

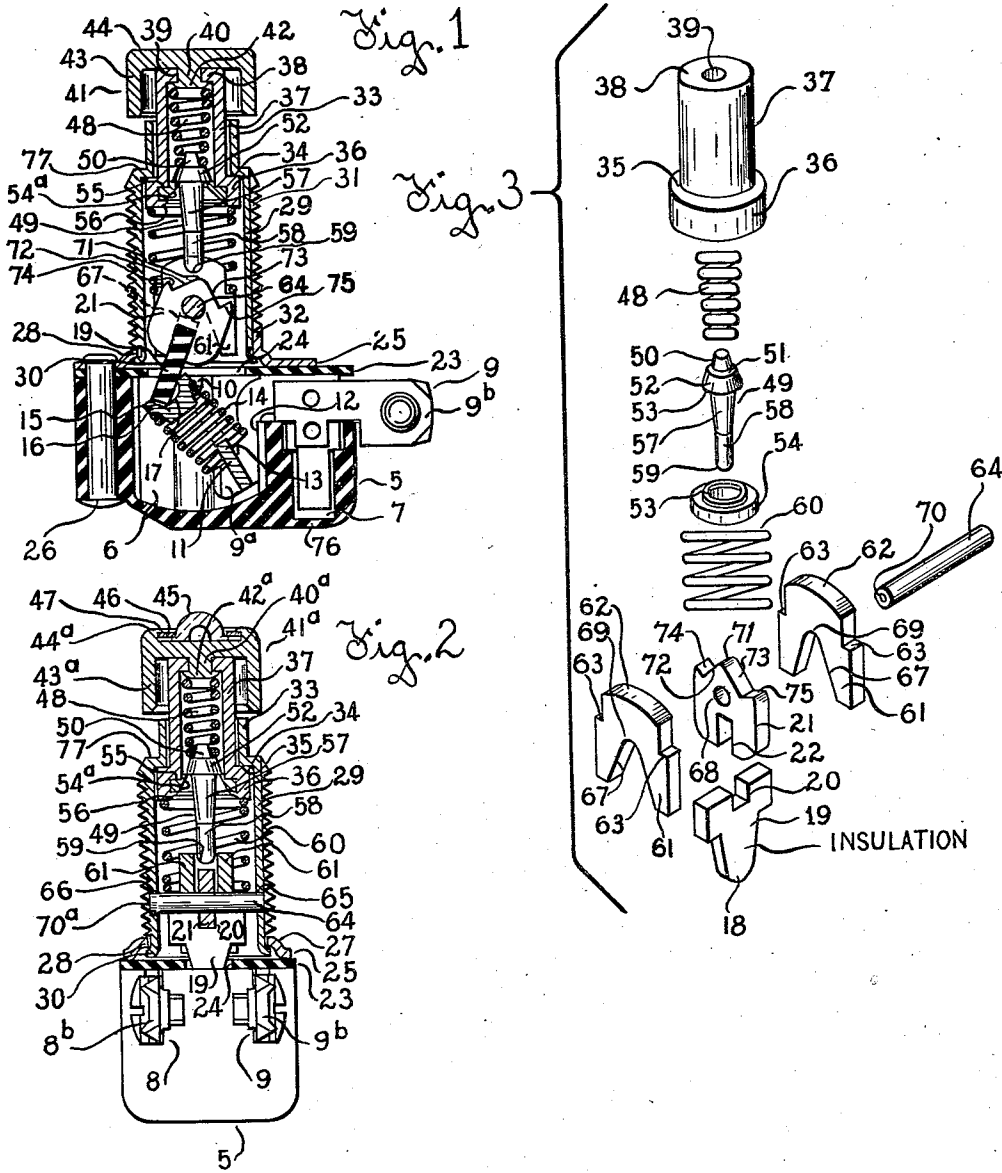
Sept. 8, 1942.

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2,295,484

PUSH-PUSH OPERATING MECHANISM FOR ELECTRIC SWITCHES

Filed June 30, 1941



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UNITED STATES PATENT OFFICE

2,295,484

PUSH-PUSH OPERATING MECHANISM FOR
ELECTRIC SWITCHES

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Application June 30, 1941, Serial No. 400,360

13 Claims. (Cl. 200—67)

This invention relates to improvements in push-push operating mechanism for electric switches. The operating mechanism is particularly adapted for use in the form of an electric snap switch of the one-hole mounting type.

A primary object of the invention is to simplify the structural details and improve the operative characteristics of switch operating mechanisms of the character aforementioned.

Another object is to insure against injury to either the operating parts or the switch parts in the event that excessive pressure is applied to the pushbutton.

Another object is to provide a simple push-push operating mechanism of the one-hole mounting type adapted for use in conjunction with a snap switch of well known form.

Another and more specific object is to minimize the required degree of accuracy in maintenance of tolerances normally specified for the various parts of the switch operating mechanism.

Another object is to increase the ruggedness and durability of switch operating mechanisms of the push-push type.

Another object is to provide a novel form and arrangement of the parts of the operating mechanism, whereby all of the metal parts thereof may be readily assembled as a unit prior to rigid attachment thereof to the switch mechanism.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawing illustrates an embodiment of the invention which will now be described, it being understood that the device illustrated is susceptible of modification in respect of certain structural details thereof without departing from my invention as defined by the appended claims.

In the drawing,

Figure 1 is a vertical sectional view, upon an irregular line, of a well known form of snap switch having my improved push-push operating mechanism applied thereto—certain of the parts being shown in elevation.

Fig. 2 is a vertical section, as viewed from the right-hand side of Fig. 1—the switch base and terminals and certain elements of the operating mechanism being shown in elevation, and

Fig. 3 is a perspective view, in separated relation, of certain elements of the operating mechanism.

The switch parts, other than the operating mechanism, are of the character disclosed in my prior patents, No. 1,905,914, dated April 25, 1933; No. 1,998,962, dated April 23, 1935; and No.

2,171,368, dated August 29, 1939—to which reference may be had for a detailed description of the structural and operative characteristics thereof. It is to be understood, however, that the push-push operating mechanism is likewise adapted for use with other forms of switches, particularly snap switches embodying over-the-center springs for effecting snap movements of the contactors.

The switch illustrated comprises essentially a molded insulating base 5 having a recess 6 (Fig. 1) opening to the upper surface thereof. Base 5 is provided with a pair of auxiliary recesses, one of which is shown at 7 in Fig. 1, to accommodate intermediate portions of the combined contact and terminal members 8 and 9 in a substantially flush relationship to the upper surface of base 5. The resilient contact portions (see 9^a Fig. 1) are located within recess 6 and the wiring terminal portions 8^b and 9^b are located exteriorly of said base at one end of the latter.

Base 5 is provided in its opposed side walls with a pair of upwardly opening bearings, one of which is shown at 10 in Fig. 1, to receive the outwardly extending integral lugs upon the arms of a punched sheet metal contactor 11 of substantially U-shape. The end wall of recess 6 adjacent to which the resilient contact portions are mounted is provided with an inward projection 12 forming a pair of vertical abutments to insure a predetermined normal spacing of the flared portions of said contacts relatively to each other.

Contact 11 is provided with an abutment 13 around which the lower end of the coiled compression spring 14 is adapted to fit. A metal member 15 is inserted downwardly into the upper end of spring 14, said member having a peripheral flange 16 to seat against the upper end of said spring—and said member having a circular recess 17 with a concave bottom wall to accommodate and provide a cooperative abutment for the rounded lower end 18 of a flat, punched insulating actuating element 19. Element 19 is provided at its upper edge with a substantially rectangular notch 20 of a width to accommodate the thickness of a flat, punched sheet metal member 21, which is pivotally supported above base 5 in a predetermined spaced relationship thereto. Member 21 is provided in its lower edge with a substantially rectangular notch 22 of a width to accommodate the thickness of element 19, whereby the latter and member 21 when assembled are restrained against lateral movement in any direction relatively to each other.

A flat punched insulating plate 23 is superimposed upon the upper surface of base 5 whereby

the same overlies the intermediate portions of the combined contact and terminal members 8 and 9 to clamp the latter in assembled relation to the base, and said plate overlies the bearings aforementioned to prevent accidental upward displacement of contactor 11. Plate 23 is provided with a longitudinally extending slot 24 which provides oscillatory clearance for the tapered lower end portion of actuating element 19, and the side walls of which slot assist in limiting element 19 to oscillatory movement in a single plane—as best illustrated in Fig. 2.

The switch is provided with a punched and stamped sheet metal cover and support plate 25, a pair of headed rivets extending upwardly through aligned openings in base 5, plate 23 and plate 25 adjacent to opposite ends thereof, the shank ends of said rivets being upset over the upper surface of plate 25 to rigidly and permanently secure the aforescribed parts in assembled relation. One of the pair of rivets is shown at 26 in Fig. 1, it being understood that the other rivet will be aligned therewith longitudinally of base 5 midway between the aforementioned combined contact and terminal members 8 and 9.

However, before riveting plate 25 in assembled position, the push-push operating elements of the device are assembled with respect thereto. Thus plate 25 is provided with a centrally located bulge or upward projection 27, which bulge is provided with a substantially circular opening 28 to accommodate the reduced lower end of an externally threaded hollow metal bushing 29, said reduced lower end being upset over the lower surface of plate 25 as shown at 30 to rigidly and permanently secure said parts to each other. Bushing 29 is provided with a vertical groove 31 (Fig. 1) and plate 25 is provided with an integral upwardly projecting lug or tongue 32 which fits into said groove to positively prevent rotation of the bushing and plate relative to each other. Groove 31 is likewise adapted to accommodate a tongue formed integrally with the wall of an opening in a panel or other support (not shown) to restrain bushing 29 against rotation relatively thereto.

Bushing 29 is provided adjacent to its upper end with an integral cylindrical portion 33 of reduced internal and external diameter, thus providing an internal annular shoulder 34 which is adapted to cooperate with the annular shoulder 35 formed between the relatively large diameter lower portion 36 and the relatively smaller diameter upper portion 37 of a hollow metal member to limit the degree of upward movement of the latter. Portion 37 is provided with a flat upper end 38 having a relatively small substantially circular opening 39 to receive the stud 40 formed integrally with the inverted cup-shaped pushbutton 41 (Fig. 1), said stud having its lower end upset over the inner surface of the flat end 38, as shown at 42, to rigidly secure said parts to each other. The downwardly extending peripheral flange 45 of pushbutton 41 is adapted for slidable clearance with respect to the exterior of portion 33 of bushing 29. The pushbutton 41^a of Fig. 2 is substantially like that of Fig. 1, and corresponding portions thereof have been given like numerals of reference with the letter "a" added. However, whereas in Fig. 1 I have shown button 41 as provided with a flat upper surface 44, the upper surface 44^a of button 41^a in Fig. 2 is recessed to accommodate a luminous tip member 45 of known form, a

washer 46 of suitable material overlying the peripheral flange of the tip 45, and the upstanding flange of the button recess is spun or turned inwardly over washer 46, as indicated at 47, to secure tip 45 in assembled relation.

After attachment of button 41 or 41^a to portion 37 of said hollow metal member, a coiled compression spring 48 of frusto-conical form is inserted into said member, with its large end abutting the upset end 42 or 42^a of the button stud. Thereafter a metal plunger member 49 has its reduced upper end 50 positioned within the smaller lower end of spring 48, member 49 having a shoulder 51 formed thereon (see Fig. 3) to limit the amount of telescopic engagement thereof with said spring. The frusto-conical portion 52 of member 49 provides a relatively larger diameter lower shoulder 53 which is adapted to seat against the upper edge 53 of an upstanding flange formed integrally with a cup-washer 54, which washer is adapted to telescopically fit into the enlarged lower end portion 36 of said metal member and to seat against the shoulder 55 formed therewithin. The inner periphery of the lower edge of portion 36 is then upset or spun inwardly as shown at 56 (Figs. 1 and 2) to retain said washer 54 in position.

The central portion 54^a of the lower surface of washer 54 is of frusto-conical shape to afford adequate oscillatory clearance for the downwardly tapered intermediate portion 57 of plunger 49—said plunger having a relatively smaller cylindrical lower portion 58 whose extremity 59 is preferably of rounded or hemispherical contour—for engagement with the pivoted toggle lever 21 aforementioned.

Prior to assembly of lever 21, a coiled compression spring 60 is inserted into bushing 29, the upper end of said spring being adapted to engage the lower end of portion 36 of said metal member. Thereafter a pair of punched sheet metal members 61, 61 of like form are inserted into said bushing jointly with lever 21. Members 61, 61 have reduced upper end portions 62, 62 which telescope into, and shoulders 63, 63 which engage, the lower end of spring 60 to effect compression of the latter to a degree to normally insure upper extreme positioning of pushbutton 41 (or 41^a) and its associated parts. When members 61, 61 and lever 21 are so inserted into the bushing, a pivot pin 64 is inserted laterally through aligned openings 65 and 66 in bushing 29 and through substantially triangular notches 67 in each of members 61 and the pivot opening 68 in lever 21. The upper reduced ends 69, 69 of notches 67 are rounded to properly bear downwardly against pin 64. Pin 64 has at least one hollow end 70, which, after insertion thereof is spread or enlarged, as shown at 70^a in Fig. 2, to restrain the pin against displacement relatively to the bushing.

The upper edge of lever 21 has a contour approximating the shape of the letter W, said contour including an apex 71 which is radial to the pivot opening 68, a pair of symmetrical, downwardly divergent cam surfaces 72 and 73, and like upwardly angled edge portions 74 and 75 at the respective extremities of said cam surfaces. When employed in conjunction with a toggle type snap switch the lever 21 will normally be held in one or the other of its extreme positions, as best illustrated in Fig. 1, wherein the switch mechanism is shown in its circuit completing position. It follows that upon depression of the pushbutton 41 the lower end 59 of plunger 49

will engage the cam surface 72 to effect counterclockwise movement of lever 21 and the insulating actuating element 19 interlocked therewith pending movement of the upper end of spring 13 to the right beyond the pivotal center of contactor 11, whereupon said spring acts to snap the contactor to its circuit interrupting position. Under the conditions just mentioned lever 21 will have been moved by plunger 29 to its extreme counterclockwise position, such movement of the lever by the plunger 49 involving tilting of the latter toward the left (Fig. 1) against the centering effect thereon of spring 48, the shape of the portions 52 and 57 of plunger 59 and of the lower surface 54^a of cup washer 54 permitting such tilting.

As best illustrated in Fig. 2 the plates 61, 61 act as guides to insure proper cooperative relationship between the lower end of plunger 49 and the cam surfaces 72 and 73 of lever 21. In the event that more downward pressure is applied to button 41 than is required to effect operation of the switch mechanism, such pressure will be transmitted through spring 48 and plunger 49 to one of the angular surfaces upon lever 21. On the other hand, it will be noted from the dotted line showing in Fig. 1 that oscillatory movement of insulating element 19 in each direction is positively limited by engagement of the latter with the opposite walls respectively of the notches 67 in members 61; and due to the interlocking connection between element 19 and lever 21 the oscillatory movements of the latter are likewise positively limited. As a consequence the excess pressure applied to button 41 will be absorbed in the spring 48 by compression of the latter, so that none of such excess pressure will be transmitted to the switch contacts or contactor or to the spring 14 associated with the latter.

As will be understood, the bushing 29 is adapted to have one or more nuts threaded thereon to provide for one-hole mounting of the switch as a whole to a panel or the like.

Although I have herein illustrated a switch of the end wiring type, it is to be understood that the base 5 illustrated is adapted, by slight modifications thereof after molding, for use with either concealed terminals or bottom wiring terminals. Thus, as shown in Fig. 1, each auxiliary recess is provided with a bottom wall portion 76 of relatively thin cross section which may be readily broached to provide a clearance opening for downward passage of a bottom wiring terminal member.

As illustrated in Figs. 1 and 2, the pushbutton 41 or 41^a is preferably of a diameter slightly less than the diameter of the root portion of the thread on bushing 29, to thereby provide for passage of the clamping nut or nuts over said button as an incident to one-hole mounting of the switch upon a panel or the like.

As will be apparent from consideration of Figs. 1 and 2, the degree of compression of spring 48 as an incident to excess pressure upon button 41 or 41^a is positively limited by engagement of the lower edge of peripheral flange 43 or 43^a with the outer surface 77 of the shoulder formed between the lower threaded portion of bushing 29 and the upper unthreaded portion 33 thereof.

It should also be noted that the frusto-conical enlarged portion 52 of plunger 49 not only provides adequate clearance between the same and the inner cylindrical wall of member 37 upon tilting of said plunger, but the surface of said por-

tion 52 is adapted upon tilting of the plunger to an extreme position to engage said wall throughout the length of said portion, to facilitate sliding movement thereof relatively to said wall. As aforeindicated, the downwardly tapered form of spring 48 permits such tilting of plunger 49 without interference with the inner wall of member 37, said spring 48 acting not only to normally center plunger 49 but also to absorb any excess pressure applied to button 41, or 41^a. From the foregoing, it will be understood that spring 48 is of substantially greater strength than the over-the-center spring 13 to insure snap operation of the switch mechanism by the latter prior to any substantial degree of downward movement of member 37 relatively to the plunger 49.

I claim:

1. In a push-push operating mechanism for electric snap switches, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and an upper unthreaded cylindrical portion of relatively smaller diameter with external and internal right-angle peripheral shoulders formed therebetween, a hollow metal member insertable upwardly into said bushing, said member having an external peripheral shoulder formed thereon to limit the degree of upward movement thereof relatively to said bushing, said member being adapted in its upper extreme position to project a substantial distance upwardly beyond said bushing, an inverted cup-shaped metal pushbutton secured to the upper end of said member, said pushbutton cooperating with said bushing to positively limit the extent to which said member may be depressed relatively to said bushing, a coiled compression spring engaging the lower end of said member to normally bias the same to its upper extreme position, and a spring and a plunger carried by said hollow metal member, said last mentioned spring acting to normally center said plunger while permitting bodily movement of the latter axially of said hollow metal member under certain conditions.

2. In a push-push operating mechanism for electric snap switches, in combination, a hollow metal bushing having an externally threaded cylindrical hollow portion and an upper unthreaded cylindrical portion of relatively smaller diameter with external and internal right-angle peripheral shoulders formed therebetween, a hollow metal member insertable upwardly into said bushing, said member having an external peripheral shoulder formed thereon to limit the degree of upward movement thereof relatively to said bushing, said member being adapted in its upper extreme position to project a substantial distance upwardly beyond said bushing, an inverted cup-shaped metal pushbutton rigidly and permanently secured to said member, said pushbutton being of smaller diameter than the root of the thread on said bushing to provide assembling clearance for a clamping nut or nuts to be threaded onto said bushing, the downwardly extending peripheral flange of said pushbutton cooperating with the external right-angle peripheral shoulder on said bushing to positively limit the degree of downward depression of said member, a coiled spring engaged under a predetermined degree of compression with the lower end of said member to normally bias the same to its upper extreme position, a plunger supported at the lower end of said member and tiltable and slidable with respect thereto, and a coiled spring carried within said member and engaged under compression

with said plunger to normally center the latter while permitting axial movement of the latter relatively to said member, for the purpose set forth.

3. In a push-push operating mechanism for electric switches, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and an upper unthreaded cylindrical portion of relatively smaller diameter with external and internal right-angle peripheral shoulders formed therebetween, a hollow metal member insertable upwardly into said bushing, said member having an external peripheral shoulder formed thereon to limit the degree of upward movement thereof relatively to said bushing, said member being adapted in its upper extreme position to project a substantial distance upwardly beyond said bushing, an inverted cup-shaped pushbutton rigidly and permanently secured to said member, said pushbutton being of smaller diameter than the root of the thread on said bushing to provide assembling clearance for a clamping nut or nuts to be threaded onto said bushing, the downwardly extending peripheral flange of said pushbutton cooperating with the external right-angle peripheral shoulder on said bushing to positively limit the degree of downward depression of said member, a coiled spring engaged under a predetermined degree of compression with the lower end of said member to normally bias the same to its upper extreme position, a coiled compression spring positioned within said hollow metal member, a plunger engaged with the lower end of said spring, said plunger having an enlargement formed thereon, a washer attached to the lower end of said member and having an opening through which the lower end of said plunger extends, the periphery of said opening underlying said enlargement to retain said plunger while permitting tilting thereof against the centering bias of said last mentioned spring, and a double inclined metal cam member with the cam surfaces of which said plunger is adapted to alternately engage.

4. In a push-push operating mechanism for electric switches, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and an upper unthreaded cylindrical portion of relatively smaller diameter with external and internal right-angle peripheral shoulders formed therebetween, a hollow metal member insertable upwardly into said bushing, said member having an external peripheral shoulder formed thereon to limit the degree of upward movement thereof relatively to said bushing, said member being adapted in its upper extreme position to project a substantial distance upwardly beyond said bushing, an inverted cup-shaped pushbutton rigidly and permanently secured to said member, said pushbutton being of smaller diameter than the root of the thread on said bushing to provide assembling clearance for a clamping nut or nuts to be threaded onto said bushing, the downwardly extending peripheral flange of said pushbutton cooperating with the external right-angle peripheral shoulder on said bushing to positively limit the degree of downward depression of said member, a coiled spring engaged under a predetermined degree of compression with the lower end of said member to normally bias the same to its upper extreme position, a coiled compression spring positioned within said hollow metal member, a plunger engaged with the lower end of said spring, said plunger having an enlargement formed thereon, a washer

attached to the lower end of said member and having an opening through which the lower end of said plunger extends, the periphery of said opening underlying said enlargement to retain said plunger while permitting tilting thereof against the centering bias of said last mentioned spring, a double inclined metal cam member with the cam surfaces of which said plunger is adapted to alternately engage, said cam member having a substantially rectangular notch formed in the lower edge thereof, and a flat, punched insulating member adapted to fit within said notch, said last mentioned member having a notch formed in the upper edge thereof to accommodate the thickness of said cam member, for the purpose set forth.

5. In a push-push operating mechanism for electric switches, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and an upper unthreaded cylindrical portion of relatively smaller diameter with external and internal right-angle peripheral shoulders formed therebetween, a hollow metal member insertable upwardly into said bushing, said member having an external peripheral shoulder formed thereon to limit the degree of upward movement thereof relatively to said bushing, said member being adapted in its upper extreme position to project a substantial distance upwardly beyond said bushing, an inverted cup-shaped pushbutton rigidly and permanently secured to said member, said pushbutton being of smaller diameter than the root of the thread on said bushing to provide assembling clearance for a clamping nut or nuts to be threaded onto said bushing, the downwardly extending peripheral flange of said pushbutton cooperating with the external right-angle peripheral shoulder on said bushing to positively limit the degree of downward depression of said member, a coiled spring engaged under a predetermined degree of compression with the lower end of said member to normally bias the same to its upper extreme position, a coiled compression spring positioned within said hollow metal member, a plunger engaged with the lower end of said spring, said plunger having an enlargement formed thereon, a washer attached to the lower end of said member and having an opening through which the lower end of said plunger extends, the periphery of said opening underlying said enlargement to retain said plunger while permitting tilting thereof against the centering bias of said last mentioned spring, a double inclined metal cam member with the cam surfaces of which said plunger is adapted to alternately engage, said cam member having a substantially rectangular notch formed in the lower edge thereof, a flat, punched insulating member adapted to fit within said notch, said last mentioned member having a notch formed in the upper edge thereof to accommodate the thickness of said cam member, for the purpose set forth, said insulating member having an abutment formed at the lower end thereof, and a coiled over-the-center compression spring with the upper end of which said abutment is adapted to cooperate.

6. In an electric switch adapted for one-hole mounting, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and a cylindrical upper portion of relatively smaller diameter formed integrally therewith, said bushing having internal and external peripheral shoulders formed as an incident to the reduction in diameter of the upper portion

thereof, a hollow metal member having integral lower and upper portions respectively slidable within the lower and upper portions of said bushing, means to limit the degree of upward and downward movement of said member relatively to said bushing, said means for limiting downward movement comprising a metal pushbutton rigidly and permanently attached to the upper end of said member, said pushbutton being of a size to permit downward movement of a nut thereover for threaded engagement with said bushing, a coiled compression spring positioned within said metal member, a plunger engaged with the lower end of said spring under a predetermined degree of compression and centered by the latter, said plunger having an enlarged intermediate portion, and a washer underlying said last mentioned portion of the plunger to retain the same within said metal member while permitting lateral tilting and upward movement of said plunger against the bias of said compression spring.

7. In an electric switch adapted for one-hole mounting, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and a cylindrical upper portion of relatively smaller diameter formed integrally therewith, said bushing having internal and external peripheral shoulders formed as an incident to the reduction in diameter of the upper portion thereof, a hollow metal member having integral lower and upper portions respectively slidable within the lower and upper portions of said bushing, means to limit the degree of upward and downward movement of said member relatively to said bushing, said means for limiting downward movement comprising a metal pushbutton rigidly and permanently attached to the upper end of said member, said pushbutton being of a size to permit downward movement of a nut thereover for threaded engagement with said bushing, a coiled compression spring positioned within said metal member, a plunger engaged with the lower end of said spring under a predetermined degree of compression and centered by the latter, said plunger having an enlarged intermediate portion, a washer underlying said last mentioned portion of the plunger to retain the same within said metal member while permitting lateral tilting and upward movement of said plunger against the bias of said compression spring, a pivot pin extending diametrically through said bushing adjacent to the lower end thereof, a metal cam member pivotally supported by said pin, said cam member having a pair of downwardly diverging cam surfaces formed at the upper edge thereof for alternate engagement by said plunger, for the purpose set forth, a pair of like flat, punched sheet metal members also supported by said pin and arranged on opposite sides of said cam member, each of said pair of members having two upwardly facing shoulders formed thereon, and a coiled compression spring interposed between said shoulders and the lower end of said hollow metal member, to thereby bias the latter to its upper extreme position.

8. In an electric switch adapted for one-hole mounting, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and a cylindrical upper portion of relatively smaller diameter formed integrally therewith, said bushing having internal and external peripheral shoulders formed as an incident to the reduction in diameter of the upper portion thereof, a hollow metal member having integral lower and upper portions respectively slidable

within the lower and upper portions of said bushing, means to limit the degree of upward and downward movement of said member relatively to said bushing, said means for limiting downward movement comprising a metal pushbutton rigidly and permanently attached to the upper end of said member, said pushbutton being of a size to permit downward movement of a nut thereover for threaded engagement with said bushing, a coiled compression spring positioned within said metal member, a plunger engaged with the lower end of said spring under a predetermined degree of compression and centered by the latter, said plunger having an enlarged intermediate portion, a washer underlying said last mentioned portion of the plunger to retain the same within said metal member while permitting lateral tilting and upward movement of said plunger against the bias of said compression spring, a pivot pin extending diametrically through said bushing adjacent to the lower end thereof, a metal cam member pivotally supported by said pin, said cam member having a pair of downwardly diverging cam surfaces formed at the upper edge thereof for alternate engagement by said plunger, for the purpose set forth, a pair of like flat, punched sheet metal members also supported by said pin and arranged on opposite sides of said cam member, each of said pair of members having two upwardly facing shoulders formed thereon, and a coiled compression spring interposed between said shoulders and the lower end of said hollow metal member, to thereby bias the latter to its upper extreme position, said like metal members also cooperating with the lower end of said plunger to limit the same to tilting movement in a single plane, whereby proper engagement thereof with said cam member is insured.

9. In an electric switch adapted for one-hole mounting, in combination, a hollow metal bushing having an externally threaded cylindrical lower portion and a cylindrical upper portion of relatively smaller diameter formed integrally therewith, said bushing having internal and external peripheral shoulders formed as an incident to the reduction in diameter of the upper portion thereof, a hollow metal member having integral lower and upper portions respectively slidable within the lower and upper portions of said bushing, means to limit the degree of upward and downward movement of said member relatively to said bushing, said means for limiting downward movement comprising a metal pushbutton rigidly and permanently attached to the upper end of said member, said pushbutton being of a size to permit downward movement of a nut thereover for threaded engagement with said bushing, a coiled compression spring positioned within said metal member, a plunger engaged with the lower end of said spring under a predetermined degree of compression and centered by the latter, said plunger having an enlarged intermediate portion, a washer underlying said last mentioned portion of the plunger to retain the same within said metal member while permitting lateral tilting and upward movement of said plunger against the bias of said compression spring, a pivot pin extending diametrically through said bushing adjacent to the lower end thereof, a metal cam member pivotally supported by said pin, said cam member having a pair of downwardly diverging cam surfaces formed at the upper edge thereof for alternate engagement by said plunger, for the purpose set forth, a pair

of like flat, punched sheet metal members also supported by said pin and arranged on opposite sides of said cam member, each of said pair of members having two upwardly facing shoulders formed thereon, a coiled compression spring interposed between said shoulders and the lower end of said hollow metal member, to thereby bias the latter to its upper extreme position, said like metal members also cooperating with the lower end of said plunger to limit the same to tilting movement in a single plane, whereby proper engagement thereof with said cam member is insured, said like metal members having downwardly opening substantially V-shaped notches formed in the lower ends thereof for cooperative engagement with said pivot pin, a flat, punched insulating member arranged at a right angle to the plane of said cam member and interlocked with the lower edge thereof against lateral movement in any direction, said insulating member having opposite side portions jointly engageable with the lower portions of said notches to limit the degree of oscillatory movement of said insulating member in each direction.

10. In a push-push operating mechanism for electric switches, in combination, a hollow metal member comprising a cylindrical upper portion having an inwardly extending flange at the upper end thereof, a cylindrical lower portion of relatively larger diameter formed integrally with said upper portion and providing right-angled internal and external peripheral flanges therebetween, a downwardly tapered coiled compression spring positioned within the upper portion of said member and seated against said upper end flange, a metal plunger having a reduced upper end telescoped into the lower end of said spring, said plunger having an enlarged intermediate portion of frusto-conical form, and a cup washer seated against said internal peripheral flange and rigidly secured in position, said washer underlying said enlargement of the plunger to retain the latter in assembled position under a given degree of compression of the spring, said spring acting to normally center said plunger while providing for tilting and bodily movement thereof relatively to said member, for the purpose set forth.

11. In a push-push operating mechanism for electric switches, in combination, a hollow metal member comprising a cylindrical upper portion having an inwardly extending flange at the upper end thereof, a cylindrical lower portion of relatively larger diameter formed integrally with said upper portion and providing right-angled internal and external peripheral flanges therebetween, a downwardly tapered coiled compression spring positioned within the upper portion of said member and seated against said upper end flange, a metal plunger having a reduced upper end telescoped into the lower end of said spring, said plunger having an enlarged intermediate portion of frusto-conical form, a cup washer seated against said internal peripheral flange and rigidly secured in position, said washer underlying said enlargement of the plunger to retain the latter in assembled position under a given degree of compression of the spring, said spring acting to normally center said plunger while providing for tilting and bodily movement thereof relatively to said member, for the purpose set forth, and a peripheral side portion of said

frusto-conical enlargement being adapted to engage the inner wall of said cylindrical upper portion upon a given degree of tilting of said plunger, such engagement being adapted to facilitate sliding movement of said member and said plunger relatively to each other in the event of further compression and subsequent decompression of said spring.

12. In a push-push operating mechanism for electric snap switches, in combination, a hollow metal bushing having an externally threaded portion, a hollow metal member insertable upwardly into said bushing, said member having an external shoulder formed thereon to limit the degree of upward movement thereof relatively to said bushing, said member being adapted in its upper extreme position to project a substantial distance upwardly beyond said bushing, a metal pushbutton rigidly attached to the upper end of said member, said pushbutton cooperating with said bushing to positively limit the extent to which said member may be depressed relatively to said bushing, a coiled compression spring engaging the lower end of said member to normally bias the same to its upper extreme position, a plunger carried by said member and tiltable and slidable relatively thereto, and a second coiled compression spring providing a yieldable driving connection between said member and said plunger.

13. In a push-push operating mechanism for electric switches, in combination, a hollow metal bushing having an externally threaded portion, a hollow metal member insertable upwardly into said bushing, said member having an external shoulder formed thereon to limit the degree of upward movement thereof relatively to said bushing, said member being adapted in its upper extreme position to project a substantial distance upwardly beyond said bushing, a pushbutton secured to the upper end of said member, said pushbutton cooperating with said bushing to positively limit the extent to which said member may be depressed relatively to said bushing, a coiled compression spring engaging the lower end of said member to normally bias the same to its upper extreme position, a coiled compression spring positioned within said hollow metal member, a plunger engaged with the lower end of said last mentioned spring, said plunger having an enlargement formed thereon, a washer attached to the lower end of said member and having an opening through which the lower end of said plunger extends, the periphery of said opening underlying said enlargement to retain said plunger while permitting tilting thereof, a double-inclined, pivoted, metal cam member with the cam surfaces of which said plunger is adapted to alternately engage, and an over-the-center spring associated with said cam member to bias the latter to one or the other of its extreme positions, said second mentioned spring being adapted to act as a centering means for said plunger and of sufficient strength to hold the latter down during its operation of said cam member against the bias of said over-the-center spring, while providing for overtravel of said hollow metal member relatively to said plunger in either extreme position of said cam member.

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