

June 24, 1941.

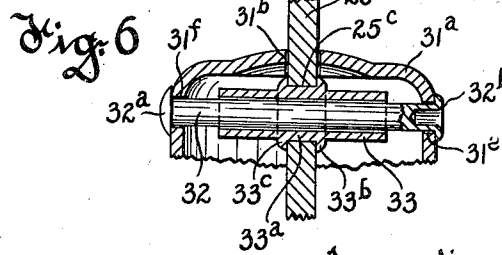
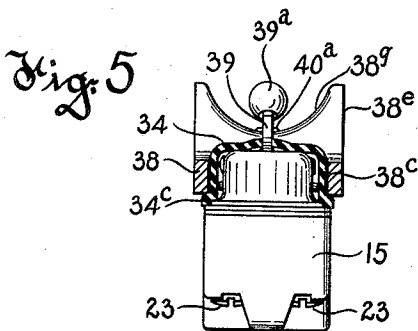
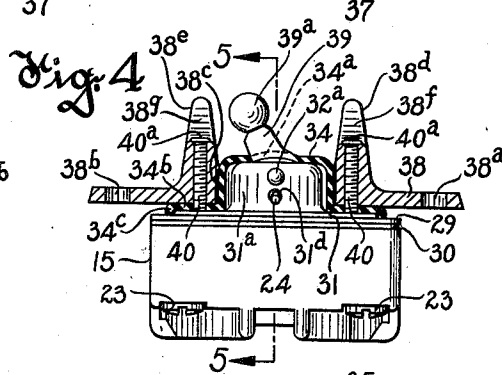
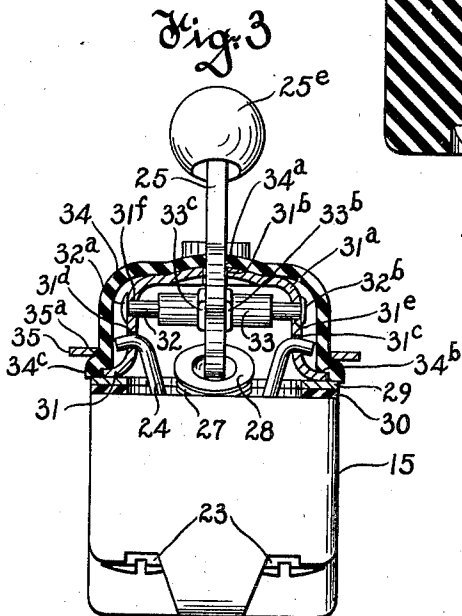
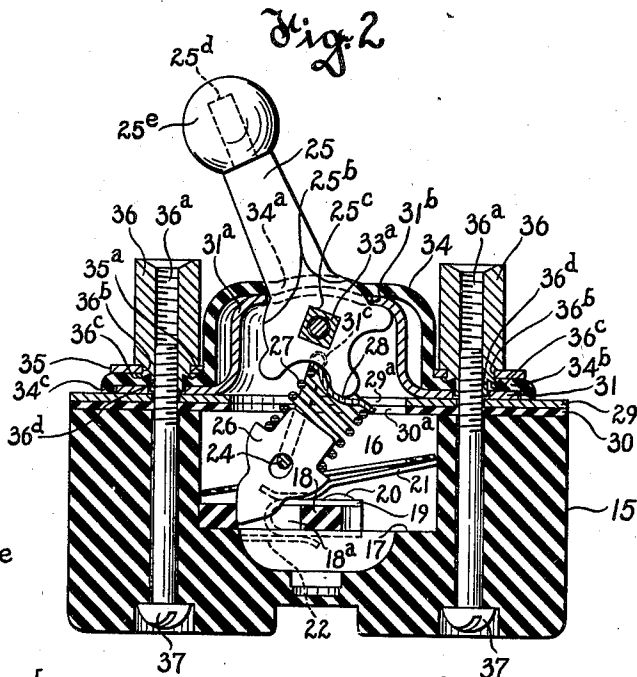
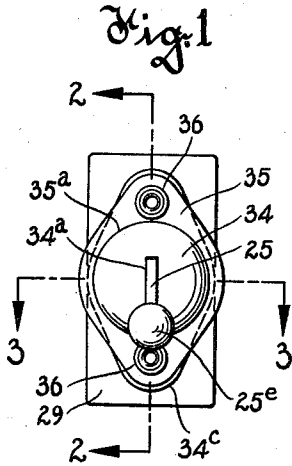
G. J. MEUER

2,247,247

ELECTRIC SWITCH

Filed Oct. 7, 1938

2 Sheets-Sheet 1



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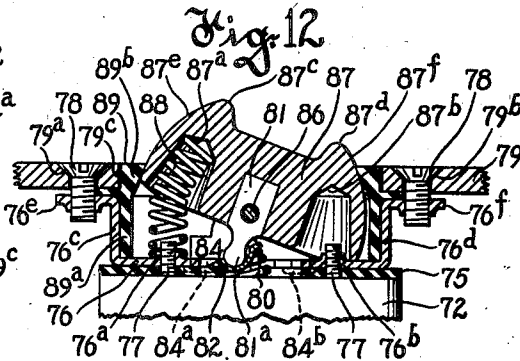
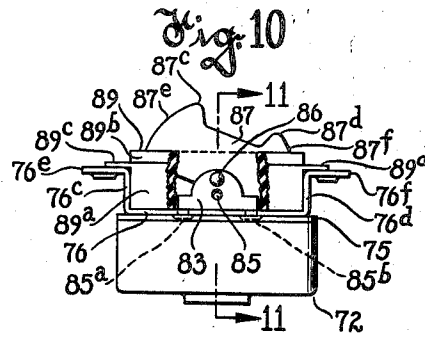
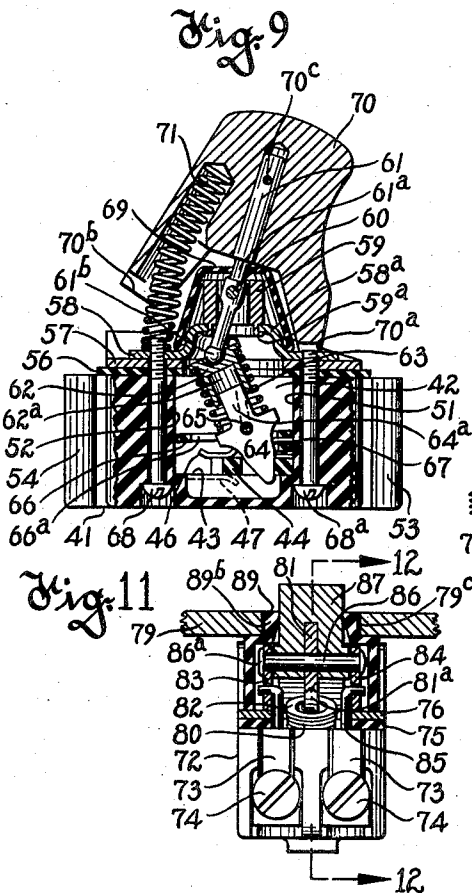
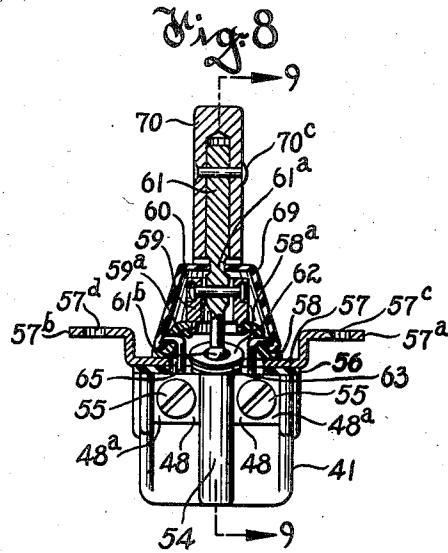
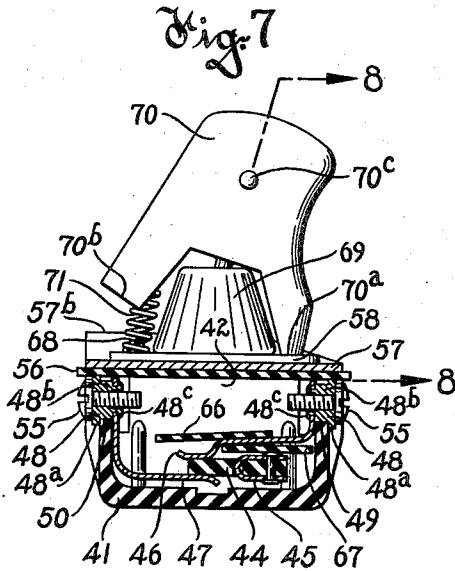
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2,247,247

ELECTRIC SWITCH

Filed Oct. 7, 1938

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,247,247

ELECTRIC SWITCH

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Application October 7, 1938, Serial No. 233,828

12 Claims. (Cl. 200—76)

This invention relates to improvements in electric switches. The invention relates more particularly to improvements in toggle operated snap switches of the tool-handle type.

A primary object of the invention is to provide a tool-handle snap switch of substantially dust-tight construction.

Another object is to provide novel means affording substantial dust-tightness of tool-handle switches having various different forms of operating levers.

Another object is to improve the details of construction and facilitate assembly of the parts of switches of the aforementioned character.

Another object is to provide a switch operating lever having novel means for pivotally supporting and guiding the same whereby wobbling or lateral displacement of the lever is substantially prevented.

Another object is to provide a tool-handle switch of the aforementioned character having combined contact and terminal members of novel form whereby peripheral dust-tightness of the molded insulating base is insured.

Another object is to provide a switch of the character last mentioned having novel means for insuring substantial dust-tightness of the operating elements of the switch.

Another and more specific object is to provide for utilization of a resilient, rubber-like material for rendering the switches substantially dust-tight without appreciably modifying the normal operative characteristics of the switch mechanism.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate certain embodiments of the invention which will now be described, it being understood that the embodiments illustrated are susceptible of modification in respect of certain details of construction thereof without departing from the scope of my invention as defined in the appended claims.

In the drawings, Figure 1 is a top view (normal size) of a toggle lever operated snap switch of the tool-handle type, said switch having novel means for mounting the same in a tool-handle or the like, and the same having elements applied thereto to render the same substantially dust-tight.

Fig. 2 is a sectional view (double-scale), on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view, on the line 3—3 of Fig. 1.

Fig. 4 is a view (normal size), partly in side elevation and partly in vertical section, illustrating a switch generally similar to the switch of Figs. 1 to 3, but having mounting means of modified form applied thereto.

Fig. 5 is an end elevation, partly in vertical section on the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary vertical sectional view of the pivotal supporting and guiding means for the toggle lever shown in Figs. 1 to 5.

Fig. 7 is a view (normal size), partly in side elevation and partly in vertical section, of a switch having combined contact and terminal members of novel form; a novel form of lever attachment to provide a trigger or finger grip; and novel means for rendering the switch mechanism substantially dust-tight.

Fig. 8 is an end elevation, partly in section on the line 8—8 of Fig. 7.

Fig. 9 is a vertical section substantially on the line 9—9 of Fig. 8, parts of the insulating base of the switch being shown in elevation.

Fig. 10 is a side elevation (normal size) of a switch having a modified form of operating lever associated therewith, a portion of the rubber-like cap being broken away to illustrate the supporting frame for the lever.

Fig. 11 is a view, partly in end elevation and partly in vertical section on the line 11—11 of Fig. 10, a fragment of the flush mounting plate being shown in position, and

Fig. 12 is a fragmentary view, partly in elevation and partly in vertical section on the line 12—12 of Fig. 11.

Referring first to Figs. 1 to 3 and 6, wherein I have illustrated a toggle lever snap action switch of the tool-handle type having an alternating current controlling capacity of 10 amperes at 250 volts or 12 amperes at 125 volts, it is to be understood that the switch mechanism embodies certain features described and claimed in my prior patents, No. 1,889,259, dated Nov. 29, 1932; No. 1,977,078, dated Oct. 16, 1934; and No. 2,089,032, dated Aug. 3, 1937; reference being had to said prior patents for a detailed description of certain of the switch parts.

Here, as in said prior patents, I provide a molded insulating base, designated in general by the numeral 15, said base having a recess 16 (Fig. 2) opening to the upper surface thereof. Base 15 is provided with a rib whose flat surface 17 (Fig. 2) is offset upwardly from the bottom wall of recess 16. Slidable upon surface 17 is a flat punched insulating plate 18 which carries a pair of like contactors arranged on opposite sides of said rib. One of said contactors is shown at 19 as comprising a metal strip bent to sub-

stantially U-shape, whereby the arms thereof are exposed on the upper and lower surfaces of plate 18. Said contactors are rigidly and permanently secured to plate 18 as by means of rivets, one of which is shown at 20. A pair of upper and lower resilient stationary contacts 21 and 22 is positioned on each side of the aforementioned rib within recess 16, the respective contacts being secured to ledges offset downwardly from the upper surface of base 15 as by means of a corresponding number of internally threaded eyelet members which provide for bottom wiring of the switch, in the manner illustrated in Fig. 4, of my aforementioned Patent No. 2,089,032. Two of the wiring terminal screws are shown herein at 23 in Fig. 3.

The toggle snap action mechanism for the switch comprises a wire yoke member 24 pivotally supported above base 15 but depending into the recess 16; a toggle operating lever 25 pivotally supported above yoke 24; a flat punched insulating plate 26 pivotally supported by said yoke, the lower end of plate 26 projecting into a slot or opening 18^a in plate 18 to provide a lost motion driving connection between said plates. A coiled spring 27 is interposed under compression between the lower end of lever 25 and plate 26, a portion of which telescopes into the lower end of said spring. Spring 27 carries at its upper end a metal cup 28 for engagement by said lower end of lever 25.

A flat metal plate 29 is superimposed upon the upper surface of base 15, a flat punched or sheared plate or piece of resilient, rubber-like material 30 being interposed between plate 29 and the upper surface of base 15. Plates 29 and 30 are provided with aligned centrally located openings 29^a, 30^a (Fig. 2) which provide oscillating clearance for yoke 24 and the aforementioned parts associated therewith. Superimposed upon plate 29 is a sheet metal top plate the peripheral flange portion of which is designated by the numeral 31^f in Figs. 2 and 3, said top plate having a centrally located portion 31^a of substantially dome-shape. Dome-shaped portion 31^a is provided at its upper end with a relatively narrow opening or slot 31^b extending in a direction longitudinally of base 15, opening 31^b having a width to rather closely accommodate lever 25 comprising a flat sheet metal punching, and the length of opening 31^b being such as to provide a rather close oscillating clearance for the arc-shaped portions 25^b forming an enlargement of said lever. Opening 31^b thus serves to guide lever 25 for oscillatory movement in a single plane, whereas said portions 25^b of the lever insure substantial closure of said opening 31^b under all conditions.

Dome-shaped portion 31^a is provided adjacent to the lower end thereof with aligned openings 31^c, 31^d (Fig. 3) into one of which an outwardly bent end of one arm of yoke 24 is freely insertable, the bent end of the other arm of said yoke being insertable into the other opening by temporarily bending the yoke arms toward each other. Portion 31^a is provided adjacent to the upper end thereof with aligned openings 31^e, 31^f which are respectively vertically aligned with openings 31^c and 31^d. Openings 31^e, 31^f are adapted to receive a pin 32 of circular form in transverse cross section, said pin having a head 32^a engaging the exterior of one side wall of portion 31^a and a hollow shank end 32^b which is upset over the exterior of the other side wall of said portion 31^a. Pin 32 freely penetrates the

passage of corresponding circular form in transverse cross section provided in a relatively long metal member 33 to provide a relatively wide area of bearing engagement between the latter and said pin. Member 33 is provided at its mid-length with a portion 33^a of exteriorly polygonal form (preferably square, as best shown in Fig. 2) in transverse cross section. Lever 25 is provided with an opening 25^c to accommodate, with a rather close sliding fit, the portion 33^a, said portion 33^a extending beyond each side of lever 25, and the material of said portion being upset against opposite sides of lever 25, as shown at 33^b and 33^c in Figs. 3 and 6, to rigidly and permanently secure said parts in assembled relation.

In practice the pin 32 is free to oscillate or rotate within the aforementioned openings 31^e, 31^f (Fig. 6), but pivotal movement of lever 25 is afforded primarily by the bearing engagement of tubular member 33 with pin 32. By reason of the rigid connection between lever 25 and member 33 and the relatively wide area of bearing engagement of the latter with pin 32 lateral tilting or wobbling of said lever is prevented. Also as aforescribed the walls of opening 31^b in dome-shaped portion 31^a cooperate with lever 25 to limit the same to oscillatory movement in a single plane. This insures against accidental lateral displacement of the lower end of lever 25 from the cup or abutment 28 at the upper end of spring 27.

Many portable tools (such as grinders, polishers or drills) are used under conditions involving the presence of metal dust, stone dust, or other particles in the surrounding air; and if such dust particles have access to the switch chamber they, of course, tend to run the switch mechanism and to greatly reduce the useful life of the latter. It is accordingly a primary object of my invention to render the switch chamber substantially dust-tight, and this object is attained in the device of Figs. 1 to 3 by providing a relatively thin walled, dome-shaped insulating member 34 molded from a resilient, rubber-like material. Member 34 and the aforementioned plate 30 may be and preferably are composed of identical resilient, rubber-like material, a preferred form of such material being made and sold commercially under the trade-name of "Neoprene." Such material is extremely live and resilient (or elastic) and is further characterized by its resistance to deterioration under the influence of, or in the presence of, oil or grease.

As best shown in Figs. 2 and 3 member 34 is provided with a slot or opening 34^a which it is to be understood is relatively narrower than the thickness of lever 25 and relatively shorter than the width of the enlarged portion (comprising arcuate portions 25^b) of said lever. Therefore the walls of said opening 34^a will be biased by the resiliency of the rubber-like material into close engagement with the sides and edges of lever 25 in all positions of the latter, the resiliency or elasticity of member 34 being such as to permit bodily deformation or distortion thereof as an incident to oscillatory movement of said lever while maintaining said close connection of member 34 with the latter.

Also as best shown in Figs. 2 and 3 member 34 is provided at its lower end with a flange portion 34^b which overlies the aforementioned top plate 31, said flange portion 34^b being provided with a downwardly extending edge portion or peripheral rib 34^c which surrounds the peripheral edge of

top plate 31 and engages the aforementioned metal plate 29. Superimposed upon flange portion 34^b is a metal plate 35 having a relatively large centrally located opening 35^a to accommodate said dome-shaped member 34. Plate 35 has associated therewith a pair of nuts here shown as substantially cylindrical elements 36 having threaded passages 36^a extending therethrough. Elements 36 are provided at their lower ends with reduced portions 36^b adapted to extend downwardly through correspondingly shaped openings in plate 35, the material of said reduced portions being upset over the lower surface of plate 35, as shown at 36^c, to rigidly and permanently secure said nuts to said plate. Elements 36 are provided with further reduced portions 36^d projecting downwardly through corresponding openings in flange portion 34^b and metal top plate 31 to afford a proper degree of engagement of elements 36 with the threaded shanks of a pair of bolts 37 extending upwardly from the bottom surface of base 15.

The flat upper ends of elements 36 are adapted to abut the inner surface of the wall of a cavity provided in a tool-handle or the like (not shown), said wall having openings formed therein to provide clearance for the shanks of mounting screws or bolts which take into the upper ends of the respective threaded passages 36^a. Said cavity wall will of course be provided with a suitable opening to afford oscillating clearance for the upper end portion of lever 25. As shown in dotted lines in Fig. 2 lever 25 is provided at its upper end with a reduced portion 25^d which is adapted for a drive fit within a recess provided in a spherical knob member 25^e. As will be understood, knob 25^e is applied to lever 25 after upward insertion of the latter through the aforementioned opening 31^b in portion 31^a of the top plate. The walls of opening 34^a in the dust-proofing cap 34 are sufficiently elastic to permit downward passage of said cap over knob 25^e and the intermediate portion of said lever.

In the modification shown in Figs. 4 and 5 most of the switch parts are identical with those aforedescribed and have been given corresponding numerals of reference. Instead of the plate 35 and nuts 36 aforedescribed, the switch is provided with a plate 38, preferably of die cast aluminum, the opposite ends of plate 38 extending beyond the respective ends of base 15 and having openings 38^a, 38^b to accommodate the shanks of securing screws (not shown) which take into suitable tapped openings in the wall of a portable tool housing or handle. Plate 38 is provided with a central opening 38^c to accommodate the dome-shaped dust-proofing cap 34 and the operating lever 39 extending upwardly through the latter, lever 39 having a spherical knob 39^a attached thereto with a drive fit in the manner aforedescribed.

Formed integrally with plate 38 and extending upwardly at substantially right angles thereto adjacent the opposite longitudinally spaced sides of opening 38^c are a pair of transverse ribs 38^d and 38^e, said lugs having segmental notches or concavities 38^f, 38^g formed in the upper edges thereof and alined with each other. Notches 38^f, 38^g provide ample clearance to enable thumb operation of lever 39 in either direction, whereas the high portions of ribs 38^d, 38^e serve to prevent accidental operation of lever 39 or injury thereto in the event of rough or careless usage of the tool to which the switch may be attached. The switch base 15 and its associated parts are at-

tached to plate 38 as by means of a pair of relatively long bolts 40 which penetrate tapped openings provided in the aforementioned ribs 38^d, 38^e, the upper ends of said bolts being upset, as shown at 40^a, to permanently secure the parts in assembled relation.

The switches illustrated in Figs. 1 to 6, inclusive, have a rated capacity of 10 amperes at 250 volts, whereas the modified form of switch shown in Figs. 7 to 9, inclusive, has a rated capacity of 20 amperes at 250 volts. In Figs. 7 to 9, the numeral 41 designates a molded insulating base having a recess 42 formed therein and opening to the upper surface thereof. Recess 42 is provided in its bottom wall with an integral rib upon the flat upper surface 43 of which (Fig. 9) the insulating plate 44 is slidably movable. Plate 44 has attached thereto a pair of bridging contactors, one of which is shown at 45 in Fig. 7. Located within recess 42 are two identical pairs of upper and lower resilient contacts, one pair of said contacts being shown at 46 and 47 in Figs. 7 and 9. Each contact has rigidly and permanently attached thereto a terminal member 48 (Figs. 7 and 8). Each member 48 comprises an outer end portion 48^a providing a flange of square contour; an intermediate portion 48^b of cylindrical form; and a reduced inner end of cylindrical form which penetrates a circular opening provided adjacent to the upper end of its associated contact, and is upset over the latter as shown at 48^c in Fig. 7 to rigidly unite said parts.

Base 41 is provided at each end thereof with two upwardly opening notches (preferably of rectangular contour) against the bottom walls of which the respective cylindrical portions 48^b of the terminal members are adapted to seat, as shown at 49 and 50 in Fig. 7. The arrangement is such that flanges 48^a overlap the bottom and side walls of the respective notches and extend to a plane substantially flush with the upper surface of base 41 (Figs. 7 and 8), said flanges being positioned rather closely against the exterior surfaces of the end walls of the base, whereas the respective contacts are positioned closely against the inner surfaces of said end walls, as shown in Fig. 7; the combined contact and terminal members being insertable with a press fit into the base notches. Formed integrally with the respective end walls of recess 42, and alined with the aforementioned rib 43 are barriers 51 and 52 which cooperate with the respective side walls of recess 42 to assist in retaining the upper and lower contacts of the respective pairs in proper alignment with each other, while assisting in insulating said pairs of contacts from each other. Also formed integrally with the respective end walls of base 41 and interposed between the terminal members 48 of the respective pairs are vertically extending barriers 53 and 54 (Figs. 8 and 9) to properly insulate said terminal members and the circuit wires to be attached thereto. Each member 48 is provided with a centrally located threaded passage to accommodate a binding screw 55.

Superimposed upon the upper surface of base 41 is a sheet or plate 56 of the aforementioned resilient, rubber-like material, which overlies the aforementioned terminal members and screws 55 (Fig. 7). Superimposed upon plate 56 is a metal top plate 57, the latter being slightly shorter than the former (Fig. 7). Top plate 57 is provided with integral upwardly offset arms 57^a, 57^b having openings 57^c, 57^d formed therein (Fig. 8) to provide for attachment of the switch as a unit

to a suitable support. Superimposed upon top plate 57 is a metal plate 58 of approximately diamond shape, plate 58 having a centrally located bulge or dome-shaped portion 58^a which is provided with a centrally located circular opening to accommodate the reduced lower end of a hollow metal member or bushing 59, said reduced lower end of the bushing being upset over the inner surface of portion 58^a, as shown at 59^a (Figs. 7 and 8) to rigidly secure said parts in assembled relation.

Pivotally supported within bushing 59, as by means of a pin 60 permanently attached thereto, is a lever having a cylindrical upper end portion 61; a reduced cylindrical portion 61^a located above pin 60, and a convex lower end 61^b which serves as a spring abutment. End 61^b of said lever engages a concavity or recess formed in the upper end of a substantially cylindrical metal member 62, the latter being adapted to telescope into the upper end of a coiled compression spring 63 (Fig. 9) and having a flange to seat against the upper end coil of said spring. Member 62 is provided in its lower end with a recess 62^a to telescopically accommodate the reduced upper end 64^a of a flat punched insulating plate 64 which is pivotally supported by the U-shaped wire yoke member 65, the latter being pivotally attached to portion 58^a of plate 58 in the manner illustrated in Figs. 8 and 9. Member 64 is provided with shoulders which serve as an abutment for the lower end of spring 63, and the substantially triangular lower end portion of member 64 is adapted for cooperation with an opening provided in the contactor supporting plate 44 to provide a lost motion driving connection between the former and the latter.

Positioned within recess 42 beneath yoke 65 but above the tips of the respective pairs of contacts is a flat punched insulating plate 66 (Figs. 7 and 9), said plate having a central slot or opening 66^a (Fig. 9) to provide oscillating clearance for member 64. Insertable vertically into recess 42 prior to insertion of the upper contacts (one of which is shown at 46) of the respective pairs is a flat punched insulating plate 67 which is interlocked with vertical grooves (not shown) at opposite sides of the aforementioned barrier 51 to prevent lateral displacement of said plate. For practical reasons barrier 52 is provided with like vertical grooves. As best illustrated in Fig. 7, plate 67 is interposed between each contactor (45) and the upper contact (46) in the "off" position of the former to substantially insure snuffing or extinguishment of arcs drawn upon separation of said parts. Moreover, plate 67 is of a length to overlap plate 44 in the "on" position of the switch parts to insure against fouling or obstruction of the latter by the former under any conditions.

A pair of bolts 68 and 68^a extend upwardly through aligned openings in base 41 and plates 56, 57 and take into tapped openings provided in plate 58 (Fig. 9) to secure the aforescribed switch parts in assembled relation. To render the switch chamber (recess 42) substantially dust-tight I provide a molded hollow cap member 69 formed of the aforementioned resilient, rubber-like material, said cap as shown being preferably in the form of a frustum of a cone. The base of cap 69 is provided with an inwardly extending annular flange which is adapted to closely surround or hug the aforementioned dome-shaped portion 58^a of plate 58, and to underlie and engage with the outwardly projecting

ends of the arms of yoke member 65, as shown in Fig. 8, to assist in retaining said cap in proper position. The flat upper end of cap 69 is provided with a centrally located circular opening of smaller size than the cross sectional area of the reduced portion 61^a of lever 61, whereby the wall of said opening closely surrounds or hugs said reduced portion 61^a of the lever. It is to be understood that the material of cap 69 is sufficiently elastic or stretchable to permit forcing of the aforementioned opening downwardly over the cylindrical upper end portion 61 of said lever after pivotal attachment of the latter to bushing 59 by pin 60. Moreover, the arrangement is such that cap 69 is bodily deformable to permit the necessary oscillatory movement of reduced portion 61^a of the lever as an incident to operation of the switch, without destroying the seal or dust-tight grip of the aforementioned wall of the opening about said portion 61^a.

I prefer to attach to lever 61 a finger member or trigger 70, the same preferably consisting of a die-cast piece of metal such as aluminum. Member 70 is provided with a recess to accommodate portion 61 of the lever, these parts when assembled as shown being drilled to receive a headed pin or rivet 70^c, the shank of which is upset (Fig. 8) to rigidly and nonrotatably unite said parts to each other. Member 70 is provided with flat portions 70^a and 70^b adapted to alternatively abut the respective opposite ends of plate 58, each of said flat surfaces having recesses, as shown in Fig. 9 to provide clearance between the same and the protruding shank ends of bolts 68 and 68^a. When the switch is provided with a trigger member 70 it is of course desirable to provide for biasing member 70 to one of its extreme positions. For this purpose member 70 is recessed as shown in Fig. 9 to accommodate a coiled spring 71 which is interposed under a predetermined degree of compression between the inner end of said recess and the upper surface of plate 58, bolt 68 being made sufficiently long so that the lower end coils of spring 71 may be telescoped onto the exposed shank portion to restrain the spring against lateral displacement. As indicated in Figs. 7 and 9 the arrangement is such that the switch will be biased to circuit interrupting position.

As will be obvious from Fig. 9 the switch may be modified to provide for normally biasing the same to circuit completing position by merely attaching member 70 to lever 61 in a position of the former 180 degrees removed from that illustrated, the positions of bolts 68 and 68^a being reversed with respect to base 41 to provide for cooperation of the shank of bolt 68 with spring 71 in the changed location of the latter.

In Figs. 10 to 12, inclusive, I have shown a tool-handle switch having a rated capacity of 6 amperes at 250 volts; it being understood that the switch mechanism is in many respects quite similar to the switch mechanisms aforescribed. In Figs. 10 to 12, however, I provide a special form of actuating lever and a special form of supporting and dust-proofing elements. Thus, base 72 is provided with an upwardly opening recess within which the stationary and movable contacts are positioned, the stationary contacts being provided with suitable end-wiring terminal elements, two of which are shown at 73 in Fig. 11. The exposed portions of elements 73 extend downwardly from a plane substantially flush with the upper surface of base 72, the lower end portions of said elements being provided with tapped

openings to accommodate the shanks of binding screws 74.

Superimposed upon, and being substantially co-extensive with the upper surface of base 72 is a sheet or plate 75 formed of resilient, rubber-like material of the character aforementioned. A punched and stamped sheet metal top plate 76 of substantially the same width as base 72 is superimposed upon sheet 75, a pair of screws or bolts 77 extending upwardly through base 72 and sheet 75 and taking into tapped openings provided in plate 76. Plate 76 is provided with upward extrusions 76^a and 76^b surrounding said openings, and the threaded shanks of said bolts preferably project upwardly a substantial distance beyond said extrusions, as shown in Fig. 12. Plate 76 is provided with integral upwardly extending parallel arms 76^c and 76^d at opposite ends thereof, and said arms are provided with integral horizontal extensions 76^e and 76^f having tapped openings formed therein to accommodate the shanks of screws 78 having countersunk heads to fit into openings 79^a, 79^b, of corresponding shape, in a substantially flush relationship to the upper or outer surface of a hollow tool-handle casing or housing, a fragment of which is shown at 79.

Sheet 75 and plate 76 are provided with aligned, centrally located openings (Figs. 11 and 12) which provide oscillating clearance for the upper end of a coiled compression spring 80 and the lever abutment 81^a associated therewith, a sheet metal member 82 being positioned within the upper end of spring 80 for engagement by said abutment. Plate 76 has attached thereto on opposite longitudinal sides of the opening therein a pair of upstanding parallel arms 83 and 84, said arms having integral lugs penetrating corresponding openings in said plate and being upset over the lower surface of the latter, as indicated in dotted lines at 84^a and 84^b in Fig. 12, and at 85^a and 85^b in Fig. 10. As best illustrated in Fig. 11, arms 83 and 84 are provided with aligned openings for pivotal engagement by the outwardly bent ends of the arms of the wire yoke member 85. Said arms 83 and 84 are provided above said yoke member with aligned openings to accommodate a pin 86 the shank of which penetrates a passage drilled transversely through the punched sheet metal lever 81 and through the teeter-bar or thumb lever 87, which is recessed to accommodate the upper end portion of lever 81. In practice the thumb lever 87 consists of a die casting composed of a zinc base metal, or a similar light weight metal adaptable for formation by die casting. As shown in Fig. 11 the shank end 86^a of pin 86 is upset to retain the parts in assembled relation.

Thumb lever 87 is provided with downwardly opening recesses 87^a and 87^b either of which is adapted to accommodate the upper end portion of a coiled compression spring 88, the lower end coils of which surround one of the extrusions 76^a or 76^b and the upwardly projecting shank end of one of the bolts 77. As shown in Fig. 12, spring 88 is interposed under a predetermined degree of compression between the inner end of recess 87^a and the upper surface of top plate 76, which it is to be understood provides a normal bias of the switch mechanism to circuit interrupting position; it being obvious that upon transfer of spring 88 to recess 87^b the switch mechanism will be normally biased to circuit completing position. Thumb lever 87 is preferably provided with knobs or projections 87^c, 87^d at its opposite ends to fa-

cilitate manual tilting thereof to effect operation of the switch mechanism.

As shown in Figs. 10 and 12 thumb lever 87 is provided with end surfaces 87^e and 87^f of arcuate contour, said arcuate surfaces extending from knobs 87^c and 87^d to the lower surface of said thumb lever. This formation of thumb lever 87 is such as to insure a like contour of said lever in all positions thereof in a plane substantially flush with the outer surface of the housing or plate 79.

In order to insure substantial dust-tightness of the switch mechanism I prefer to provide a molded hollow cap member 89 having a lower portion 89^a of substantially rectangular contour, the peripheral lower edge of said rectangular portion being adapted to seat against the upper surface of top plate 76, as shown in Figs. 11 and 12, said portion 89^a being of a size to accommodate arms 83 and 84 and the switch parts associated therewith, and to provide oscillating clearance for thumb lever 87. Cap member 89 is provided with an upper end portion 89^b of a length corresponding to portion 89^a (see Fig. 12) but of lesser width than said portion 89^a (see Fig. 11), said portion 89^b being adapted to fit within an opening 79^c in housing 79 in a substantially flush relationship to the outer surface of the latter. Member 89 is provided at opposite ends thereof with integral lugs or extensions 89^c and 89^d which are adapted to be clamped between housing 79 and the respective lugs 76^e, 76^f (Fig. 12), said lugs being notched as indicated in Fig. 12 to provide clearance for the shanks of screws 78.

The inner wall surface of said upper portion 89^b is formed at opposite ends thereof to provide a close sliding fit with the arcuate surfaces 87^e, 87^f on member 87, as best shown in Fig. 12, and the opposite sides of said inner wall surface are formed to provide a close sliding fit with the respective sides of member 87, as shown in Fig. 11. Said upper portion 89^b of member 89 is thus provided with an opening which permits oscillation of member 87, whereas the latter is entirely surrounded and closely engaged by the rubber-like material of member 89 to insure substantial dust-tightness of the switch as a whole.

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

1. In an electric snap switch, in combination, an insulating base having a recess formed therein and opening to the upper surface thereof, stationary switch contacts located within and carried by the walls of said recess, contactor means also located within said recess, operating means including a pivoted lever projecting from said base, said operating means being adapted to effect snap movement of said contactor means into and out of bridging engagement with said contacts, a metal top plate secured to said base in sealing relation to the peripheral wall of said recess and having an opening to accommodate the projecting portion of said lever, and yieldable, resilient rubber-like means overlying the opening in said top plate and attached to the latter and acting by its own resiliency to closely surround the projecting portion of said lever intermediate the length of the latter to thereby completely seal off said recess against entry of foreign particles.

2. In an electric snap switch of the toggle type, in combination, a molded insulating base having a recess opening to the upper surface thereof, a pair of resilient stationary switch contacts located within said recess and biased to-

ward each other, means comprising a flat plate of insulating material continuously interposed between said contacts and movable relatively thereto, a contactor carried by said plate and movable thereby into and out of bridging engagement with said contacts, manual operating means comprising a lever the upper end of which projects from said base, spring means interposed between the lower end of said lever and said plate to effect the aforementioned movements of said contactor with a snap action, means comprising a metal top plate for substantially closing and sealing the upper end of said recess and having an opening providing oscillating clearance for the upper end of said lever, and a hood formed of resilient, rubber-like material overlying said opening and interlocked with said metal top plate to retain said hood in assembled relation, said hood having a relatively small opening formed therein, the wall of said opening being stretchable to accommodate said lever during assembly of said parts and to surround an intermediate portion of the lever with a close fit in all positions of the latter, whereby said recess is rendered substantially dust-tight.

3. As an article of manufacture, a sealing device for direct attachment to and support by otherwise complete electric snap switches of the toggle type, said device comprising a hollow, self-sustaining substantially dome-shaped member molded from a resilient, elastic rubber-like material, said member being formed to provide a self-maintaining resilient interlocking connection between the same and the metal top plate of a switch, and said member having an opening formed in the upper end thereof, the wall of said opening being stretchable to accommodate a toggle lever of suitable form and to engage by its own resiliency with a close fit an intermediate portion of the lever, the material of said part around said opening being yieldable to accommodate the movements of said lever while maintaining said close fit around the intermediate portion of the latter solely by the elasticity of said material.

4. In a toggle snap switch of the tool-handle type, in combination a molded insulating base having a recess formed therein and opening to the upper surface thereof, a metal top plate superimposed upon said base and directly rigidly attached thereto, a resilient, rubber-like gasket interposed between said top plate and the upper surface of said base to provide a substantially dust-tight seal for the entire peripheral upper edge of the wall of said recess, said top plate having an upwardly extending hollow projection, an operating lever pivotally supported within said projection and having a portion extending upwardly from the latter, a relatively thin-walled hollow molded member of resilient, elastic, rubber-like material directly attached to said top plate and extending above said projection, and said member having a relatively small opening formed in the upper end thereof to forcibly accommodate said lever to permit assembly of said parts and to provide a close fit about an intermediate portion of said lever, the material of said member being yieldable to accommodate the movements of said lever while insuring self-maintenance of the close fit aforementioned.

5. A substantially dust-tight snap switch of the tool-handle type comprising, in combination, a molded insulating base having a recess formed therein and opening to the upper surface thereof, stationary and movable switch con-

tact elements positioned within said recess and wiring terminal elements accessible from the exterior of said base, a flat metal plate superimposed upon said base and a flat, rubber-like gasket interposed between said plate and the upper surface of said base, said gasket providing a substantially dust-tight seal around the peripheral upper edge of said recess, said plate and said gasket having aligned substantially centrally located openings formed therein, a sheet metal member having a flat portion seated upon said plate, said member having a centrally located portion of substantially dome-shape, said dome-shaped portion having a relatively narrow opening formed therein and extending longitudinally of said base, a flat punched sheet metal lever positioned within said opening and pivotally supported with respect to said dome-shaped portion, a yoke member pivotally supported below said lever, a coiled compression spring interposed between said lever and said yoke member, means associated with said yoke member for effecting snap movements of said switch operating elements upon movement of said lever in opposite directions respectively, a molded hollow cap member formed of resilient, rubber-like material overlying and engaging said dome-shaped portion, said cap having a relatively small opening formed therein to forcibly accommodate said lever and to closely engage the sides and edges of said lever in all positions of the latter, said cap having a peripheral flange, a perforated, flat punched sheet metal plate overlying said flange, a pair of nuts associated with said last mentioned plate, and a pair of bolts extending upwardly through said base and engaged with said nuts to retain said overlying parts in assembled relation.

6. In an electric switch of the snap action toggle type, in combination, a molded insulating base having a recess opening to the upper surface thereof, a top plate secured to said base in substantially dust-tight relation to the peripheral upper edge of the wall of said recess, stationary and movable contacts located within said recess, operating means for said movable contacts comprising a pivoted lever having a portion thereof projecting upwardly beyond said base through an opening in said top plate and spring toggle snap action means associated with said lever at the lower end of the latter, and a hollow molded cap member of substantially dome-shape secured to said top plate and overlying the opening in the latter, said cap member comprising a yieldable, rubber-like material and the same having a relatively small opening formed in the upper end thereof to forcibly accommodate said lever when assembled and to hug an intermediate portion of the latter, whereby said cap completes a substantially dust-tight seal for said recess and the switch parts located therewithin.

7. In an electric snap switch of the tool handle type, in combination, a molded insulating base having a recess formed therein and opening to the upper surface thereof, a rib formed integrally with the bottom wall of said recess and having a flat surface located above said bottom wall, a pair of upper and lower resilient stationary contacts located on each side of said rib and respectively biased below and above the plane of said flat surface, a thin, punched insulating plate slidable upon said flat surface and interposed between the contacts of the respective pairs in all positions of said plate, said insulating member having a pair of strip metal con-

tacts attached thereto and exposed upon the upper and lower surface thereof for movement thereby into and out of bridging engagement with said pairs of contacts, each of said contacts having a machined metal terminal member rigidly attached thereto, said base having notches formed in the upper edge thereof to freely accommodate said terminal members in a plane substantially flush with the upper surface of said base, each of said terminal members having a tapped opening extending therethrough in a plane parallel to but offset downwardly from the upper surface of said base, binding screws the shanks of which cooperatively engage said tapped openings, a metal top plate overlying the upper surface of said base and secured thereto, an insulating plate of resilient rubber-like material interposed between said top plate and said base, said insulating plate cooperating with said terminal members to retain the latter in assembled position and to provide a substantially dust-tight seal around the peripheral upper edge of said recess, said top plate having an opening, an oscillatable actuating lever positioned within said opening and extending upwardly from said base, and a molded resilient rubber member closely engaging the upper end portion of said lever and said top plate to afford a dust-tight closure for said opening in the latter.

8. In an electric snap switch of the tool-handle type, in combination, a molded insulating base having a recess formed therein and opening to the upper surface thereof, a rib formed integrally with the bottom wall of said recess and having a flat surface located above said bottom wall, a pair of upper and lower resilient stationary contacts located on each side of said rib and respectively biased below and above the plane of said flat surface, a thin, punched insulating plate slidable upon said flat surface and interposed between the contacts of the respective pairs in all positions of said plate, said insulating member having a pair of strip metal contactors attached thereto and exposed upon the upper and lower surfaces thereof for movement thereby into and out of bridging engagement with said pairs of contacts, each of said contacts having a machined metal terminal member rigidly attached thereto, said base having notches formed in the upper edge thereof to freely accommodate said terminal members in a plane substantially flush with the upper surface of said base, each of said terminal members having a tapped opening extending therethrough in a plane parallel to but offset downwardly from the upper surface of said base, binding screws the shanks of which cooperatively engage said tapped openings, a metal top plate overlying the upper surface of said base and secured thereto, an insulating plate interposed between said top plate and said base, said insulating plate cooperating with said terminal members to retain the latter in assembled position and to provide a substantially dust-tight seal around the peripheral upper edge of said recess, a lever pivotally supported relatively to said top plate and having a portion projecting upwardly from the latter, means providing a toggle snap action connection between said lever and said insulating member, and means comprising a dome-shaped cap of resilient, rubber-like material engaged with and attached to said top plate, said cap having a relatively small opening formed in the upper end thereof to forcibly accommodate said lever and to closely surround an intermediate portion of the latter, said

cap being yieldable to permit oscillatory movement of said lever while maintaining said close connection with the latter.

9. In an electric snap switch of the toggle type, a molded insulating base having a recess opening to the upper surface thereof, stationary and movable contact elements located within said recess, an oscillatable operating lever, a sheet metal member superimposed upon said base and rigidly attached thereto, said sheet metal member being formed to provide a clearance opening and a pivotal support for said lever, a yieldable, elastic insulating sheet interposed between said sheet metal member and said base to provide for substantial dust-tightness of said recess at the periphery of the upper end thereof while providing clearance for said lever and the oscillating switch parts associated therewith, a hollow molded member formed of elastic, rubber-like material, said last mentioned member being of substantially inverted channel-shape in vertical cross sections at right angles to each other and having a peripheral lower edge affording a substantial dust-tight seal around said clearance opening, said hollow member having an opening formed in the upper end thereof to forcibly accommodate an intermediate portion of said lever and to provide a substantially dust-tight connection with the latter in all positions thereof, whereby substantially complete dust-tightness of said recess is insured, and means associated with said sheet metal member for clamping said hollow member in assembled relation thereto.

10. In an electric snap switch of the toggle type, in combination, a molded insulating base having a recess opening to the upper surface thereof, stationary and movable contact elements located within said recess, a yieldable, elastic insulating member superimposed directly upon said base and adapted to provide a substantially dust-tight seal for the peripheral upper end of said recess, exteriorly accessible wiring terminal elements penetrating the walls of said recess in a dust-tight relationship and electrically connected with the stationary contact elements respectively, said insulating member having a centrally located opening aligned with said base recess, an operating lever pivotally supported above said base and having a spring-toggle snap action connection with said movable contact elements, a molded hollow member formed of elastic, rubber-like material, said hollow member having a peripheral lower edge which is adapted to provide a substantially dust-tight seal around the opening in said insulating member, the upper end of said hollow member having an opening formed therein to provide a frictional, substantially dust-tight connection between the same and said lever, and means associated with said base to retain said insulating member and said hollow member in assembled relation to said base.

11. In an electric snap switch of the toggle type, in combination, a molded insulating base having a recess opening to the upper surface thereof, a plurality of pairs of stationary switch contacts located within said recess, a movable insulating member positioned within said recess, a plurality of contacts carried by said insulating member and movable thereby into and out of bridging engagement with the respective pairs of contacts, manual operating means comprising a pivoted lever the upper end of which projects from said base, spring means interposed between

the lower end of said lever and said insulating member to effect the aforementioned movements of said contactors with a snap action, means carried by said base for substantially dust-tightly closing the upper end of said recess at the periphery of the latter while providing insulating clearance for the upper end of said lever, and a hood formed of resilient rubber-like material having its lower end portion interlocked with said last mentioned means to retain said hood in assembled relation to said base, said hood having an opening formed therein to accommodate said lever and to surround an intermediate portion of the same with a close fit in all positions of the latter, whereby said recess is rendered substantially dust-tight.

12. In an electric snap switch of the toggle type, in combination, a molded insulating base having a recess opening to the upper surface thereof, a plurality of pairs of stationary contacts located within said recess, wiring terminal elements associated with said contacts and exposed at the outer surface of said base, a movable insulating member positioned within said recess, a plurality of contactors carried by said insulating member and movable thereby into

and out of bridging engagement with the respective pairs of contacts, manual operating means comprising a pivoted lever the upper end of which projects from said base, spring means interposed between the lower end of said lever and said insulating member to effect the aforementioned movements of said contactors with a snap action, means including a metal top plate for substantially closing and sealing the upper end of said recess while providing oscillating clearance for the upper end of said lever, and a hood formed of resilient, elastic rubber-like material interlocked with and supported directly by said metal top plate to retain said hood in assembled relation thereto, said hood having a relatively small opening formed therein, the wall of said opening being stretchable to forcibly accommodate said lever to permit assembly of said parts and to surround an intermediate portion of said lever with a close fit in all positions of the latter, whereby said upwardly opening base recess is rendered substantially dust-tight while providing for exposure of said wiring terminal elements.

GEORGE J. MEUER.