July 9, 1957 G. R. LAWSON ET AL 2,798,914

TOGGLE SWITCH WITH SHOCK ABSORBER

Filed July 31, 1956

Fig. 1.

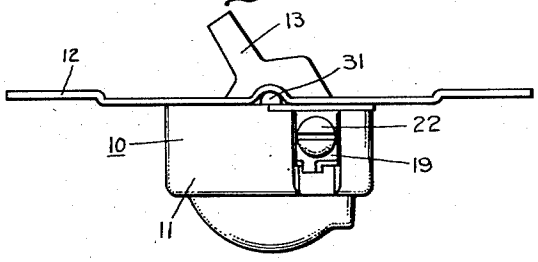


Fig. 2.

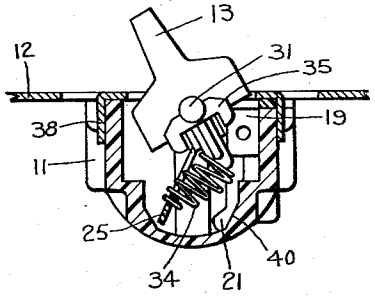


Fig. 3.

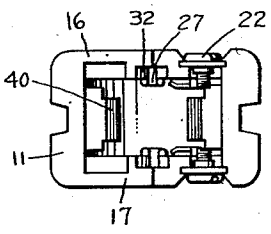


Fig. 4.

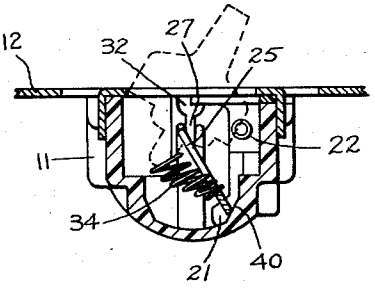
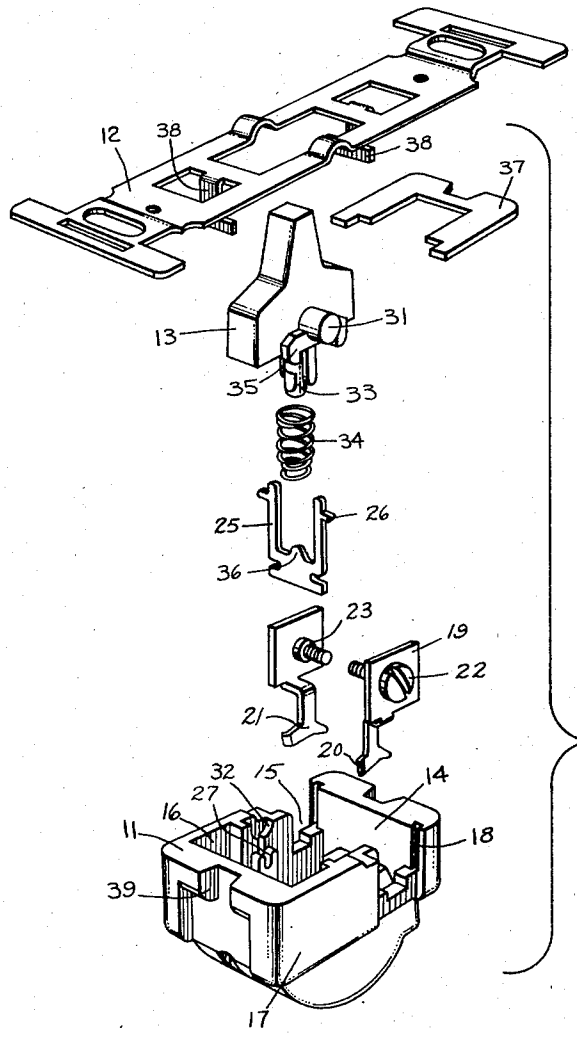


Fig. 5.



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TOGGLE SWITCH WITH SHOCK ABSORBER

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3 Claims. (Cl. 200—67)

Our invention relates to an electric switch and particularly to the type of electric switch known as a toggle switch having an over-center spring member for giving the switch a snap action.

A toggle switch of the class described has a hollow housing comprising a recessed base of insulating material and a cover member. In a single pole toggle switch a pair of fixed contacts are arranged near one end of the base and each adjacent one of the opposite side walls, while there is an oscillating flapper pivotally mounted by means of trunnions from the side walls of the base to form a movable contact which bridges the circuit between the fixed contacts. As is the usual practice, an over-center coil spring is supported on the flapper and compressed between the flapper and the bottom portion of a switch trigger that is also pivotally mounted from the base. The trigger has two extreme positions and when it is moved from one to the other position, it first compresses the spring which expands and forces the flapper to swing to its opposite position. When this takes place, the spring tends to rock from one side of the flapper to the other, and once it passes through the plane of the flapper it is no longer compressed and it tends to expand rapidly to move the flapper to its other extreme position. Finally, in the closed circuit position the flapper is wedged between the pair of fixed contacts.

In all of the known prior art devices, a vertical stop member is molded in the base of the switch and serves to bring the flapper to a sudden halt at the end of its stroke. However, in these prior art devices, serious damage may be caused by the electrical arcs which are struck during the opening and closing of the switch mechanism. This damage is due to the extreme temperatures attained which tend to weld the contacts together and carbonize the switch housing. Also, failures have occurred due to the fact that the flapper has bounced out of the fixed contacts, or the fixed contacts vibrate with respect to the flapper thereby drawing high current arcs which melt the two contact surfaces to cause the welding of the contacts when they reclose.

This situation has been successfully met by the present invention where the mechanical action of the mechanism has been stabilized in the preferred embodiment by using stop members inclined approximately 15° from the vertical so that the relative angle between the plane of the flapper and the stop when the two are in engagement is less than 90°. Thus, when the flapper strikes the stop member the flapper will tend to climb up the inclined surface thereby compressing the spring and raising the trunnions of the flapper out of their open bearings to absorb the shock of the rapidly moving flapper. It is not the friction between the flapper and the inclined stop which provides this improved result, but it is the shock absorbing action caused by the direction of the force of the spring which does not take effect until after the normal travel of the flapper is over and which adjusts its own effectiveness to the amount of excess energy to be absorbed. After this action is completed, the flapper returns to its normal rest position which is a predetermined point. It will thus be seen that the presence of a shock absorbing feature has no adverse effect on the next cycle of operation.

This invention results in several important results, namely, it makes possible the use of a higher speed for the flapper and greater forces than were used previously because of the rebound problem. This higher speed results in faster breaking of the circuit and consequent arc extinction. Also, the higher forces permit greater contact pressure with less bounce.

Accordingly, the principal object of this invention is to provide an electrical toggle switch with a shock absorbing feature to prevent the oscillating flapper from bouncing out from between the fixed contacts when the switch is being closed.

A further object of this invention is to provide an electrical toggle switch with a shock absorbing feature for the oscillating flapper so that the flapper speed may be increased which will in turn permit a higher fixed contact spring pressure.

A further object of this invention is to provide an electric switch with an inclined stop member between the fixed contacts of the switch to absorb the shock of the movable contact as it is brought into engagement with the fixed contacts.

A further object of this invention is to decrease the damage due to the burning of the contacts by the electrical arc by stabilizing the mechanical action of the switch with an inclined stop member that will absorb the shock of the flapper striking the stop when taking advantage of the over-center spring of the switch to perform the additional function of arresting the motion of the flapper.

Our invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Fig. 1 is a front elevational view of a toggle switch embodying our invention.

Fig. 2 is a cross-sectional elevation view taken along the central plane of the switch and showing the mechanism of the switch in the "off" position.

Fig. 3 is a top plan view of the recessed base of the switch merely showing the fixed contacts of the switch inserted therein as well as the inclined stop members for cooperation with the oscillating flapper that is not shown in this view.

Fig. 4 is a cross-sectional elevational view similar to that of Fig. 2 except that the trigger has been moved to its opposite position and the flapper is shown instantaneously rising up the inclined stop member against the compressive action of the over-center spring.

Fig. 5 is an exploded view of the switch parts which are included in one embodiment of our invention.

Referring in detail to the drawing and in particular to Fig. 1, **10** represents a hollow switch housing comprising a recessed base **11** molded of suitable insulating material and a metal mounting strap **12** which serves as a cover for the base as well as the means for supporting the switch in a switch box as will be well understood by those skilled in this art. A switch handle or trigger **13** is likewise a molded part of insulating material and it is pivotally mounted in open bearings in the opposite side walls of the base for movement between its two extreme positions.

A better understanding of the design of the parts of this switch may be had by considering the exploded view of Fig. 5 showing a single pole switch embodying our invention. The recessed base **11** is generally of box shape with an open top **14** that is closed by a mounting strap **12** when the switch is fully assembled. Open windows **15** are cut at one end of the base in the opposite side walls **16** and **17**. The side faces **18** of the windows **15** are grooved to receive the side edges of the terminal portions **19** of a pair of fixed contacts **20**. The lower portion **21** of each fixed contact is offset inwardly from the terminal portion **19** to lie against the interior surface of the respective side walls **16** and **17**. A terminal screw

22 is located in a threaded opening 23 in each terminal 19 so that lead wires may be connected to the fixed contacts and the switch joined into the electrical circuit that is to be controlled.

The movable contact of the switch is represented by a U-shaped flapper 25 having oppositely-disposed trunnions 26 arranged near the tops of its upright portions to be supported in open bearings 27 in the side walls 16 and 17 of the switch base. The flapper is adapted to oscillate from a position connecting the two fixed contacts to an opposite position where the switch holds the circuit open. The molded switch handle or trigger 13 has a similar set of trunnions 31 arranged near its bottom to seat in the open bearings 32 in the side walls of the base slightly above and outside the previously mentioned open bearings 27. Extending downwardly from the bottom of the trigger is a central projection 33 which serves as a spring seat for an over-center spring 34 of the toggle mechanism. Finally, a pair of rigid fingers 35 are disposed below each trunnion 31 for engagement with the upper ends of the uprights of the flapper 25 when the trigger is being shifted to its opposite position. These fingers 35 constitute a positive kickoff feature to insure that the flapper will move when the handle is shifted. The best showing of this is probably in Fig. 2 although it should be recognized that this feature is well-known in the art and does not constitute part of the present invention.

A second spring seat 36 for supporting the lower end of the over-center spring 34 is disposed in the base of the U-shaped flapper 25 so that the spring may rock in the plane of movement of the switch trigger 13. The assembly of the switch is completed by a U-shaped insulating plate 37 which is sandwiched between the mounting strap 12 and the top of the base 11 at the end nearest the fixed contacts 20 so as to insulate the fixed contacts from each other. The mounting strap 12 is of conventional construction which is stamped out of thin sheet steel material and has a pair of T-shaped lanced members 38 at the ends which are bent down around the ends of the base 11 to be engaged under the ledges 39 in a well-known manner.

The construction of the switch as explained above is generally conventional design which necessitated the introduction of the present invention. Figs. 2, 3, and 4 show the base 11 with a pair of backwardly inclined stop members 40 one of which is disposed between the fixed contacts 20. The angle of inclination is such that the included angle between the flapper when it is in engagement with the stop is less than 90°. Thus, it will be seen that as the flapper first engages the stop, the flapper will be moving at such a speed that it will tend to climb up the inclination. This rise is resisted by the compression of the over-center spring 34 as the trunnions of the flapper are lifted out of the open bearings 27. Hence, the over-center spring performs two functions. First, it provides the necessary toggle action for the quick opening and closing of the switch and, second, it serves the opposite function of slowing down and stopping the movement of the flapper when it reaches the end of its stroke. This unobvious result has been accomplished by utilizing the elements already present in the combination rather than an increase in the number of switch parts.

Having described above our invention as it is used in a single pole toggle action switch, it will be readily appreciated that while our invention is relatively simple in nature and easy to apply to existing designs, it has brought about a noteworthy increase in the efficiency and reliability of toggle action switches and represents a decided advance in this art. These problems have existed in this art since the advent of toggle switches nearly 50 years ago yet it has not been until this late date that this invention has been made to improve the operation of these switches.

Modifications of this invention will occur to those skilled in this art and it is to be understood, therefore, that this invention is not limited to the particular embodiment disclosed but that it is intended to cover all modifications which are within the true spirit and scope of this invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A snap action switch comprising a hollow housing having a recessed base and a cover member, fixed contacts arranged in the base, and a U-shaped flapper provided with trunnions journaled in open bearings in opposite side walls of the recessed base, the flapper serving as the movable contact of the switch to bridge the circuit between the fixed contacts, a switch trigger also having trunnions pivotally supported from the side walls of the base parallel to the pivotal axis of the flapper, an upwardly facing spring seat on the lower portion of the flapper, and a downwardly facing spring seat on the lower portion of the trigger, a coil spring compressed between the complementary spring seats of the trigger and flapper, the invention comprising a backwardly inclined wall formed in the base between the fixed contacts so that the motion of the flapper will be arrested when the flapper strikes the inclined wall and tends to climb over it thereby moving the flapper upwardly out of its bearings against the resistance of the spring.

2. An electrical switch comprising a hollow housing having a fixed contact arranged adjacent two of the opposite side walls thereof, and a U-shaped flapper provided with trunnions journaled in over-sized bearings in the said opposite side walls of the housing, the flapper serving as the movable contact of the switch to bridge the gap between the fixed contacts, a switch trigger also having trunnions pivotally supported from the said side walls of the housing with a pivotal axis parallel to the pivotal axis of the flapper, and an over-center spring compressed between the lower portion of the trigger and the bottom portion of the flapper, the invention comprising a backwardly inclined wall formed in the base between the fixed contacts so that the motion of the flapper will be arrested when the flapper strikes the inclined wall and tends to climb over it, thereby moving the flapper upwardly out of its bearings against the resistance of the spring, the relative angle between the plane of the flapper and the inclined wall when the flapper is engaging the wall being less than 90°.

3. A snap action toggle switch comprising a hollow housing formed by a recessed base of insulating material and a cover member, at least two fixed contacts supported at one end of the base adjacent the opposite side walls thereof, and a U-shaped flapper provided with trunnions at its upper portion which are journaled in open bearings in the said opposite side walls of the base, the flapper serving as the movable contact of the switch to close the circuit between the fixed contacts, a switch trigger pivotally mounted in the base with the pivotal axis parallel to the pivotal axis of the flapper, and spring means connected between the lower portion of the trigger and the lower portion of the flapper for providing the flapper with a snap action, and a backwardly inclined wall formed in the base between the fixed contacts for arresting the motion of the flapper as it nears the end of its stroke when the flapper tends to rise up the inclined surface and move out of its supporting bearings against the resistance of the spring, the relative angle between the plane of the flapper and the inclined wall being less than 90°.

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