Tool Trigger Switch

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This invention relates to a trigger switch for tools and more particularly to such a switch making use of a large, hollow, moulded trigger forming the closure for the switch housing.

It is a general object of the present invention to provide a novel and improved construction of trigger switch for tools having enhanced appearance, operating characteristics and manufacturing facility.

More particularly it is an object of the invention to provide a trigger switch for tools including an open top housing having stationary and movable switch contacts therein, a trigger slideable through the top housing opening and accommodating within itself, operating mechanism for the movable contacts, and a frame element secured to the housing mounting a fulcrum for said mechanism and serving to retain the housing, trigger and movable switch parts in assembled relation.

One important object of the invention is to provide a switch having a trigger element of hollow moulded construction, large size and rectangular cross-section whereby it not only serves to close mouth of the switch housing but is itself hollow to accommodate actuating mechanism for the switch.

Another important object of the invention consists in the use of an operating lever, for moving the switch contacts, having arms extending oppositely from the lever fulcrum for engagement respectively with an actuating abutment in the trigger and a trigger return spring also housed therein and both offset laterally from the said fulcrum.

A further important object consists in the arrangement within the trigger of the actuating abutment and the return spring whereby the latter is compressed through the actuating lever by manual movement of the trigger.

Still another object of the invention consists in extending the operating lever fulcrum pin across the width of the trigger, supporting the same in frame brackets straddling the trigger and slotting the trigger shell to slide over and be guided by said pin.

An important feature of the invention resides in the use of guiding arms in cooperation with grooves and walls on the trigger to guide the latter for straight movement into the housing.

Other and further objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the following specification and accompanying drawings wherein is disclosed a single exemplary embodiment of the invention with the understanding that such modifications may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

Fig. 1 is an end elevation of a tool trigger switch constructed in accordance with the present invention, the locking pin being in the inactive position; Fig. 2 is an elevation of the switch, looking from the locking pin side; Fig. 3 is central longitudinal section on an enlarged scale, taken on line 3—3 of Fig. 1, looking in the direction of the arrows showing the parts in solid lines for the "off" position and in dotted lines for the "on" position; Fig. 4 is a side elevation of the trigger separated from the switch; Fig. 5 is a longitudinal section through the trigger taken on line 5—5 of Fig. 4, and Fig. 6 is a bottom plan view of the trigger.

Trigger switches of small size and capacity such as are used in hand drills, portable power saws and in many other hand held power tools have not hereetofore been entirely satisfactory from the standpoint of simplicity of construction, reliability of operation, ease of application to the tool, and facility of operation. The present invention is directed to a trigger switch which solves the problems not satisfactorily solved by existing devices. The switch makes use of the large, molded, trigger of rectangular cross-section protruding through the open top of the switch housing, into which it partially telescopes when pulled to close the circuit.

Referring now to the drawings for a better understanding of the invention, Figures 1 and 2 illustrate the completely assembled device, where is seen at 10 a switch housing of the molded type, generally rectangular in plan, elevation and end views and closed on all sides but the top 11. Within this housing as seen in Figure 3 is a large irregular shaped chamber 12 for the switch mechanism. The open upper end of the housing is closed by the trigger 14 seen in side and end elevations in Figures 1 and 2 in its assembled relation, and in Figures 4, 5 and 6 alone, showing it to be molded from a suitable insulating plastic. Its outer end or top 15 is suitably curved to cooperate with the trigger finger for ease in pressing the trigger which slides rectilinearly into and out of the housing for a distance limited by the stop shoulders 16 and 17 therein. The stroke is quite short as depicted in Figure 3, for its relaxed and pulled positions are shown respectively in solid and dotted lines therein.

The trigger is rectangular in horizontal section and of uniform width and length throughout its height, except at the bottom, where end flanges 18 and 19 not only serve for guidance along the end walls 20 and 21 of the recess or chamber 12 but, are overhung by edges of the insulating cover plate 23, as seen at 24 and 25, to maintain the trigger in position and limit its outward movement. The flanges also cooperate with stop surfaces 16 and 17. In order to hold the housing 10, the cover plate 23 and the trigger in assembled relationship, a one piece sheet metal stamping is called into play, comprising a pair of vertical side rails 27 and 28 connected by transverse flat members 29 at the right end and 30 at the left which overlie the ends of the cover plate 23.

Fastening devices, such as shown at 31 and 32, depend and are arranged to be deformed, as shown in Figure 4, for engagement with abutments on the housing 10 to secure the frame and the cover plate thereto in at least three places insuring a rigid assembly. On the right, as viewed in Figure 1, a narrow wing or tab 33 projects upwardly from the rail 28 near its center and is laterally offset as shown to closely engage the flat side 34 of the trigger. On the other side a substantial upward extension 35 is in alignment with the rail 27 from which it protrudes and is provided with a depressed border area 36 which not only ridgetifies it but causes it to closely engage the side 38 of the trigger. Thus the trigger is guided well above the surface of the housing by the wing and border. It is further guided against lateral movement or canting by tongue 39 extending integrally upwardly from the part 29 of the frame and having parallel edges which cooperate with the walls 40 of a groove in one end wall of the trigger, as clearly seen in Figure 4. All supporting frame parts are of less height than the trigger so that
even when the latter is pulled none of them projects beyond its finger surface 15. The actual switch mechanism is of the more or less conventional kind; snap variety including the laterally spaced stationary contacts 42 of a pair mounted adjacent the floor 43 of the chamber in the housing and appropriately recessed to receive the swinging bridge-contact element 44 of conventional construction, swinging about trunnions, not shown, fulcrumed in notches 45 centrally located in the upper edges of the side walls of the housing. A sheet metal switch actuator 46 is fulcrumed on cross pin 77 extending from wing 33 to wing 35 above the side walls 27 and 28 of the frame. An arm 48 on this actuator has a partially circular head 49 engaging in a socket in insulating button 50 whose reduced cylindrical lower end is housed in the upper few coils of helical spring 51 whose lower end fits over projection 52 in the U-shaped insulating contact 44 and provides for the snap action in the customary manner. In the position illustrated in Figure 3 the switch is in the open position with the swinging contact abutting against fixed stop 54 and the spring "over center" to the left. If the actuator is swung so that part 49 carries the spring over center and the contact yoke 61 engages the lower end of the bridge stationary contacts 42 and closing the circuit between suitable connectors, not shown, for conductors which enter through the left end of the switch as viewed in Figure 2. The switch actuator 46 is centrally positioned in respect to the long pivot pin 47 by being confined between the walls 56 of the vertical central slot in the trigger and is in effect a double bell-crank having the arm 48, already described, and lateral arms 59 and 60 generally oppositely disposed and roughly on an axis at right angles to arm 48. Arm 59 extends to the left, as viewed in Figure 3, and is topped by arcuate cutout 61 which bears at all times against the abutment surface 62 at the top of the left portion of slot 56 whereby downward movement, or a "pulling" of the trigger, rotates the actuator in a counterclockwise direction and moves the switch to the "on" position. To permit such "pull" of the trigger, as well as to facilitate switch assembly, the two sides of the trigger are vertically slotted at 64, as best seen in Figure 4. The width of these vertical slots is such that the sides substantially engage pivot pin 47 for the actuator. As seen in Figure 4 and 6 the slots 64 are widened at their lower ends at 65 for a length at least equal to the stroke of the trigger and here the walls straddle those of ribs 66 projecting inwardly from each housing side wall. These ribs run to the top of the housing and accommodate portions of the notches 45 in which the trunnions of the movable contact element fulcrum.

By having the trigger guided at its lower end over ribs 66 as well as above its center over pivot pin 47, any canting about a transverse axis, due to eccentric pressure on the finger surface 15, is prevented. Transverse canting is taken care of as was explained in connection with tongue 39 and groove walls 40 as well as the cooperation of wings 33 and 35 with the side walls of the trigger.

The right arm 60 on the switch actuator is provided with an upturned portion 68 having an arcuate upper end which cooperates with a dished follower 69 fitted into the lower end of the helical trigger return spring 70 housed in vertical bore 71 in the right end of the trigger. The upper end of the spring is compressed against the top of bore 71, frame 74 being normal or "relaxed" position, illustrated in full lines in Figure 3, the trigger is retained in the lifted position not only by the action of the switch spring 51 urging the actuator in the clockwise direction through its arm 48 and pressing the arm 59 against the abutment 62, but spring 70 presses upward at 72 to urge the trigger to its fully extended position where its bottom flanges 18 and 19 engage beneath the housing cover portions 25 and 24 but the spring also bears on its follower 69 which bears on arcuate end 68 of arm 60 further urging the actuator in a clockwise direction. When the trigger is "pulled" abutment 62 acting on arm 59 moves lever 48 in a counterclockwise direction snap the switch to the "on" position as previously explained. At the same time arm 60 lifts the lower end of the spring 70 while the upper end is forced downwardly by top wall 72, whereby the spring is compressed from both ends simultaneously, cocking thereby with sufficient force so that it can return the trigger and snap the switch to the "off" position when the trigger is released.

Over and beyond its function of supporting one end of the fulcrum pin 47, the enlarged area of wing 35 provides a rigid support for locking pin assembly 80, shown in Figures 1 and 2. This includes a sleeve 81 having one end secured to 35 around a hole therein, and housing a helical return spring, not shown, and the button 82 telescopeically arranged therein and held to the normal released position by the spring. The side wall 38 of the trigger has an opening 84 therein so positioned that with the trigger retracted an extension pin, not shown, on the button is moved into hole 84 so that the trigger may be released for the finger and yet held from moving to its relaxed position by engagement of the pin with the lower wall of hole 84. To prevent the retraction spring for locking button 82 from withdrawing the pin from hole 84 the pin is fitted with an enlarged head, the underside of which will engage against the inner face of wall 58 at the lower edge of hole 84 when the button 82 is released to prevent withdrawal. The switch will thus remain closed until pressure is applied to the trigger to retract it slightly to allow the button retraction spring to withdraw the locking pin as its head becomes released from the lower wall of hole 84. The trigger may now be released and will be automatically returned to its relaxed position.

The locking pin arrangement and assembly is the invention of Robert O'Mara and forms the subject matter of United States Patent Application Serial Number 698,139, filed November 22, 1957, and reference should be had to that application for full details of the construction, assembly and operation of the locking pin.

For certain purposes the locking pin may be undesirable and can easily be omitted in the switch assembly operation, without detracting from the improved characteristics of the trigger switch, such as the large cross-section, rectangular, insulating trigger, the telescopic relationship of trigger and switch housing, the unique arrangement of the trigger return spring and the housing of the switch actuator in the trigger.

Having thus described our invention, what we claim as novel and desire to secure by Letters Patent of the United States is:

1. In a trigger switch, in combination, an open top housing having a chamber containing stationary contacts, a contact movable for two-way snap cooperation with said stationary contacts, a trigger rectilinearly slidable toward said chamber, when pulled, wings extending from said housing alongside opposite exposed faces of said trigger, a fulcrum pin extending between said wings, a flat actuating lever pivoted on said pin and having an overcenter-spring connection, a-said movable contact, laterally and oppositely disposed arms on said lever, a pin accommodating slot in said trigger, means in said trigger to center said lever on the pin, an abutment in said trigger to engage one of said arms to snap the switch when the trigger is "pulled" toward the housing, a spring in trigger bearing on the other lever arm so as to be loaded when the trigger is pulled, and said spring acting to return the trigger on its release and to snap the switch contact in the opposite direction.

2. The switch of claim 1 in which said wings are part of a combined frame and housing top closure supporting the trigger and means securing said frame to said housing to partially close said open top.
3. The switch of claim 2 in which the trigger has lateral ledges on its end facing the chamber and said frame and top closure has means overhanging said ledges to retain the trigger in the housing.

4. The switch of claim 2 in which said trigger has a longitudinal groove in a wall between said exposed faces and a tongue on said frame extending longitudinally into said groove to guide the trigger.

5. The switch of claim 1 in which one of said wings mounts a locking pin assembly with its axis normal to said wing, said assembly including a spring retracted pin, said trigger face adjacent said wing having a hole therethrough adapted for alignment with the pin axis when the trigger is retracted to receive the locking pin to hold the trigger "pulled."

6. In a trigger switch, in combination, a housing having a chamber containing stationary and swinging snap contacts, an actuator having a lever connected to the snap contacts by an overcenter spring and a pair of arms directed toward opposite sides of said lever, a pivot for said actuator fixed to said housing, a trigger slidably in respect to said housing, an abutment in said trigger to engage one of said arms when the trigger is "pulled" toward the housing to snap the switch, and a coil spring between the other arm and a second abutment in said trigger so as to be compressed as the trigger is pulled.

7. The switch as defined in claim 6 in which the spring in the trigger is of sufficient strength to return the trigger to its repose position and thereby snap the switch again.

References Cited in the file of this patent

UNITED STATES PATENTS

2,211,815 Hansson  Aug. 20, 1940
2,277,555 Meuer  Mar. 24, 1942
2,366,474 Bentley  Jan. 2, 1945
2,473,848 Baxter  June 21, 1949
2,552,471 Watkins  May 8, 1951
2,576,771 Bentley  Nov. 27, 1951
2,775,711 Kommer  Dec. 25, 1956
2,810,081 Hellstrom  Oct. 15, 1957