Jan. 29, 1957 M. N. RUSSELL 2,779,835

SNAP SWITCH FOR TOOLS

Filed April 22, 1953

FIG. 1.

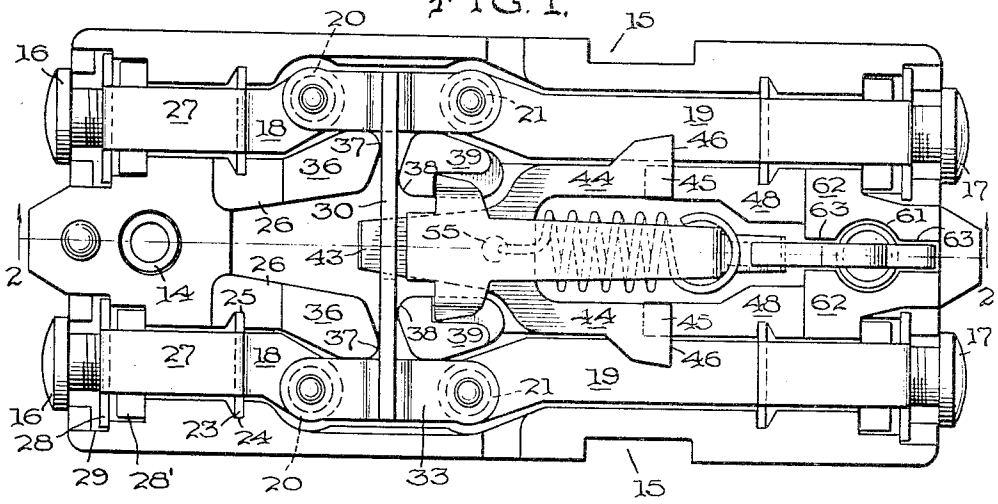


FIG. 2

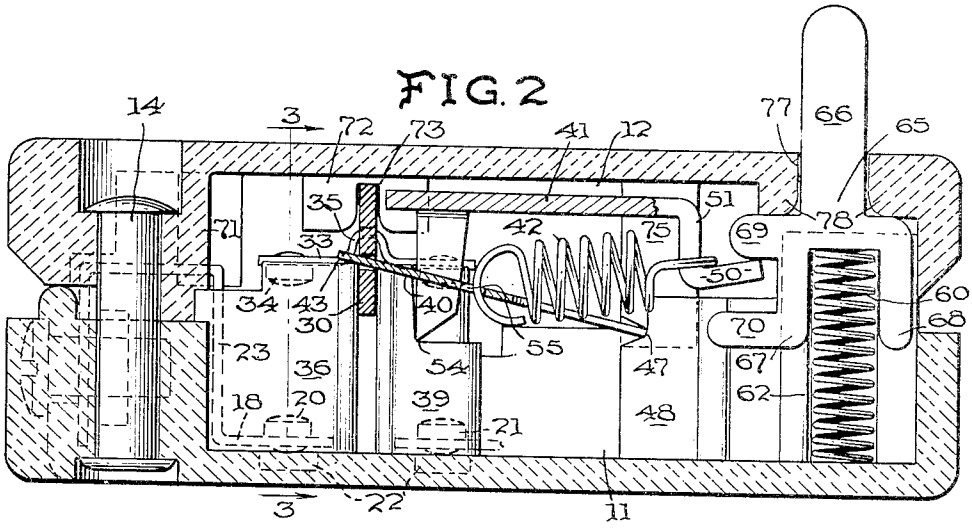
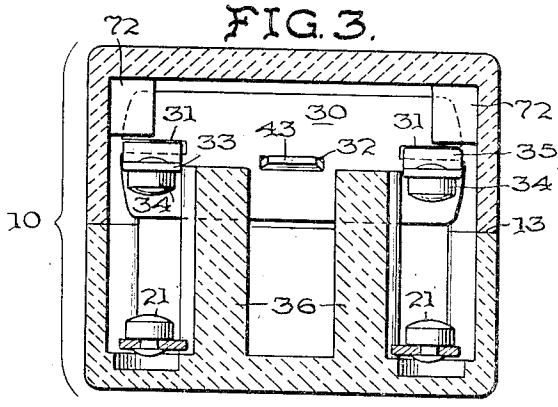


FIG. 3.



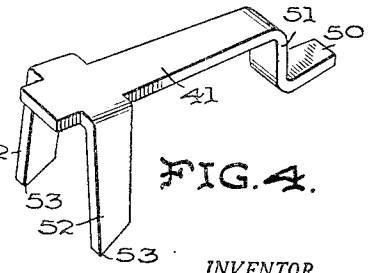


FIG. 4.

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SNAP SWITCH FOR TOOLS

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14 Claims. (Cl. 200—76)

This invention relates to snap switches and more particularly to such switches for the control of hand tools and the like and providing double snap, double pole, double break action.

It is a general object of the present invention to provide a novel and improved switch of the type described.

More particularly it is an object of the present invention to provide in a switch of the type described a novel action and arrangement for the snap elements together with a unique disposition of the stationary and movable contacts.

An important object of the invention resides in the cooperative arrangement of the snap elements, both arranged with wide straddle fulcrums, one offset in the plane of oscillation to clear the tension spring.

Another important object of the invention resides in the construction and arrangement of the companion housing parts arranged to receive, cooperate with and position all of the parts of the switch without the use of other fastenings or holding means.

A further important object of the invention resides in the construction, arrangement and mounting of both the stationary and movable contacts whereby they assume floating equalized positions without the use of special mounting and fastening means.

One of the features of the invention is the wide separation of the stationary contacts, both those of opposite polarity and the stationary ones of a pair plus the interposition of insulation between them to prevent the possibility of flash over.

Another feature of the invention is the arrangement of the plunger-operator and its return spring whereby simple smooth operation of the switch is effected with freedom from damage in the event of the application of excessive pressure.

Other and further objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and following specification, it being understood that such changes and modifications may be made in the disclosed switch as fall within the scope of the attached claims without departing from the spirit of the invention.

In said drawings:

Fig. 1 is a top plan view of the lower portion of the housing showing all switch parts assembled therein;

Fig. 2 is a longitudinal vertical central section through the switch, showing the parts arranged in the open circuit position, the view being on the plane of line 2—2 of Fig. 1 but with the housing cover in position;

Fig. 3 is a transverse vertical section taken in the plane of line 3—3 of Fig. 2; and

Fig. 4 is a perspective view of one of the snap elements.

The switch of the present invention is illustrated enlarged to about four diameters and is of the double snap, double pole, double break type primarily intended as a control switch for use in connection with portable and similar tools under the action of a trigger, push button,

grip or some similar actuator. It is constructed to be biased to the "off" position and to be snapped to the "on" position by depressing the operator-plunger projecting through the cover of the housing, having a relatively long stroke and serving to protect the switch against damage from an excess pressure thereon. Because of the extremely small size and relatively high current capacity of the switch its compactness requires unusual arrangements and mounting of the parts, not only to facilitate assembly but to eliminate all unnecessary fastenings and other mounting means and the like. The construction is such that no parts are fastened in the housing except by their cooperation with recesses, channels, grooves, projections and the like formed on the two parts thereof. The whole of the switch parts can be assembled into the lower portion of the housing and the cover subsequently applied to further aid in maintaining the assembly.

Referring now to the drawings, it will be seen that the switch is wholly encased in a two part housing **10** generally rectangular in plan, side and end elevations.

The housing comprises two molded insulating sections, generally of similar exterior appearance, a base **11** and cover **12** meeting along a median plane shown by the parting line **13** in Fig. 3. In the form illustrated assembly is maintained by hollow rivet **14** passing through the housing parts near the left end and provision is made for additional fastening means, including strap arms adapted to be housed in grooves **15** in the side walls of the housing. Such fastening assembly may include mounting and actuating mechanism for the switch if desired.

As shown the switch is provided with two pairs of screw terminals **16**, **16** and **17**, **17**, one pair available at each housing end through appropriate notches therein, but it will be apprecited that soldered or clamp type terminals might equally as well be substituted with no change in the inventive concept and but minor changes in construction. The switch is double pole as previously mentioned so that line wires enter with opposite polarity through one of the pairs of terminals and the circuit control conductors are fed from the terminals at the opposite end of the housing.

The inner surface of the bottom wall of the lower portion of the housing is substantially flat, as seen in Fig. 2, and along it extend the portions **18**, **18** and **19**, **19**, of conductor straps leading respectively from the stationary contacts **20**, **20** and **21**, **21**. These contacts are the heads of small rivets, secured to the offset ends of the conductor straps and appropriate recesses **22** are provided in the floor of the housing to receive the riveted over portions. Each cooperating pair **20**, **21** of contacts are spaced apart a substantial distance along the length of the housing and the similar contacts of an opposite polarity pair are widely spaced apart transversely of the housing, as clearly seen in Fig. 1.

Referring now to the conductor strap portions **18**, it will be seen from Figs. 1 and 2 that they extend only a short distance from the contacts **20** toward the adjacent end of the housing before they turn upwardly in widened sections **23**, the edges of which are received in and closely engaged by the walls of vertical channels **24** and **25** respectively in the thickened side wall of the lower portion of the housing and in the pillar **26**. The straps are then bent at right angles, narrowed and extended horizontally, in the sections **27**, nearly to the end of the housing where they are again widened, and turned downward vertically to form the terminal plates **28**, through which the screws **16** pass to be received in non-rotatably mounted nuts **28'**. These terminals are received in the recess **29**, which together with the slots **24** and **25** serve to firmly position the assembly. Parts, later to be described, of the cover engage and maintain the contact-terminal assemblies in position.

The terminal strap and contact assemblies 19, 21 for the opposite end of the housing are not substantially different in construction and mounting from those described, but the portions of conductors 19 along the housing bottom are longer. Attention is directed to the outward offset of 18 and 19 near their contacts to provide maximum lateral spacing between contacts of opposite polarity while bringing the terminals closer together to facilitate their mounting and to provide added strength in the adjacent side walls.

A bridging strap with two spaced contacts is arranged to cooperate with each set 20, 21 of stationary contacts to close the circuit between them, and the straps are supported in and actuated by the barrier plate 30 which extends transversely of the switch housing from side wall to side wall intermediate contacts 20, 20 and 21, 21, as seen in Fig. 1, and is vertically movable from its "off" position against the housing cover to a corresponding "on" position adjacent the bottom wall of the housing. This barrier is a punching of sheet insulating material substantially rectangular in shape, with rounded ends, as seen in Fig. 3, and is provided with slots 31, one extending inwardly from each end and with a rectangular perforation 32 near its center.

In each of the slots 31 is fitted a contact carrying bridging member 33 comprising a narrow metal strap supporting at either end a contact 34, the two being spaced the same as the spacing between contacts 20 and 21, with which they cooperate. The central portion of the strap is deformed upwardly as seen at 35 in Figs. 2 and 3. The width of each strap is equivalent to the depth of a slot 31 in the barrier and the deformed portion is such as to centralize the strap in the barrier plate when assembly is made, as shown in the drawings. When the barrier plate is lowered it carries with it the floating bridging straps so that their contacts engage the stationary contacts to complete the circuits. At the initiating of circuit breaking any arcing between separating contacts is isolated by the barrier plate which is interposed between the stationary contacts until the moving ones are well separated therefrom. Thus the barrier plate serves not only to handle and position the straddle contacts but to act as an interposed arc barrier.

It has already been pointed out that the barrier plate 30 is restrained longitudinally by the side walls of the housing. It is further guided and maintained in its vertical position and path by means of two pairs of pillars, those to the left in Fig. 1 being higher extensions of columns 26 previously referred to in connection with the positioning of the conductor straps 18. These extensions 36 have rounded noses 37 which guide the left face of barrier plate 30 and prevent it from moving toward the left. Similar rounded noses 38 inwardly offset and spaced to the right from noses 37 guide the right face of the barrier plate and are vertical edges of columns 39 extending upwardly from the bottom wall of the housing. The barrier plate is thus constrained to a vertical path for movement and yet is free to travel under the action of the snap mechanism now to be described and to have a certain amount of floating action to assist in equalizing the pressures which close the bridging straps onto the stationary contacts.

Movement is imparted to the barrier plate by snap mechanism comprising two overlying, oppositely fulcrumed levers 40, 41 connected together by a tension spring 42. The first lever has a narrow tapered tip 43 which fits loosely in slot 32 in the barrier plate to move the same, while midway of its length the lever is bifurcated, providing the straddle legs 44, each having a laterally widened foot 45 terminating in a transverse edge 46. The inner portions of the edges 46 rest in the obtuse notches 47 cut into the left edges of narrow column 48 extending up from the floor of the housing and containing the notches positioning the right terminal

straps. The fulcrum notches 47, as seen in Fig. 2, are midway of the height of the housing so that the angularity of the lever 40 in respect to a median plane through the housing is substantially the same in either the "on" or the "off" position of the switch.

The second lever 41 is best seen in Fig. 4 and includes the main straight central portion having a downwardly offset tip 50 connected thereto by an intermediate part 51. At the opposite end are downturned legs 52 splayed as shown and having their lower ends clipped at an angle to provide the fulcrum points 53 fitting in the substantially right angled notches 54 in the inner faces of the columns 39. The side walls of these notches prevent lateral movement of the lever and the wide splaying of the legs prevent any skewing under action of the spring, which is connected, as seen in Fig. 2, between the intermediate portion 51 of the lever 42 and hole 55 in the single section of lever 40.

The geometry of the lever arrangement is such that with lever 41 positioned at the top of its up stroke, as shown, the spring attachment thereto is substantially above fulcrum notches 47 for the other lever, whereby the latter is lifted, as shown, to hold the bridging straps in their maximum upward or "open" circuit position. When the right end of lever 41 is lowered the axis of spring 42 passes below fulcrum notches 47 for lever 41 and the latter immediately snaps to its lower position carrying the lever 41 to its lowest position in the usual manner of such snap action mechanisms. This lowermost position of the two elements causes the bridging straps to be tightly forced into engagement with the stationary contacts completing the circuits for both sides of the line.

Since this switch is intended to return to the "off" position when pressure is released from the operator, biasing means in the form of an open coil helical spring 60 is housed in a vertical chamber 61 between the two columns 62, extending up from the bottom of the housing at the right end thereof and being connected to and of greater height than the columns 48. These columns are spaced by the slots 63 providing guides for the flat operator-plunger plate 65, best seen in Fig. 2, and including a straight plunger portion 66 having a rounded top end, furcations 67 and 68 straddling the spring and horizontal arms 69 and 70 extending laterally from the top and bottom, respectively, of furcation 67. These loosely straddle the offset end 50 of lever 41 to form the top and bottom stops therefor in the operation of the switch mechanism.

When the plunger 66 is pushed down the overlying arm 69 carries the outer end 50 of lever 41 downwardly until "snap" occurs when the end 50 is forced down against 70, which is now near the bottom of the housing. When pressure is released from plunger 66, arm 70 lifts 50 under the action of spring 60 until "snap" occurs when the part 50 moves up against the upper arm 69 now in its topmost position. Excessive operating pressure on plunger 66 can do no harm since it is merely pressed against the housing bottom at the end of its limited stroke.

The cover portion of the housing has already been generally alluded to, and reference to Figs. 2 and 3 will now show how it cooperates with the various parts already described to hold them assembled in the lower portion of the housing. The meeting of the side walls is illustrated at 13 in Fig. 3, while Fig. 2 discloses the depending column portions 71 notched to fit over the conductor strap parts 27 near the left terminals. Similar parts, not shown, are provided for the straps at the other end and serve to hold them tightly positioned in their notches, channels and grooves.

The columns 36, 36, 39, 39, which guide the barrier plate 30 do not extend much above the median plane from the bottom portion of the housing but further guide means for the barrier plate are formed integrally with the cover and are seen at 72 in Fig. 2 having appropriate notches

73 in which the barrier plate is received at the upper part of its stroke. These parts 72 are seen in Fig. 3, serving also to reinforce the junctions of the side and top walls of the cover.

It will be remembered that the inner portions of the straight edges 46 terminating the feet on the bifurcated lever engage in wide notches 47 in the columns 48. To prevent lateral movement of these feet and to insure them against moving upwardly out of the obtuse notches, depending columns 75 in the cover are provided with notches for the outer portions of the edges 46 and with walls extending longitudinally of the housing to prevent lateral movement of the feet. These are best seen in Fig. 2 overlapping columns 48 and as regards form are not substantially different from the notches seen in plan, Fig. 1, at the upper ends of columns 39 forming the fulcrums for the other lever. The cover is provided with a passage 77 through which the plunger 66 passes and the thickened upper walls 78 adjacent thereto provide for limiting upward movement of the plunger-operator under the action of its spring 60.

I claim:

1. In a double snap switch, in combination, a narrow, elongated, shallow housing having a bottom and side walls, two pairs of contacts laterally spaced on said bottom, the contacts of each pair being longitudinally spaced, a single barrier plate of sheet insulation extending transversely of said housing, means including said side walls to guide said plate for movement in its own plane toward and from said bottom in a position intermediate the contacts of said pairs, a bridging strap for each pair of contacts and having an offset intermediate portion, a slot in each end of the plate to laterally and loosely receive one of said intermediate portions to support the straps positioned therein by said side walls, snap levers and a connecting spring fulcrumed in said housing to move in a plane normal to said bottom and said plate, and means to positively actuate said plate in each direction from one of said levers.

2. The switch as defined in claim 1 in which said barrier plate is guided between longitudinally spaced pairs of laterally spaced columns extending from the housing bottom, one pair of said columns being similarly notched to provide dual fulcra for the other lever.

3. The switch as defined in claim 2 in which the said columns are interposed between the pairs of contacts of opposite polarity.

4. The switch as defined in claim 1 in which the said one lever is fulcrumed remote from said plate and has its free end extending through an opening in said plate to move it, posts forming fulcra for the other lever, said posts being adjacent to said plate and acting as guides therefor.

5. The switch as defined in claim 4 in which the free end of the other lever is loosely received between lateral arms on a plunger reciprocably mounted in said housing for movement along an axis parallel to that along which the said plate moves.

6. In a double snap switch, in combination, a barrier plate mounted to slide in its own plane, bridging contacts carried by said plate and adapted to cooperate with stationary contacts on opposite sides of said plate, a flat snap lever having one end extending through a perforation in said plate for moving the latter, a fulcrum for the other end of said lever remote from said plate, a second lever overlying a portion of the first lever and having legs straddling said portion of the first lever and terminating below it, a fulcrum adjacent said plate and below the first lever for said second lever legs, a spring beneath the second lever connecting portions of said levers remote from their respective fulcra and means to actuate the free end of the second lever.

7. The switch as defined in claim 6 wherein the first lever is bifurcated between the point of spring connection and the fulcrum and the second lever is offset upwardly between fulcrum and spring attachment point to overlie the spring.

8. In a double snap switch, in combination, a narrow, elongated, shallow housing having a bottom, side and end walls and a top, said casing being divided into upper and lower portions of similar size along a parting plane substantially parallel to said bottom and top, longitudinally spaced contacts supported on said bottom, a bridging strap to close the circuit between said contacts, a barrier plate extending loosely between said side walls and supporting said strap, means extending from said bottom to loosely engage the faces of said plate whereby it is guided for sliding between the limits of said bottom and top, a flat plunger extending through an opening in said top, spaced columns projecting from said bottom guiding said plunger, the lower portion of the plunger having a longitudinal slot, a helical spring guided in channels in the spaced walls of said columns, said slot receiving said spring, and snap mechanism interposed between said plunger and barrier plate to actuate the latter from limit to limit.

9. The snap switch as defined in claim 8 in which said snap mechanism comprises a pair of overlapping levers one connected to said barrier plate and the other to said plunger, an over-center spring connecting said levers, and columns longitudinally spaced on said bottom forming spaced fulcra for the extending ends of said levers.

10. The snap switch as defined in claim 9 in which the said fulcra comprise open top notches in said columns and a column depending from said top to maintain one of said levers in its fulcrum.

11. In a switch of the type described, in combination, a housing comprising upper and lower interfitting sections forming a chamber for the switch mechanism, said mechanism including two-lever and over-center spring snap means, an insulation post extending from one housing section toward the other and having a fulcrum notch therein for one of said levers, said notch having one wall substantially normal to the bisector of the angle of the throw of said lever, and a similar post extending from the other section of the housing and overlapping the first, said second post having a similar but reversed notch, the remaining walls of the notches jointly forming an acute angle serving to confine the lever end against slippage under the action of said spring.

12. The switch as described in claim 11 in which the said one lever is bifurcated, with a wide flat foot on each furcation, said feet having aligned hinge edges, there being a notched post for one end of each foot edge extending from one housing section and another for the other end of each foot edge extending from the other section of the housing, one set of posts having means thereon to engage lateral edges of the lever to prevent movement thereof parallel to said hinge edges.

13. A housing providing fulcra for a fulcrumed lever snap switch comprising confronting and interfitting hollow cup portions of moulded plastic, a pair of posts extending from each section toward and into the other, those of one pair straddling those of the other, obtuse angled walls on and forming a notch in the corresponding face of the outer end of each post, one wall of all notches lying in a single plane and the remaining walls in pairs defining acute angled planes substantially intersecting at said first mentioned plane whereby spaced V notches are formed providing said fulcra.

14. In a switch of the type described, in combination, two pairs of stationary contacts, the pairs being laterally spaced and the contacts of a pair being longitudinally spaced, a bridging strap for each pair of contacts, an insulating barrier plate laterally disposed in a plane between the contacts of the pairs and supporting and separating said bridging straps, means independent of said contacts guiding said plate for movement in its plane to engage the straps with the stationary contacts or widely

separate them therefrom, said plate being interposed between the contacts of each pair during contact engagement and the first portion of separation movement, oppositely fulcrumed levers and a connecting spring adjacent one side of said plate, the plane of movement of the levers being normal to the plane of said plate and parallel to the axis of movement thereof, and the free end of one of said levers penetrating the plate to move it in opening or closing direction, the free end of the other lever being movable to actuate the switch.

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