pivotal member, an operating member carried by said enclosure, a pivot for said operating member and spaced from said pivot for said switching member, a pair of pivotal levers mounted on said operating member and at opposite sides thereof, each of said pivotal levers being adapted to engage alternately with said pivotal switching member and with a pivotal latch to effect movement of each, and a pair of spring means, said spring means being disposed on opposite sides of said operating member and cooperating with said pivotal levers to move said pivotal switching member with a snap action into engagement with a pivoted latch.

2. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a pivotal switch member supported within said enclosure and movable to move said movable contact to engaged and disengaged positions, a pivot for said switch member, latch means mounted within said enclosure and being engageable with said pivotal switch member to retain said latter member in either of two positions, an operating member carried by said enclosure, a pivot for said operating member and spaced from said pivot for said switching member, a pair of movable members mounted on said operating member, said movable members being operable to alternately engage said pivotal switch member for movement thereof in opposite directions, and spring means carried by said operating member and at opposite sides thereof, said spring means exerting their bias against said movable members for movement thereof to effect snap movement of said pivotal switch member between said two positions.

3. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a switch member supported within said enclosure and movable to move said movable contact into and out of engagement with said stationary contact, a pair of pivoted latches mounted on the base of said enclosure and adapted to alternately engage the switch member to restrain movement thereof, an operating member carried by said enclosure, spaced pin means fixed thereon, a pair of movable members supported by said pin means, said operating member being actuable to move said movable members into alternate engagement with said switch member, and spring means operable to effect snap movement of said switch member when moving out of engagement with one pivoted latch and into engagement with the other.

4. In an electric switch, an enclosure, a base therefor, a stationary contact mounted thereon, a switch member supported on said base and being movable between two predetermined positions, a movable contact, a reciprocating member mounting said movable contact, said switch member having a pin and slot connection with said reciprocating member and being actuable to effect movement of said movable contact into engaged and disengaged positions, a pair of pivoted latches supported by said base and operable to engage alternately with said switch member to restrain said switch member in said predetermined positions, a pair of pivotal members, an operating member carried by said enclosure, means carried on opposite sides of said operating member providing a pivotal support for each of said pivotal members on said operating member, means to actuate said operating member to move said pivotal members into alternate engagement with said pivoted latches for alternate movement thereof out of engagement with said switch member, and spring means cooperating with said pivotal members to effect snap movement of said switch member out of engagement with one pivoted latch and into engagement with the other.

5. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a switch member pivotally supported on the base of said enclosure and movable between two positions of rest to effect movement of said movable contact toward and away from said stationary

contact, a pivot for said switch member, a pair of pivoted latches mounted on said base and adapted to engage, alternately, opposite sides of said switch member to restrain said switch member in said two positions of rest, a pair of movable rigid members disposed within said enclosure, operating means carried by said enclosure and upon a pivot spaced from said pivot for said switching member and operable to move the first of said movable rigid members into engagement with a first pivotal latch for movement thereof, and to move the second movable rigid member into engagement with said switch member to effect movement thereof when said first pivotal latch is moved to unlatching position.

6. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a switch member supported on the base of said enclosure and movable between two positions of rest to effect movement of said movable contact for cooperation with said stationary contact, a pivot for said switch member, a pair of latches pivotally supported on said base and adapted to alternately engage opposite sides of said switch member to restrain said switch member in said two positions of rest, a pair of movable rigid members supported within said enclosure, an operating member carried by said enclosure and upon a pivot spaced from said pivot for said switch member and operable to move the first of said rigid members into engagement with said switch member and to move the second rigid member into engagement with a pivotal latch to effect movement thereof, and spring means cooperating with said first rigid member to effect snap movement of said switch member, when said pivotal latch is moved to unlatching position.

7. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a switch member supported within said enclosure and actuable to move said movable contact into and out of engagement with said stationary contact, a pivot for said switch member, a pair of pivoted latches mounted on the base of said enclosure and adapted to engage alternately with said switch member to restrain the movement thereof, an operating member carried by said enclosure and upon a pivot spaced from said pivot for said switch member, a pair of rigid members mounted on said operating member and being movable relative thereto, said operating member being operable to effect movement of said rigid members to alternately engage said switch member for movement thereof out of engagement with one pivoted latch and into engagement with the other, and spring means carried by said operating member and cooperating with said rigid members to effect snap movement of said switch member when moving out of engagement with one pivoted latch and into engagement with the other.

8. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a switch member supported within said enclosure and movable to effect engagement and disengagement of said movable contact with said stationary contact, a pivot for said switch member, a pair of pivoted latches mounted within said enclosure and adapted to alternately engage opposite sides of said switch member to restrain movement thereof, an operating member carried by said enclosure and upon a pivot spaced from said pivot for said switch member, a pair of rigid members supported on said operating member and being movable relative thereto, said operating member being movable to move the first of said rigid members into engagement with a first pivoted latch for movement thereof and to move the second rigid member into engagement with said switch member to effect movement thereof when said first pivoted latch is moved to unlatching position, spring means mounted on said operating member and cooperating with said first rigid member to snap said switch member into engagement with said second pivoted latch upon said movement of the first pivoted latch to unlatching position.

9. In an electric switch, an enclosure, a stationary contact mounted therein, a movable contact, a switch member supported on the base of said enclosure and movable to move said movable contact into and out of engagement with said stationary contact, a pivot for said switch member, a pair of pivoted latches supported within said enclosure, spring means biasing said pivoted latches toward said switch member whereby said latches alternately may engage with said switch member, an operating member carried by said enclosure and upon a pivot spaced from said pivot for said switch member, a second spring means acting to continually bias said operating member toward a predetermined position, a pair of rigid lever members movably mounted on said operating member and at opposite sides thereof, a pair of resilient means carried by said operating means and biased against said rigid lever members, said operating member being movable to move the first of said movable rigid levers to move a first pivoted latch against the bias of a resilient member and out of engagement with said switch member, and to move the second movable rigid lever to actuate said switch member with a snap movement into engagement with the second pivoted latch, and spring means disposed within said enclosure and operative to effect movement of said switch member into reengagement with said first pivoted latch.

10. In an electric switch, a base member, an enclosing member, a contact block having an opening therein and supported within said enclosure and spaced from said base member, a stationary contact mounted on said contact block, a switching member supported by said base member and disposed between the contact block and the base member, a pivot for said switch member, a movable contact assembly disposed in said opening in said contact block, means providing a pin and slot connection between said movable contact assembly and said switching member, a pair of latching members mounted on the base member and on opposite sides of the switching member and engageable with said latter member to restrain movement thereof, an operating member supported by said enclosing member and upon a pivot spaced from said pivot for said switch member, a pair of rigid members pivotally supported on opposite sides of said operating member and being actuated thereby to move said pivoted latches alternately, and spring means mounted within said enclosure and operating to effect snap movement of said switching member.

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