June 16, 1936. H. A. DOUGLAS 2,044,065

ELECTRIC SWITCH CONSTRUCTION

Original Filed Feb. 8, 1934 3 Sheets-Sheet 1

Fig. 1.

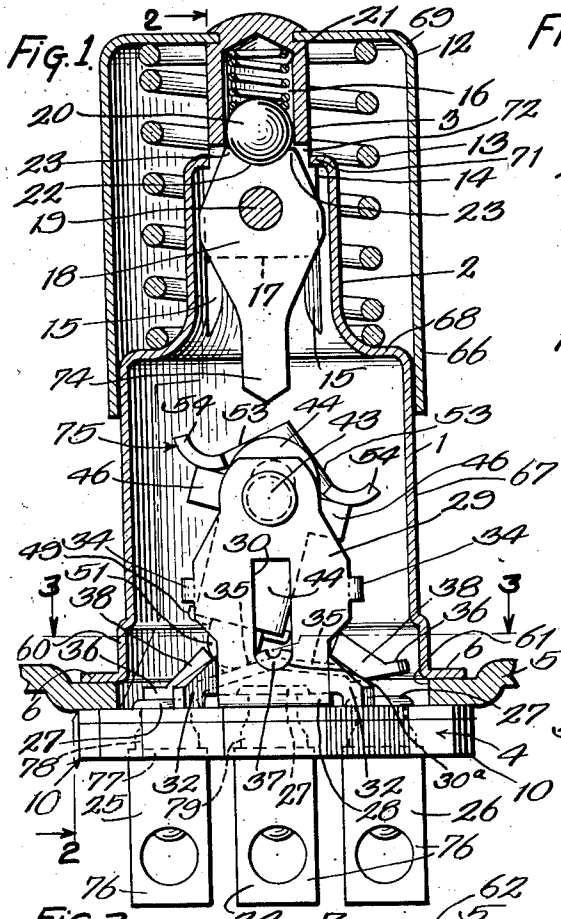


Fig. 2.

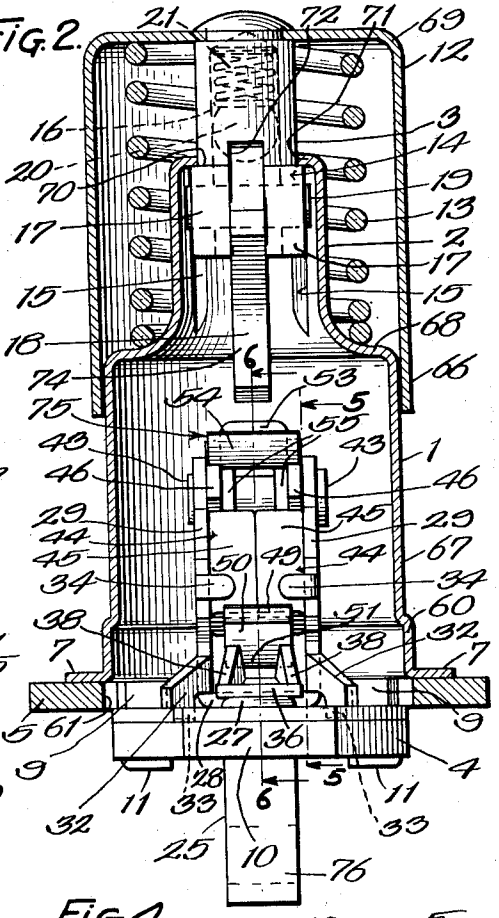


Fig. 3.

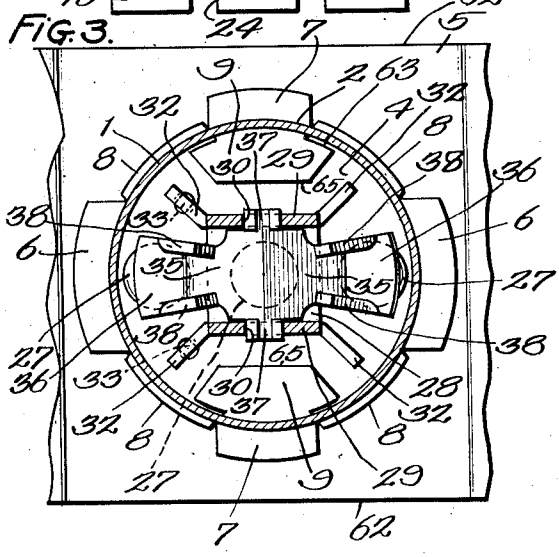
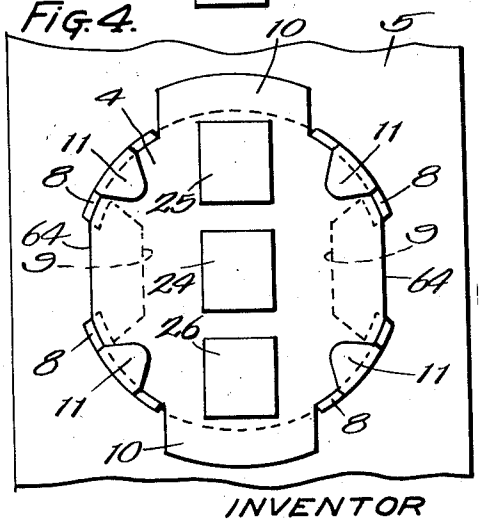


Fig. 4.



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ELECTRIC SWITCH CONSTRUCTION

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Fig. 5.

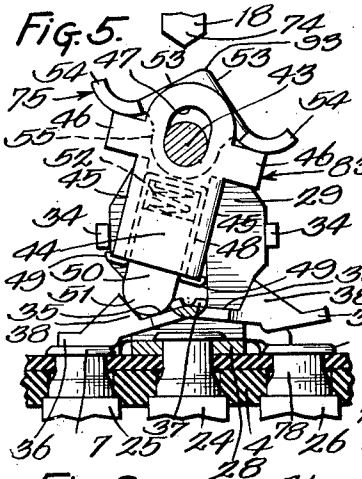


Fig. 6.

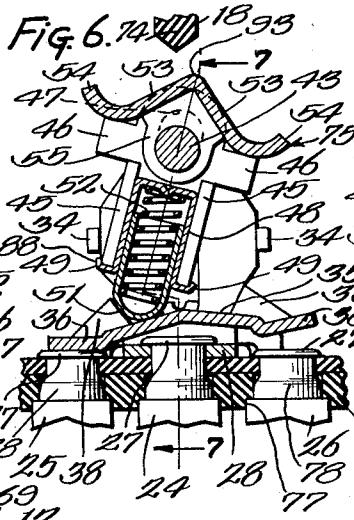


Fig. 7.

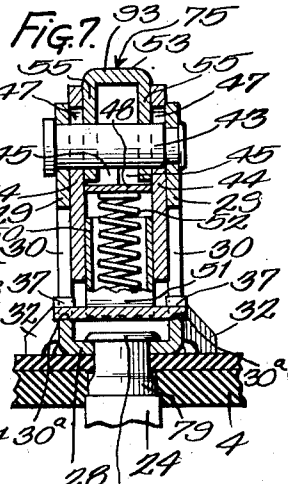


Fig. 8.

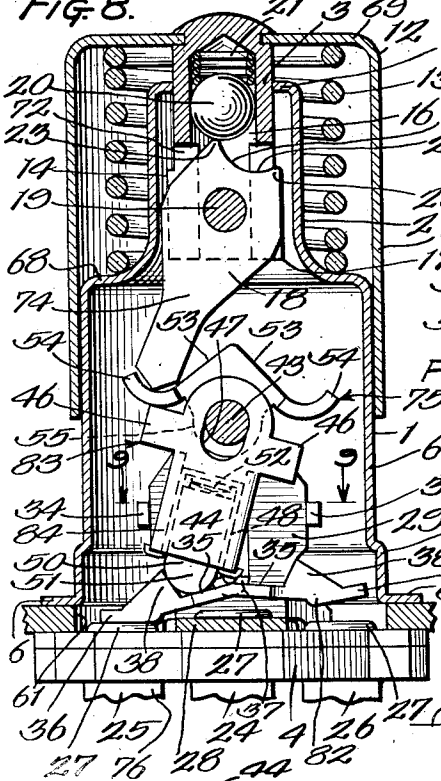


Fig. 10.

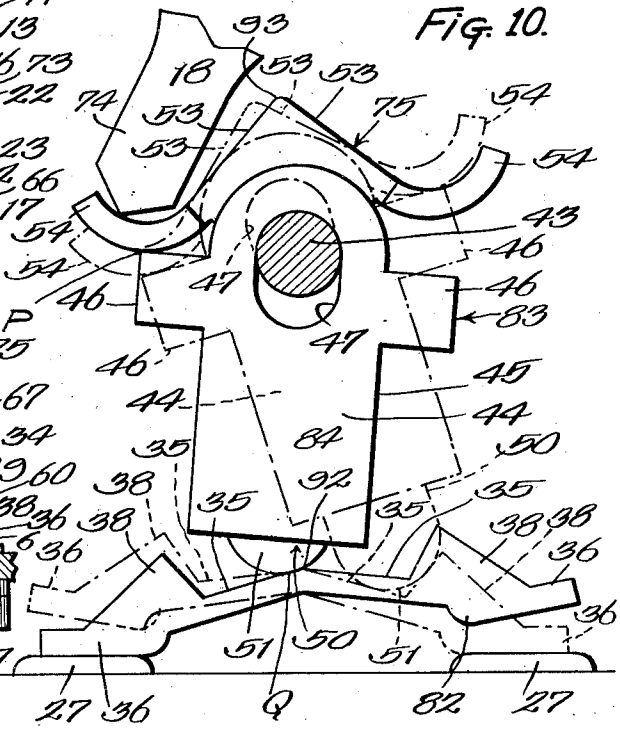
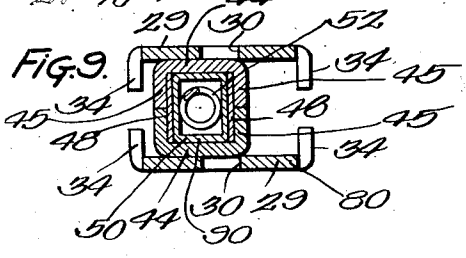


Fig. 9.



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ELECTRIC SWITCH CONSTRUCTION

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Fig. 11.

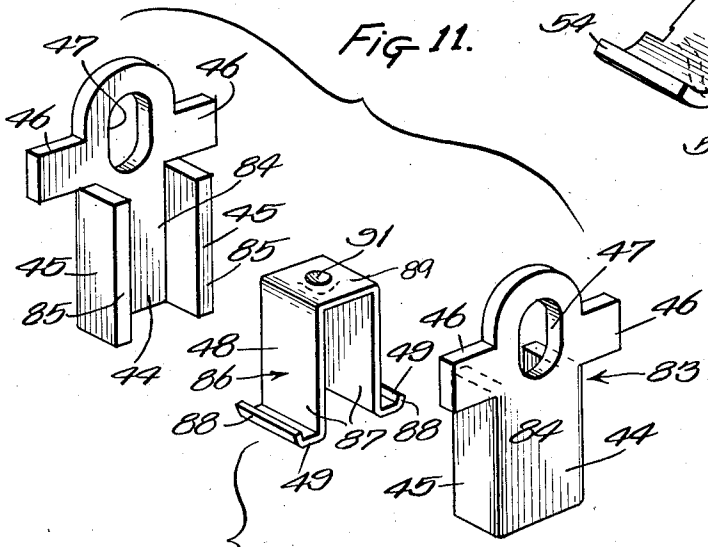
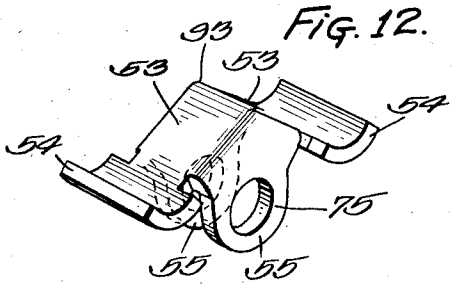


Fig. 12.



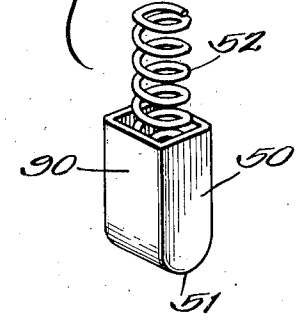


Fig. 13.

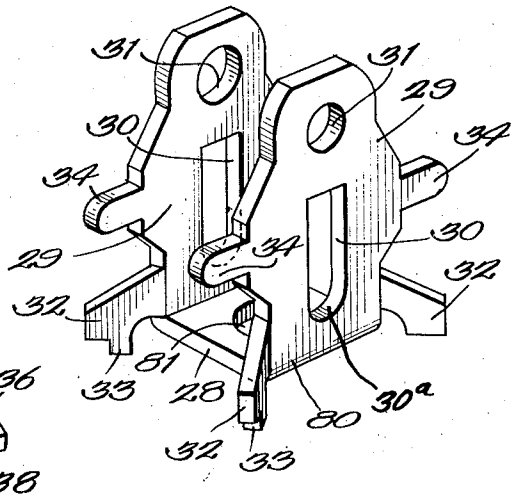
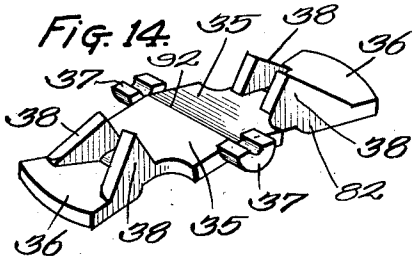


Fig. 14.



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Patented June 16, 1936

2,044,065

UNITED STATES PATENT OFFICE

2,044,065

ELECTRIC SWITCH CONSTRUCTION

Harry A. Douglas, Bronson, Mich.

Application February 8, 1934, Serial No. 710,279
Renewed January 13, 1936

45 Claims. (Cl. 200—18)

My invention relates to electrical switches, and an object of my invention is to provide switches of improved construction and operation.

One use for switches according to my invention is on automobiles, to control the headlights between so-called bright and dim conditions, and in this application I illustrate my invention by an embodiment suitable for that use.

In the drawings accompanying this specification, and forming part of this application:

Figure 1 is a view of the illustrated embodiment of my invention, generally in central vertical section, but with some parts shown in elevation.

Figure 2 is a view at right angles to the view of Figure 1, on the line 2—2 of Figure 1, generally showing the casings in section and the remaining parts in elevation.

Figure 3 shows a horizontal section, on the line 3—3 of Figure 1.

Figure 4 is a bottom plan view.

Figure 5 is a fragmentary detail view, on the line 5—5 of Figure 2, showing the mechanism in the position, as shown in Figure 1, prior to the initiation of its movement.

Figure 6 is a similar view, on the line 6—6 of Figure 2, showing additional parts in section.

Figure 7 is a view of the same parts, at right angles to the views of Figures 5 and 6, on the line 7—7 of Figure 6.

Figure 8 is a view similar to Figure 1, but illustrating the position assumed by the parts just prior to the initiation of oscillation, and with certain parts broken away.

Figure 9 is a detail fragmentary view, on the line 9—9 of Figure 8.

Figure 10 is an enlarged detail diagrammatical view of the contact making and breaking mechanism, as shown in Figures 5–7, showing in full lines the position of the parts after the initiation of oscillation in one direction and before the snap action has occurred, and showing in dot and dash lines the position assumed after the snap has occurred, and the oscillation in that direction has been completed.

Figure 11 is a detail projection, in perspective, of the parts constituting the energy storing element of the switch.

Figure 12 is a detail view, in perspective, of the element by which the energy storing element is actuated.

Figure 13 is a detail view, in perspective, of the supporting means.

Figure 14 is a detail view, in perspective, of the current continuing member.

The embodiment of my invention herein disclosed comprises a cylindrical metal casing 1, having at its upper end an elongated portion 2, of reduced diameter, serving to guide an axially reciprocable plunger 3, and closed at its lower end by a contact carrying plate or disc 4, of insulating material, mounting the contact making and breaking mechanism within the casing 1.

A mounting plate 5, as for securing the switch in position upon the floor board of an automotive vehicle, is secured to the casing 1 by the contact carrying plate 4. To this end the open end of the casing 1 enlarged, as shown at 60 in Figures 1 and 2, and this enlarged portion 60 is provided with a first pair of two diametrically opposed outstanding radial flanges 6, and with a second pair of diametrically opposed outstanding radial flanges 7, spaced midway between the flanges 6, and of lesser circumferential extent than the flanges 6, and the casing wall 60 is extended below the flanges 6 and 7, to form two pairs of diametrically opposed depending fingers 8 of equal width.

The mounting plate 5 is herein shown as an elongated strip of metal slightly wider than the diameter of the casing 1, and substantially longer, provided with a central opening 61, primarily circular, of a diameter substantially equal to the exterior diameter of the enlarged base of the casing 1, but interrupted by reentrant integral oppositely disposed portions 9, projecting inwardly from the plate 5 opposite the longer edges 62 thereof, and provided on each side with arcuate cut-out portions 63 adapted to receive the fingers 8 projecting from the casing 1.

When the casing 1 is so mounted, the flanges 6 and 7 bear upon the upper surface of the plate 5, and the fingers 8 extend therebelow. The contact carrying plate 4 is of general disc form, provided with oppositely disposed radial extensions 10 passing between the fingers 8 below the casing flanges 6, and as shown particularly in Figures 2 and 4, the tips 11 of the fingers 8 are bent over the exterior of the contact carrying disc 4, to firmly hold the mounting plate 5 in engagement with the casing flanges 6 and 7.

The periphery of the contact carrying disc 4 is trimmed opposite the mounting plate extensions 9, between the edges of the fingers 8, as shown at 64 in Figure 4, and the mounting plate 5 is depressed over its central portion, as shown, so that the upper surface of the mounting plate lies in the same plane as or a little above the upper surfaces of the flanges 6 and 7, as shown in Figure 1. The mounting plate extensions 9 are terminated in straight edges 65 parallel to each

other and spaced equally from the axis of the casing 1 and a sufficient distance apart to clear the mechanism carried on the contact carrying plate 4, as shown in Figure 3. The radial extensions 10 of the contact carrying plate 4 project longitudinally of the mounting plate 5, in engagement with the under side thereof, while the plate extensions 9 project transversely of the mounting plate 5, in engagement with the upper side of the contact carrying plate 4, whereby the mounting plate 5 may be reduced in width and at the same time retain sufficient engaging surface for maintaining rigid positioning with the contact carrying plate 4.

The plunger 3 is secured to the top 69 of a plunger cap 12 surrounding the reduced portion 2 of the casing 1 and having its skirt 66 depending therebelow with its lower end closely surrounding the body portion 67 of the casing 1. Surrounding the reduced casing portion 2 is a coil spring 13 compressed between the shoulder 68 formed by the reduction of the casing 1 and the interior of the top 69 of the cap 12 and serving to bias the plunger 3 to extended position. To limit reciprocation of the plunger 3 in that direction, the cylindrical plunger is provided at its lower end with an extending rectangular end portion 14 forming a transverse shoulder 70, and the metal of the restricted casing portion 2 is struck in to form an abutment 71 arranged to engage the shoulder when the plunger 3 has reached the limit of the desired outward movement.

The wall of the restricted casing portion 2 is provided with longitudinal grooves 15 to receive and guide the longitudinal corners of the rectangular end portion 14 of the plunger 3, and to prevent axial rotation of the plunger 3. The plunger 3 is provided with an axial bore 16 terminating adjacent the end secured to the cap 12, and with a transverse slot 72 extending upward to a level slightly above the upper face 70 of the rectangular end portion 14, dividing this portion of the plunger into two similar depending legs 17 disposed on opposite sides of the axis.

A reciprocating operator 18, preferably of insulating material, is mounted in the transverse slot in the plunger 3, upon a pivot pin 19 extending through both legs 17 of the plunger 3. The body of the operator 18 is tapered above the pivot to the diameter of the bore 16 in the plunger 3, and is terminated short of the end of the slot. A ball 20 is mounted in the plunger bore 16, and is held in engagement with the operator 18 by a coil spring 21 compressed between the ball 20 and the end of the bore. The upper end 22 of the operator 18 is provided with a cut-out 73, cut on the arc of a circle concentric with the center of the ball 20, and this cut-out 73 normally receives the ball 20 in continuous contact therewith, whereby the longitudinal axis of the operator 18 normally is maintained coincident with the axis of the casing 1.

The portion of the reciprocating operator 18 below the pivot 19 is tapered to form a narrower operating end 74 extending below the plunger 3 to cooperate with the operator 75 of the contact making and breaking mechanism.

As shown in Figures 1 and 2, the spring pressed ball 20 normally maintains the longitudinal center line of the reciprocating operator 18 coincident with the axis of the casing 1. As shown in Figure 8, upon depression of the plunger 3 the reciprocating operator 18 oscillates about its pivot 19 when the operating end 74 is brought into engagement with the oscillating operator 75 of the contact making and breaking mechanism, as hereinafter described, and whenever such movement is imparted, the arcuate upper end 22 of the reciprocating operator 18 is thrown off center from the ball 20, forcing the ball upward against the spring 21. However, the relation of the apices 23 formed by the junction of the upper tapered sides and the cut-out 73 of the reciprocating operator 18 is such that the apices 23 always remain on their respective sides of the axis of the casing 1, so that whenever the plunger 3 is released from the depressed position, the action of the ball spring 21 causes the ball 20 to return the reciprocating operator 18 to its normal position with the surface of the ball 20 in continuous engagement with the cut-out 73.

The contact making and breaking mechanism is all mounted within the casing 1 on the contact carrying plate or disc 4. In the herein illustrated embodiment of my invention, three metallic electrical terminals are mounted upon the contact carrying plate 4. As shown in Figures 1, 2, and 4, the terminals are of the construction disclosed in my prior copending application, Serial No. 565,127, filed September 25, 1931. One terminal 24 is mounted on the axis of the casing 1, and the other two terminals 25 and 26 are mounted equidistant from the terminal 24 on the diameter coincident with the longitudinal center line of the mounting plate 5. Each terminal is provided with a rectangular body 76 depending from the under side of the contact carrying plate 4 and having a portion thereof received in a similarly shaped recess 77 in the plate 4, to prevent rotation, and the upper ends 78 of the terminals 25 and 26 are of cylindrical formation, passing through the contact carrier 4, and then expanded to engage the interior surface of the carrier 4 to secure the terminals thereto and to form electrical contacts 27. The middle terminal 24 is provided with a similar cylindrical upper end 79, which passes through the carrier 4 and then through the base 28 of a U-shaped metallic bracket 80, and the end of which is then expanded to form an electrical connection to the bracket 80, as shown in Figures 1, 2, and 3, and at the same time, to mount the bracket 80 on the inner surface of the carrier 4.

As shown in Figures 1 and 2, and in perspective in Figure 13, the bracket base 28 is centrally perforated at 81, to receive the cylindrical portion 79 of the terminal 24. Opposite sides of the base 28, equidistant from its center, are continued upwardly at right angles to the base 28, to form parallel arms 29 of similar conformation. Each arm 29 is provided with an elongated central cut-out 30, and with a circular cut-out 31 thereabove, to receive and mount a pivot pin parallel to the base, as will be hereinafter described. Also, each side of each arm 29 is extended adjacent the base to form angularly disposed feet 32 adapted to engage the inner surface of the carrier 4 to impart rigidity to the bracket 80, and if desired, one or more of the feet 32 may have a right angularly depending toe 33 adapted to be received in a similar recess in the carrier 4 to prevent rotative movement. Outstanding fingers 34 are provided on each side of each arm 29, approximately midway between the base 28 and the axis of the circular openings 31.

A metallic current continuing bridge 82 is mounted between the arms 29 of the bracket 28 for oscillation about an axis cutting the axis of the casing 1 and parallel to the inner surface of

the carrier 4. The current continuing bridge 82 is preferably formed from a flat strip of metal centrally struck up to form oppositely disposed similar angular surfaces 35 sloping downwardly from the transverse center line 92 and terminating in flat feet 36 lying in angularly disposed planes and adapted to be brought into and out of engagement alternately with the contacts 27 upon the terminals 25 and 26. The metal on each side of the transverse center line 92 is extended outwardly, and the sides of the extensions are curved upwardly on the arcs of similar circles having their respective centers lying in the transverse center line of the upper surface of the bridge 82 coinciding with the meeting edge of the angular surfaces 35, thus to form supporting trunnions 37 supporting the bridge 82 for oscillation on an axis coinciding with the meeting edge of the angular surfaces 35. Each side of the body of the bridge 82, including a portion of each contact foot 36 and the contiguous angular surface 35, is struck up at right angles to the plane of the feet 36, to form similar stops 38, the purpose of which will be hereinafter described.

The trunnions 37 are mounted in circular or semicircular bearings 30a formed by the lower ends of the cut-outs 30 in the sides 29 of the supporting bracket 80, to support the bridge 82 midway between the contacts 27, with the axis of oscillation of the bridge 82 disposed at right angles to the line through the centers of the contacts 27, and a sufficient distance above the contacts 27, so that when the bridge 82 is oscillated about its axis the bridge feet 36 will make and break electrical connection with the respective contacts 27 alternately.

The circuit continuing bridge 82 is caused to oscillate by the cooperation of an oscillating actuator 83 coacting with the oscillating operator 75 actuated by the reciprocating operator 18 upon reciprocation of the plunger 3.

The actuator 83 is mounted upon a pivot pin 43 mounted in the apertures 31 in the arms 29 of the supporting bracket 80, and includes two similar metallic plates 44 provided with apertures 47 adapted to receive the pivot pin 43 in sliding engagement therewith. These plates 44 terminate short of the high point of the current continuing bridge 82, and have the lower portion of their opposite longitudinal sides 84 struck up at right angles to the main body to form right angular flanges 45, leaving oppositely disposed similar outstanding arms 46 extending from the body of the plate. The flanges 45 are of such extent that the longitudinal edges 85 of opposed flanges engage.

The elongated bearings 47 by which the actuator plates 44 are mounted upon the pivot pin 43 allow a sliding longitudinal movement of the plates 44 relative to the pin 43. When the upper ends of the bearings 47 are in contact with the upper surface of the pin 43 the upper surfaces of the actuator arms 46 lie in a plane passing slightly below the axis of the pivot pin 43.

Mounted between the plates 44, embraced by the flanges 45, is a spring housing 86 in the form of an inverted U, the extremities of the sides 87 of which are provided with transverse flanges 49 adapted to pass under the lower extremities of the actuator flanges 45 and having their ends 88 inclined upwardly to engage the outer sides of the oppositely disposed actuator flanges 45 on each side of the housing 86 and to position the housing top 89 at a distance below the lower end of the actuator bearing apertures 47.

The housing 48 receives in sliding engagement therewith a detent 50 in the form of a rectangular casing 90 closed at one end in a rounded nose 51 and open at the other end to receive a coil spring 52 compressed between the interior of the nose 51 and the interior of the housing top 89, which may be provided with a central depression 91 to center that end of the spring 52. The details of the oscillating actuator, housing, detent, and spring, are shown in perspective in the projected illustration in Figure 11.

As shown in Figure 12, the oscillating operator 75 is formed of a flat strip of metal centrally struck up to form oppositely disposed similar angular flat surfaces 53 sloping downwardly from the transverse center line 93 and terminating in upwardly extending tangential stops 54. The opposite sides of the operator 75 intermediate the stops 54 are struck downwardly to form depending perforated ears 55 adapted to encircle the pivot pin 43 between the actuator plates 44, to mount the operator 75 for oscillation about the pivot pin 43.

When the bridge 82 and actuator 83 and operator 75 have been assembled upon the supporting bracket 80 the fingers 34 of the bracket arms 29 are bent toward each other, as shown in Figure 2, to prevent the nose 51 from riding over either stop 38 of the bridge 82.

Figures 1 and 2 illustrate the normal position of the various parts of the switch when the plunger 3 is in extended position, from which it is seen that the pivoted operator 18 carried by the plunger 3 maintains its lower or operating end 74 in the axis of the casing 1, above the underlying angular surfaces 53 of the oscillating operator 75, and the foot 36 of the current continuing bridge 82 is in engagement with the contact 27 of the terminal 25, and is maintained in electrical contact therewith by the action of the spring 52 holding the nose 51 of the detent 50 in engagement with the adjacent stop 38. The circuit making and breaking mechanism in this position is better illustrated in detail in Figures 5, 6, and 7.

When the plunger 3 is depressed, the lower end 74 of the pivoted operator 18 is brought into engagement with the opposed angular surface 53 of the oscillating operator 75, and rides thereover, turning about its axis 19, until it engages the adjacent stop 54. Upon continued depression of the plunger 3 the pivoted operator 18 imparts a rotative movement to the oscillating operator 75, and through contact of the engaged stop 54 with the adjacent actuator arms 46, bodily moves the actuator 83 in the direction of the engaged stop 38 of the bridge 82, until the upper end of the bearing 47 engages the upper side of the pin 43, placing the detent spring 52 under greater compression than normal. Figure 8 shows the parts at this stage.

As the plunger 3 continues its downward movement the motion is transmitted through the pivoted operator 18 to impart a rotative movement to the actuator 75 about the pivot 43, to cause the nose 51 to travel over the upwardly inclined surface 35 of the bridge 82, towards the high point 92 of the bridge 82, to the position shown in full lines in Figure 10, and holding the bridge 82 in tighter contact with the engaged terminal 27, by reason of the increasing force of the spring 52 as the nose 51 approaches the high point 92 of the bridge 82.

During this movement of the actuator 83 the

actuator operates as a bell-crank lever, pivoting on the pivot pin 43, and with the force applied at the point of contact of the oscillating operator 75 with the arm 46 of the actuator 83, indicated at P in Figure 10.

However, by reason of the lost motion pivot of the actuator 83 on the pivot pin 43, the actuator 83 also is inherently capable of operating as a bell-crank lever pivoted at the point P, with the force applied at the point of engagement Q of the nose 51 with the bridge inclined surface 35.

At the beginning of the movement of the actuator 83 this second operation is impossible, by reason of the fact that the operation would result in further insertion of the nose 51 into the frame of the actuator 83, and thus, in further compression of the spring 52, so that the force to produce the operation is lacking.

This condition continues until the nose 51 has traveled along the inclined surface 35 to the point Q, as indicated in full lines in Figure 10, when the line from the point P to the point Q is perpendicular to the inclined surface 35, but immediately thereafter the parts assume a position where this second operation of the actuator will permit the nose 51 to emerge, and the spring 52 to expand, and accordingly, immediately the nose 51 passes this perpendicular position the second operation ensues, and the actuator 83 acquires the corresponding supplemental movement, moving the nose 51 in the same direction as the principal movement.

This supplemental movement will occur before the actuator 83 has reached its central position, with the nose 51 at the crest or junction 92 of the inclined surfaces 35 of the bridge 82, and accordingly, before the actuator 83 otherwise is in position to snap to its other extreme position. Also, the supplemental movement will continue to the full extent of the lost motion in the pivot of the actuator 83 on the pivot pin 43.

Accordingly, I provide between the actuator 83 and the pivot pin 43 a lost motion of such extent that the supplemental movement will continue until the nose 51 has passed the crest 92 of the inclined surfaces 35 of the bridge 82, and the actuator 83 is in position to snap to its other extreme position.

In this way I provide a mechanism by which the parts are snapped, not as they pass central position, but before they reach central position, whereby there is a force acting positively to move the parts past central position, and the parts cannot stop in central position, but pass central position with an augmented velocity.

Upon the succeeding depression of the plunger 3, the lower end 74 of the pivoted operator 18 will engage the opposite end 54 of the oscillating operator 75, and the bridge 82 will be shifted in the reverse direction. The parts being in all respects symmetrical, the operation and action obviously are the same in both directions.

In either direction, until the parts reach the position where the supplemental movement occurs, the nose 51 holds the bridge 82 firmly in its original position, and upon release of the plunger 3 the parts will return to normal position, without having imparted any movement to the bridge 82. Yet immediately the parts reach the position where the supplemental action occurs, the bridge 82 will be snapped to the alternative position. The bridge 82 cannot rest in any intermediate position, regardless of any manipulation of the plunger 3.

The advantages of this characteristic will be well understood by those skilled in the art, and accordingly, those skilled in the art will understand that the herein disclosed embodiment of my invention does provide an improved electric switch.

However, while this particular embodiment of my invention does accomplish the object of my invention, the accomplishment of this object is not confined to this particular embodiment. Many changes and variations may be made, without departing from the spirit of my invention, or sacrificing the advantages thereof, and accordingly, it is to be understood that the disclosure herein is illustrative only, and that my invention is not limited thereto.

What I claim is:

1. An electric switch, comprising: actuated means, movable in both directions through a central position and including means whereby to be actuated in either direction at a point off-center; energy storage mechanism; and cooperating means acting when said actuated means is so actuated in either direction, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

2. An electric switch, comprising: actuated means, having an oscillating movement through a central position, having also a reciprocating movement substantially radial of the axis of oscillation, and including means whereby to be actuated at a point off-center, to produce both said movements; energy storage mechanism; and cooperating means acting when said actuated means is so actuated, upon oscillation of said actuated means toward said central position first to store energy in said storage mechanism by reason of said reciprocating movement and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

3. An electric switch, comprising: actuated means, having a first movement through a central position, having also a second movement, and including means whereby to be actuated at a point off-center, to produce both said movements; energy storage mechanism; and cooperating means acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism both by reason of said first movement and also by reason of said second movement, and then, before said actuated means reaches said position, to release that part of said energy stored by said second movement, and cause said part to throw said actuated means past said position, and thereupon, when said actuating means reaches said position, to release that part of said energy stored by said first movement, and cause that part to accelerate the movement of said actuated means.

4. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; actuating means for so actuating said actuated means; energy storage mechanism; and cooperating means acting when said actuated means is so actuated, upon movement of said actuated means toward said central posi-

tion first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

5. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; energy storage mechanism; and cooperating means acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

6. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; energy storage mechanism, carried by said actuated means; and cooperating means acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

7. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; energy storage mechanism; cooperating means acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position; and connections between said actuated means and said cooperating means whereby such movement of said actuated means operates said cooperating means.

8. An electric switch, comprising: actuated means, having a first movement through a central position, having also a second movement, and including means whereby to be actuated at a point off-center, to produce both said movements; energy storage mechanism; and cooperating means acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism by reason of said second movement and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

9. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; energy storage mechanism; and cooperating means; said actuated means and said cooperating means comprising coacting cam means operating when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy; and said energy storage mechanism operating then to throw said actuated means past said position.

10. An electric switch, comprising: oscillating actuated means, oscillating through a central position and including means whereby to be actuated at a point off-center; energy storage mechanism; and cooperating means acting when said actuating means is so actuated, upon oscillation of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

11. An electric switch, comprising: a member mounted for limited oscillation about a pivot, an actuator therefor, means mounting said actuator for oscillation about a normal axis and also for oscillation about an eccentric axis, an operator for the actuator mounted for oscillation and adapted to oscillate said actuator, and means cooperating with the actuator and said oscillating member normally maintaining said member at one limit of its oscillation and adapted upon oscillation of the operator to oscillate the actuator, to shift the actuator from its normal axis to rotate about its eccentric axis and snap said member to the opposite end of oscillation.

12. An electric switch, comprising: a member mounted for limited oscillation, an actuator therefor, means mounting said actuator for oscillation about a normal axis and also for oscillation about an eccentric axis, an operator for the actuator mounted for back and forth movement and adapted to engage and oscillate said actuator, and means cooperating with the oscillating member and actuator normally maintaining said member at one limit of its oscillation and adapted upon movement of the operator to oscillate the actuator to shift the actuator from its normal axis to rotate about its eccentric axis and snap said member to the opposite end of oscillation.

13. An electric switch, comprising: a member mounted for limited oscillation, an actuator therefor, means mounting said actuator for oscillation about a normal axis and also for actuation about an eccentric axis, spring means in cooperative connection with the oscillating member and the actuator normally maintaining said member at one limit of its oscillation and adapted upon oscillation of the actuator to shift the actuator from its normal axis, and means operable upon said shifting of the actuator to cause the actuator to oscillate about its eccentric axis and snap said member to its opposite end of oscillation.

14. An electric switch, comprising: means movable from one normal position to another; and means for actuating said movable means into at least one of said normal positions, with a snap action, said actuating means including a member adapted to transmit force to said movable means, means for supporting said member, energy storing means, and means whereby operation of said actuating means initially causes relative substantially translatory motion only as between said supporting means and said member, to thereby store energy in said energy storing means, and thereafter causes said member to execute a motion of rotation.

15. An electric switch, comprising: means movable from one normal position to another; and means for actuating said movable means into at least one of said normal positions, with a snap action, said actuating means including a member adapted to transmit force to said movable means, means for supporting said member, energy storing means, and means whereby operation of said actuating means initially causes relative substantially translatory motion only as between said supporting means and said member, to

thereby store energy in said energy storing means, and thereafter causes said member to execute a motion of combined translation and rotation.

16. An electric switch, comprising: means movable from one normal position to another; and means for actuating said movable means into at least one of said normal positions, with a snap action, said actuating means including a member adapted to transmit force to said movable means, a pivot for supporting said member, said member having a slot extending longitudinally thereof, said pivot being normally seated in one end of said slot, energy storing means, and means whereby operation of said actuating means causes said pivot to become unseated in said end of said slot, to thereby store energy in said energy storing means, and thereafter causes said member to swing with respect to said pivot before said pivot again becomes seated in said end of said slot.

17. An electric switch, comprising: actuated means, including mounting means for said actuated means, comprising a pivot on one of said means and a slot in the other of said means, providing for oscillating movement of said actuated means through a central position, and also for a reciprocating movement substantially radial of the axis of oscillation, and including means whereby to be actuated at a point off-center, to produce both movements; energy storage mechanism; and cooperating means acting when said actuated means is so actuated, upon oscillation of said actuated means toward said central position first to store energy in said storage mechanism by reason of said reciprocating movement and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

18. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; a pivoted lever for so actuating said actuated means; energy storage mechanism; and cooperating means acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position.

19. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; energy storage mechanism; cooperating means, including a pivoted member, acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position; and connections between said actuated means and said cooperating means whereby such movement of said actuated means operates said cooperating means.

20. An electric switch, comprising: actuated means, movable through a central position and including means whereby to be actuated at a point off-center; energy storage mechanism; cooperating means, including a pivotally mounted member constituting an electric switch member, acting when said actuated means is so actuated, upon movement of said actuated means toward said central position first to store energy in said storage mechanism and then, before said actuated means reaches said position, to release said energy, and cause said energy to throw said actuated means past said position; and connections between said actuated means and said cooperating means whereby such movement of said actuated means operates said cooperating means.

21. An electric switch, comprising: an actuated member mounted for oscillating movement; lever means; mounting means for said lever means comprising a pivot on one of said means and a slot in the other of said means; a follower member, operatively associated with said lever means and movable relatively thereto, engageable with said actuated member; resilient means acting against said follower member and said lever means to press said follower member against said actuated member and to normally seat said pivot in one end of said slot; and an actuator member positioned to engage said lever means at a point eccentric to said pivot to move said lever means to store energy in said resilient means.

22. An electric switch, comprising: an actuated member mounted for oscillating movement; a slotted lever; a pivot disposed in the slot of said lever; a follower member, operatively associated with said lever and movable relatively thereto, engageable with said actuated member; resilient means acting against said follower member and said lever to press said follower member against said actuated member and to normally seat said pivot in one end of said slot; and an actuator member positioned to engage said lever at a point eccentric to said pivot to move said lever to store energy in said resilient means.

23. An electric switch, comprising: an actuated member mounted for oscillating movement; a slotted lever; a pivot disposed in the slot of said lever; a follower member, operatively associated with said lever and movable relatively thereto, engageable with said actuated member; resilient means acting against said follower member and said lever to press said follower member against said actuated member and to normally seat said pivot in one end of said slot; and an actuator member mounted for oscillation and positioned to engage said lever at a point eccentric to said pivot to move said lever to store energy in said resilient means.

24. An electric switch, comprising: an actuated member mounted for oscillating movement; a slotted lever, having a lateral projection; a pivot disposed in the slot of said lever; a follower member, operatively associated with said lever and movable relatively thereto, engageable with said actuated member; resilient means acting against said follower member and said lever to press said follower member against said actuated member and to normally seat said pivot in one end of said slot; and an actuator member mounted for oscillation and positioned to engage said lateral projection to move said lever to store energy in said resilient means.

25. An electric switch, comprising: a cam member; lever means; mounting means for said lever means comprising a pivot on one of said means and a slot in the other of said means; a follower member, operatively associated with said lever means and movable relatively thereto, engageable with said cam member; resilient means acting against said follower member and said lever means to press said follower member against said cam member and to normally seat said pivot in one end of said slot; and an actuator member

positioned to engage said lever means at a point eccentric to said pivot to move said lever to store energy in said resilient means.

26. An electric switch, comprising: a cam member; a slotted lever; a pivot disposed in the slot of said lever; a follower member, operatively associated with said lever and movable relatively thereto, engageable with said cam member; resilient means acting against said follower member and said lever to press said follower member against said cam member and to normally seat said pivot in one end of said slot; and an actuator member positioned to engage said lever at a point eccentric to said pivot to move said lever to store energy in said resilient means.

27. An electric switch, comprising: a cam member; a slotted lever; a pivot disposed in the slot of said lever; a follower member, operatively associated with said lever and movable relatively thereto, engageable with said cam member; resilient means acting against said follower member and said lever to press said follower member against said cam member and to normally seat said pivot in one end of said slot; and an actuator member mounted for oscillation and positioned to engage said lever at a point eccentric to said pivot to move said lever to store energy in said resilient means.

28. An electric switch, comprising: a cam member; a slotted lever, having a lateral projection; a pivot disposed in the slot of said lever; a follower member, operatively associated with said lever and movable relatively thereto, engageable with said cam member; resilient means acting against said follower member and said lever to press said follower member against said cam member and to normally seat said pivot in one end of said slot; and an actuator member mounted for oscillation and positioned to engage said lateral projection to move said lever to store energy in said resilient means.

29. In an electric switch, the combination of a circuit continuing bridge, means for mounting said bridge for oscillation about an axis intermediate the ends of said bridge, an operating member mounted for reciprocation in the same plane with the bridge, transforming means, interposed in the said plane between the operator and bridge, engageable with portions of said bridge between said axis and either end of said bridge, for transforming the reciprocable movement of the operator into oscillating movement to oscillate the bridge upon movement of the operator in one direction, and means for mounting said interposed means separately from the operator and the bridge.

30. A plunger operated electric switch including a circuit continuing bridge, means for mounting said bridge for oscillation about an axis intermediate the ends of said bridge, an oscillating actuator, means engageable with portions of said bridge between said axis and either end of said bridge, to transmit movement of the actuator to the bridge, a plunger mounted to reciprocate, means to transmit movement of the plunger in one direction to oscillate said actuator, and means for mounting said actuator separately from said plunger and said bridge.

31. A plunger operated electric switch including a cylindrical casing, a contact carrier disc of insulating material closing one end thereof, the casing being reduced in diameter for a substantial distance from the other end, a plunger mounted to be guided and reciprocated within said reduced portion of the casing, an electric contact arranged axially in the contact carrying disc, a circuit continuing bracket extending thereabove and secured to said contact, a pair of equidistant oppositely disposed contacts arranged in the contact carrying disc on each side of the first contact, a circuit continuing bridge mounted for oscillation upon said bracket to alternately engage one contact while disengaging the other at the end of each oscillation, actuating means mounted for oscillation on said bracket above said bridge, said actuating means including a depending resilient member adapted to wipe over the upper side of the bridge and maintain contact therewith during oscillation and including a portion having oppositely disposed sloping surfaces on its upper side, means normally maintaining the plunger at the end of its travel most distant from the contact carrier, an operating finger of insulating material pivotally carried by said plunger and normally depending axially therebelow terminating adjacent the upper surface of said portion adapted upon reciprocation of the plunger to engage, travel over the adjacent sloping surfaces and oscillate said actuating means in one direction.

32. The structure of claim 31 wherein the opposite ends of the oppositely disposed sloping surfaces of the actuating means terminates in abutments adapted to be engaged alternately by the operating finger upon continued reciprocation of the plunger to complete the oscillation of the actuating means first in one direction and then in the opposite direction.

33. The structure of claim 31 wherein the said bracket is of U shape connected to the contact through its base with its opposite arms slotted to form bearings for oppositely disposed ears of the bridge and perforated above the slots to receive a pivot pin for the actuating means.

34. The structure of claim 31 wherein a cylindrical plunger cap is axially secured to the upper end of the plunger and surrounds the reduced portion of the casing and is adapted to reciprocate about the casing therebelow and wherein a coil spring interposed between the interior of the cap closure and the shoulder formed by the reduced portion of the casing normally maintains the plunger at the upper end of its travel.

35. The structure of claim 31 wherein the plunger is provided with an axial bore terminating adjacent its upper end and wherein said plunger is provided with a transverse slot to receive the operating finger with the pivot pin thereof mounted in the opposite depending plunger arms formed by the slot and a spring pressed biasing means constructed and arranged to bear against the upper end of the operating finger with the spring thereof received in the axial bore of the plunger to normally maintain the operating finger in axial alignment with the plunger.

36. An electric switch, comprising: a reciprocating operator; an actuator pivotally secured on said operator; a follower; means whereby said follower is carried by said operator for cooperation with said actuator; a part of said actuator being contoured so that movement of said actuator from central position in either direction represses said follower; and spring means acting on said follower to bias said follower against repression, thereby to bias said actuator toward central position.

37. An electric switch, comprising: a reciprocating operator; an oscillating actuator means

for mounting said actuator separately from said operator; means whereby successive reciprocations of said operator in the same direction oscillate said actuator alternately in one direction and in the reverse direction; and cooperating means, coacting with said actuator to cause said actuator to snap through the remainder of its movement in either direction, not later than when the actuator has passed central position; said cooperating means comprising a member carried by said actuator and means for mounting said member for reciprocation with respect to said actuator; said operator comprising a pivotally mounted operating tongue, and said actuator comprising a surface guiding said tongue alternately to one side and to the other side, on successive reciprocations of said operator.

38. An electric switch, comprising: a reciprocating operator; an oscillating actuator mounted separately from said operator; means whereby successive reciprocations of said operator in the same direction oscillate said actuator alternately in one direction and in the reverse direction; and cooperating means, coacting with said actuator to cause said actuator to snap through the remainder of its movement in either direction, not later than when the actuator has passed central position; said cooperating means comprising a member resiliently mounted on said actuator and a convex member with which said resiliently mounted member slidably coacts.

39. An electric switch, comprising: operating means including an oscillatable member movable bodily with said operating means; an oscillatable actuator, operable by said operating means; cooperating means, including an oscillatable member, coacting with said actuator to cause said actuator to oscillate with a snap movement; and means for mounting said actuator and each of said oscillatable members for oscillation about separate axes.

40. An electric switch, comprising: a reciprocating operator; oscillating actuating means mounted separately from said operator; means whereby successive reciprocations of said operator in the same direction oscillate said actuating means alternately in one direction and in the reverse direction; and cooperating means, including a part, pivoted intermediate its ends, having lost motion connection with a part of said actuating means, said parts being slidable with respect to each other along the general direction of oscillation of said actuating means, coacting with said actuating means to cause said actuating means to snap through the remainder of its movement in either direction, not later than when said actuating means has passed central position.

41. An electric switch, comprising: a reciprocating operator; oscillating actuating means mounted separately from said operator; means whereby successive reciprocations of said operator in the same direction oscillate said actuating means alternately in one direction and in the reverse direction; and cooperating means, coacting with said actuating means to cause said actuating means to snap through the remainder of its movement in either direction, not later than when said actuating means has passed central position; said cooperating means comprising, cooperating members one of which is carried by said actuating means, and means for mounting said second named member for reciprocation with respect to said actuating means.

42. An electric switch, comprising: a reciprocating operator; oscillating actuating means mounted separately from said operator; means whereby successive reciprocations of said operator in the same direction oscillate said actuating means alternately in one direction and in the reverse direction; and cooperating means, coacting with said actuating means to cause said actuating means to snap through the remainder of its movement in either direction, not later than when said actuating means has passed central position; said cooperating means comprising, a member having a surface extending in the general direction of oscillation of said actuating means, and means, carried by said actuating means, for slidably engaging said surface, and means for preventing translatory motion of at least a portion of said engaged surface with respect to the axis of oscillation of said actuating means.

43. An electric switch, comprising: a reciprocating operator; oscillating actuating means mounted separately from said operator; means whereby successive reciprocations of said operator in the same direction oscillate said actuating means alternately in one direction and in the reverse direction; and cooperating means, coacting with said actuating means to cause said actuating means to snap through the remainder of its movement in either direction, not later than when said actuating means has passed central position; said cooperating means comprising, a convex member, a fixed support for at least the crest portion of said convex member, for preventing translatory motion of said crest portion away from the axis of oscillation of said actuating means, and means, carried by said actuating means, for slidably engaging the convex surface of said convex member along the general direction of oscillation of said actuating means.

44. An electric switch, comprising: oscillating actuating means; means for oscillating said actuating means; and cooperating means, coacting with said actuating means to cause said actuating means to snap through the remainder of its movement in either direction, not later than when said actuating means has passed central position; said cooperating means comprising, cooperating members one of which is reciprocable and is carried by said actuating means; said actuating means comprising two juxtaposed channel shaped portions forming a tubular portion within which said reciprocable member is reciprocably disposed.

45. An electric switch, comprising: a base; a casing; switch actuating mechanism, unitary with said base, having a portion swingable in a predetermined general plane with respect to said base; operating mechanism, unitary with said casing, having a portion swingable in a predetermined general plane with respect to said casing, adapted to operate said actuating mechanism when said casing is in operative assembly with said base; and means so constructed and arranged that said casing and said base may be operatively assembled ony when said general planes are in coincidence.

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