Oct. 25, 1966 D. W. GRADY ETAL 3,281,565

EXTERNAL SWITCH ACTUATOR

Filed July 1, 1965 2 Sheets-Sheet 1

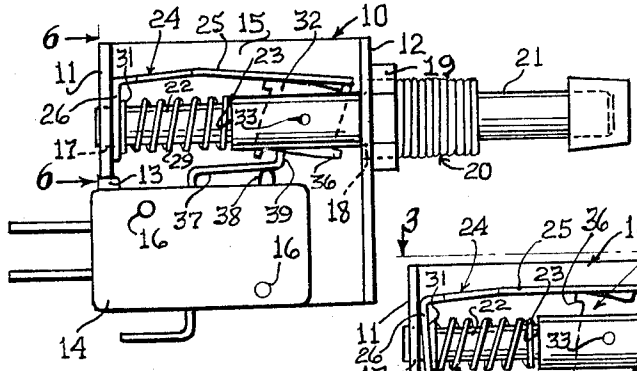


Fig. 1.

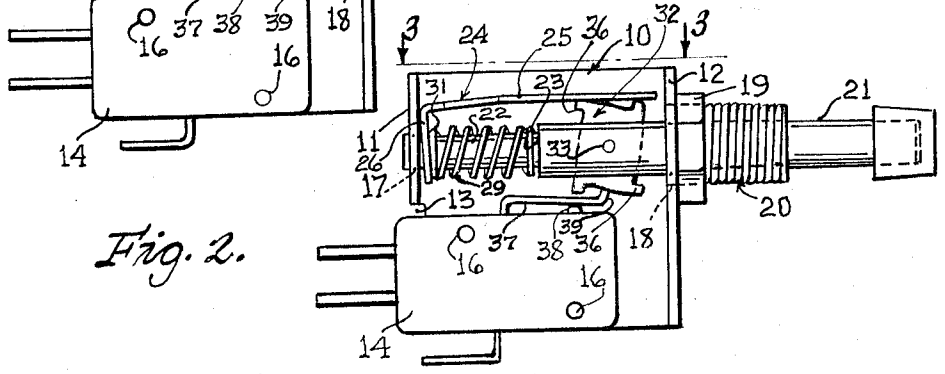


Fig. 2.

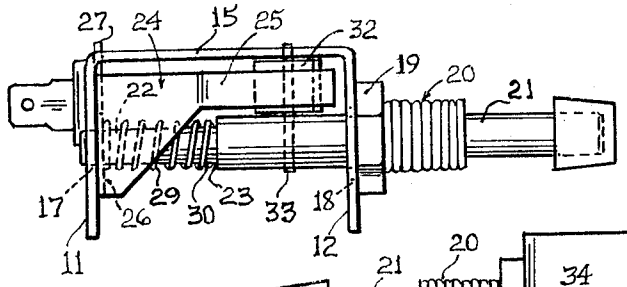


Fig. 3.

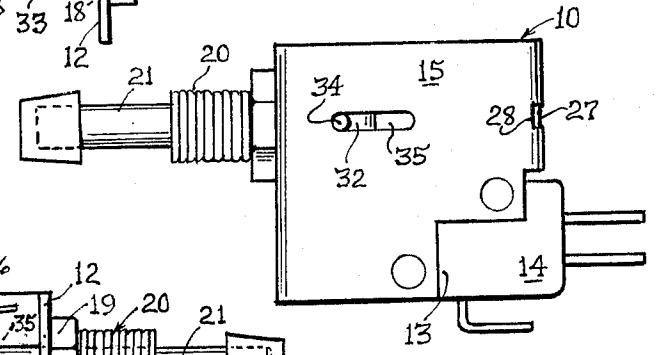


Fig. 4.

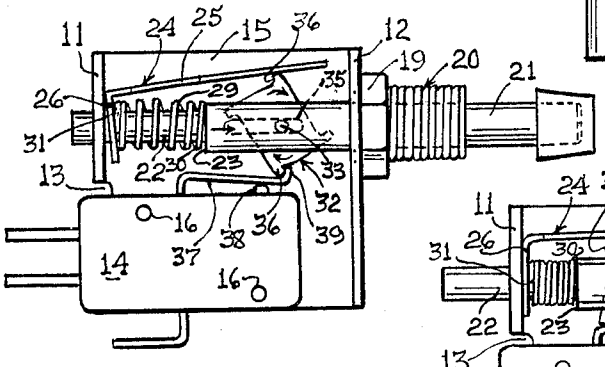


Fig. 6.

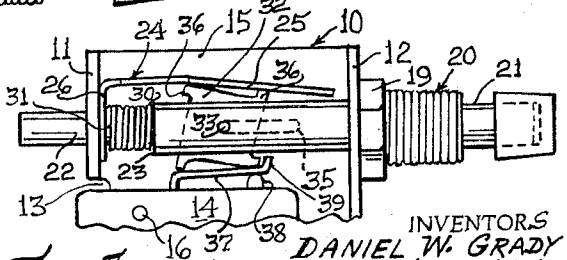


Fig. 5.

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EXTERNAL SWITCH ACTUATOR

Filed July 1, 1965 2 Sheets-Sheet 2

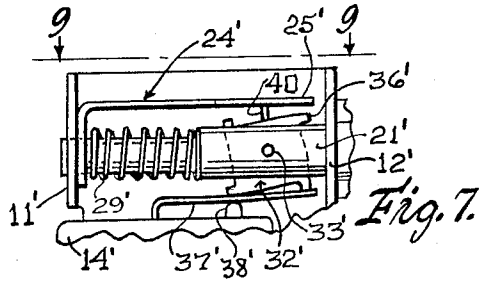


Fig. 7.

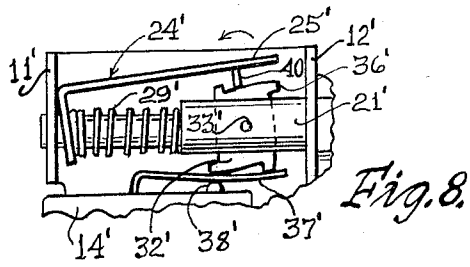


Fig. 8.

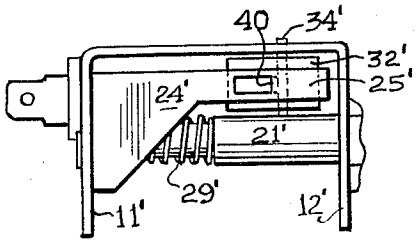


Fig. 9.

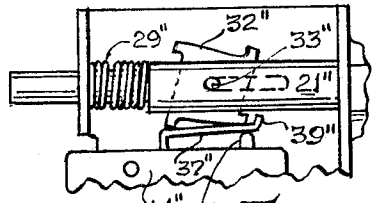
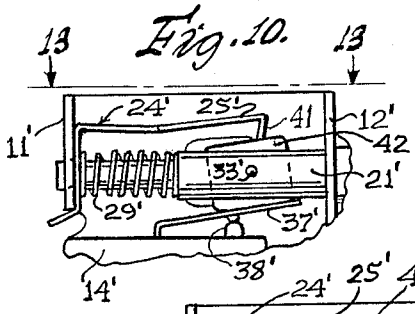


Fig. 17.

Fig. 10.



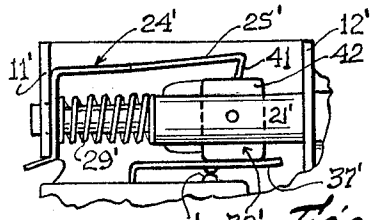


Fig. 11.

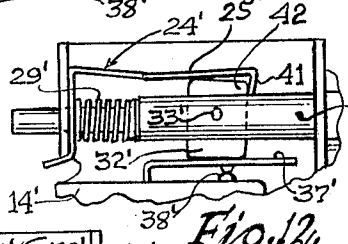


Fig. 12.

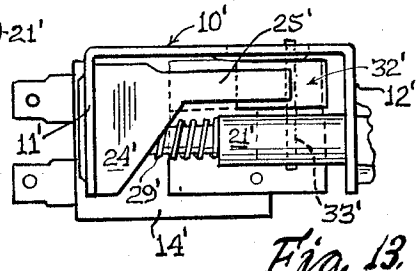


Fig. 13.

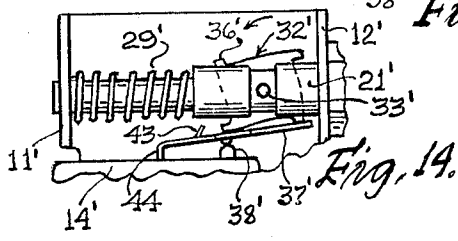


Fig. 14.

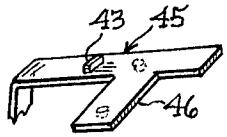


Fig. 16.

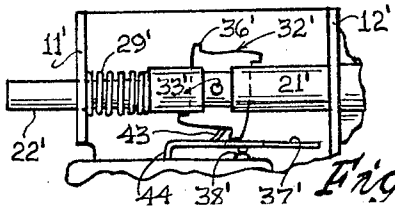


Fig. 15.

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3,281,565

EXTERNAL SWITCH ACTUATOR

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Filed July 1, 1965, Ser. No. 468,828
10 Claims. (Cl. 200—172)

Our invention relates to a new and useful improvement in an external switch actuator and more particularly, to a plunger-type actuator for an electrical snap-action switch.

A principal object of our invention is in the provision in a device of this character of an external plunger-type switch actuator operatively associated with and capable of actuating a pivotal switch actuating lever for selectively operating an electrical switch.

Yet another object of our invention is in the provision in a device of this character of an external plunger-type actuator having a substantially axial reciprocal movement, provided with a rotatable member operable upon a free exposed end of a pivotal switch actuating lever of an associated switch structure to effect actuation thereof upon axial movement of the plunger-type actuator in one direction.

A further object of our invention is in the provision in a device of this character of a rotatable means having a supporting axis carried by and movable with an external plunger-type actuator having reciprocal movement axially and transversely to the direction of movement of the recipient switch actuator.

An equally important object of our invention is in the provision in a device of this character of a mounting bracket for the switch and its external plunger-type actuator.

A still further object of our invention is to provide in a device of this character a switch actuator having a new and novel mode of operation combining axial, rotational, and pivotal movements, for effecting selective actuation of an associated switch structure.

Other objects will appear hereinafter.

The invention consists in the novel combination and arrangement of parts to be hereinafter described and claimed.

The invention will be best understood by reference to the accompanying drawings showing the preferred form of construction, and in which:

FIG. 1 is a side elevational view of our improved external switch actuator in its normal position;

FIG. 2 is a side elevational view similar to FIG. 1 but showing the parts to our invention in a switch actuated position;

FIG. 3 is a top plan view taken on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary rear elevational view of our improved invention;

FIG. 5 is a fragmentary side elevational view of our improved invention in a first actuated position;

FIG. 6 is a fragmentary side elevational view showing the parts in an intermediate actuated position;

FIG. 7 is a fragmentary side elevational view of a modified form of an external switch actuator;

FIG. 8 is a fragmentary side elevational view of the modified form of an external switch actuator in a switch actuating position;

FIG. 9 is a top plan view of our modified form of external switch actuator taken on line 9—9 of FIG. 7;

FIG. 10 is a fragmentary side elevational view of another modified form of our external switch actuator;

FIG. 11 is a fragmentary side elevational view similar

to FIG. 10, but showing the modified external switch actuator in an actuated position;

FIG. 12 is a fragmentary side elevational view showing the switch parts of the switch structure of FIG. 10 in an intermediate actuated position;

FIG. 13 is a top plan view taken on line 13—13 of FIG. 10;

FIG. 14 is a fragmentary side elevational view of a further modification of our external plunger-type switch actuator;

FIG. 15 is a fragmentary side elevational view showing the switch and actuator parts thereof in an intermediate actuated position;

FIG. 16 is a fragmentary perspective view of the pivotal switch actuating lever as employed in the device of FIG. 14;

FIG. 17 is a fragmentary perspective view of a further modification of our external plunger-type switch.

As shown in FIGS. 1 through 6, we have provided a mounting bracket 10 substantially U-shaped in cross section which provides spaced apart parallelly extending walls 11 and 12. The wall 11 of the bracket 10 is relieved as at 13 so that a portion of a snap-action switch housing 14 may be positioned therebeneath and in facial abutment with the web 15 of such U-shaped bracket 10.

This snap-action switch housing 14 is connected to the web 15 of the bracket 10 in any suitable manner, such as by rivets 16 as shown.

Each wall 11 and 12 of the bracket 10 is provided with an aperture 17 and 18 respectively which are in horizontal alignment. The aperture 18 as formed in the wall 12 of the bracket 10 is of a diameter greater than the diameter of aperture 17 formed in the opposite wall 11 and as such as adapted to receive the circular boss 19 of a suitable bushing 20, press fitted into the aperture 18, as shown in FIGS. 1 through 3.

Adapted to be projected through the bushing 20 and the aligned opening 17 formed in the wall 11, is a switch actuating means in the form of an elongated plunger rod 21. This plunger rod 21 has a portion of its length reduced as at 22, so as to provide a circumferentially extending shoulder 23 intermediate its ends.

Between the walls 11 and 12 of the bracket 10 is mounted a pressure member 24. This pressure member 24 is substantially L-shaped and as such provides an elongated leg 25 positioned above and in spaced relation to the plunger rod 21, and a base leg 26 disposed in facial abutment with the inner surface of the wall 11. Formed in the base leg 26 is an opening adapted to be placed in alignment with the aperture 17 formed in the wall 11 and through which slidably projects the reduced end 22 of the plunger rod 21.

The base leg 26 of the pressure member 24 has a lug 27 laterally projecting from one edge thereof in the direction of and through a cut-out 28 formed in the web 15 of the bracket 10 (FIGS. 3 and 4). This lug 27 will prevent the pressure member 24 from rotating about the plunger rod 21 during its reciprocal movement as hereinafter described.

Coiled about the reduced end of the plunger rod 21 is a spring 29. As shown in FIGS. 1 and 2, the spring 29 has one end 30 abutting the shoulder 23 formed on the plunger rod 21, and its opposite end 31 expanded against the base leg 26 of the pressure member 24 to resiliently hold the base leg 26 in facial abutment with the inner surface of the wall 11, and with the elongated leg 25 in its desired position above and in spaced relation to the plunger rod 21.

Positioned within the walls 11 and 12, and between the web 15 of the bracket 10 and the plunger 21 is an operating means comprising a substantially rectangularly shaped rotatable actuator member 32. This member 32

is rotatably mounted upon a shaft 33 which extends through the plunger 21 and has a free end 34 projected into a guide slot 35 formed in the web 15 of the bracket 10 (FIGS. 3 and 4).

This rotatable member 32 is formed so as to provide latch elements 36 extending outwardly from each corner thereof, each of the latch elements 36 extending laterally beyond its adjacent peripheral edge at right angles with respect to each other, as is clearly shown in FIG. 2.

The snap action switch 14 is normally provided with a switch actuator button 38 extending vertically therefrom. This actuator button 38 has engagement with an actuator lever 37 having one end pivotally connected to the switch housing 14 in a manner shown and described in Patent No. 3,098,904. The opposite end of the lever 37 is provided with an elevated trip finger 39 which is adapted to ride upon the peripheral edge of the substantially rectangularly shaped rotatable member 32. The free end of the elongated leg 25 of the pressure member 24 yieldably bears upon the upper edge of the rotatable member 32 during its reciprocal movement with the plunger rod 21, while the trip finger 39 of the actuator lever 37 engages the opposite or lower edge portion of the member 32 as viewed in FIGS. 1 and 2.

Upon axial movement of the plunger 21 in a direction from right to left, the rotatable member 32 is caused to move in a like direction until one of its latch elements 36 is caused to pass over and behind the trip finger 39 of the lever 37, as shown in FIG. 5. Upon reciprocal movement of the plunger 21, in the opposite direction, under the expansion pressure of the coil spring 29, the trip finger 39 of the lever 37 will contact one of the latch elements 36 and resist axial movement of the member 32 and thus cause it to rotate in a clockwise direction about its shaft 33, over the trip finger 39, as shown in FIG. 5.

As can readily be seen, the operating means 32 in its rectangular form, presents a rotatable member that has a short axis which when it is positioned transversely to the long axis of the plunger rod 21 will be in an inoperative position for actuating the switch (FIG. 1). When the operating means 32 is caused to rotate about its connection to the plunger rod 21 so that its long axis is transversely positioned with respect to the plunger rod 21, the rotatable member will be in its operative position wherein it has pivoted in a downward direction the actuator lever 37, which in turn has depressed the actuator button 38 of the switch (FIG. 2).

The operating means 32 is caused to rotate successively into each position upon each complete axial reciprocal movement of the plunger rod 21.

As the rotatable member 32 is moved axially with the plunger rod 21, the pressure member 24 will yieldably maintain the rotatable member 32 in its initial plane until its bottom edge passes over and beyond the trip finger 39 provided by the free end of the actuator lever 37. The pressure member 24 will then pivot the rotatable member 32 about its shaft 33 so that one of its latch elements 36 will lie behind the trip finger 39, as seen in FIG. 5. As the plunger rod 21 is caused to return to its original position under the action of the coil spring 29, the rotatable member 32 is caused to pivot in a clockwise direction, as seen in FIG. 6, over the trip finger 39.

Referring to FIGS. 7 through 17, we show a number of modified external switch actuators all of which are within the inventive concept hereinbefore described. For the sake of clarity, corresponding character references will be used and primed to indicate identical structure in each of the modified external switch actuators. In FIGS. 7 through 9 we show a modification wherein the means for rotating the operating means 32' comprises a trip finger 40 struck from the pressure member 24.

In the operation of the first modified external switch actuator as shown in FIGS. 7 through 9, the initial movement of the plunger rod 21' against the coil spring 29' will cause the upper edge of the rotating member 32' to pass beneath the elongated leg 25' of the pressure member 24' until one of the latch elements 36' of the rotating member 32' passes beneath and to the left of the trip finger 40, as shown in FIGS. 7 and 8.

Upon reciprocal axial movement of the plunger rod 21' the operating means 32' will be caused to rotate about its shaft 33' into its operating position as shown in FIG. 8 wherein its long axis extends transversely to the plunger rod 21'. In such a position, the actuator lever 37' is pivoted away from the plunger rod 21' and effects depression of the actuator button 38' thus operating the switch.

In the modification of the external switch actuator shown in FIGS. 10 through 13, the elongated leg 25' of the pressure member 24' has its free end formed to provide a trip finger 41 in the form of a depending hook. This hook 41 is adapted to engage the corners 42 of the rotating member 32' as it is reciprocally moved by actuation of the plunger rod 21'.

In FIGS. 14 and 15 we show an external switch actuator wherein the actuator lever 37' is provided with a raised trip finger 43 which is positioned between the pivoted end 44 of the actuator lever 37' and the actuator button 38'. In this construction, when the plunger rod 21 is initially moved so as to correspondingly move the rotatable member 32' from right to left, as seen in FIGS. 14 and 15, the latch element 36' which is positioned upon the actuator lever 37' in close proximity to the trip finger 43, will engage the trip finger 43 and effect rotation of the rotatable member 32' in an anti-clockwise direction as seen in FIGS. 14 and 15, to change the position of the operating means. The return movement of the plunger rod 21' through the action of the coil spring 29' maintains the operating means 32' in its actuated condition as the lower edge thereof will be caused to slide off the trip finger 43. Thus the operation of this switch actuator is effected upon the initial movement or push of the plunger rod 21'.

In the modification, as shown in FIG. 17, the construction is similar to that shown in FIGS. 5 and 14. In such modification, the plunger 21'' rotatably carries the operating means or rotatable member 32'', which is in turn caused to be rotated by the trip finger 39'' formed on the end of the lever 37''.

In the forms shown in FIGS. 12 through 17, it is possible to simultaneously actuate more than one switch. In such a construction the switch housings 14' are mounted in side-by-side relation on the mounting bracket 10' (FIG. 13). The actuator lever 45 (FIG. 16), as associated therewith, provides a lateral extension 46 which rests upon the switch actuator buttons of each of the switches that are thus mounted in side-by-side relation. Any pivotal action of the switch actuator lever 45 simultaneously operates the switches associated therewith.

While we have illustrated and described the preferred form of construction for carrying our invention into effect, this is capable of variation and modification without departing from the spirit of the invention. We, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of such variations and modifications as come within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to protect by Letters Patent is:

1. An external actuator for an electrical switch having a switch housing and an external switch actuator comprising,

(a) a mounting for said switch housing,

(b) means provided by said mounting for slidably receiving a switch actuating means,

(c) a switch actuating means slidably carried by said mounting for reciprocal axial movement relative to said external switch actuator,

(d) operating means rotatably carried by said switch actuating means and having an operative and inoperative position with respect to said external switch actuator,

(e) means rotatably connecting said operating means to said switch actuating means for reciprocal movement therewith relative to said external swtich actuator, and

(f) means provided by said external switch actuator for rotating said operating means about its rotable connection to said switch actuating means alternately into an operative position and an inoperative position on each successive reciprocal axial movement of said switch actuating means to operate said external switch actuator and the electrical switch thereof.

2. An external actuator for an electrical switch as defined by claim **1** wherein said switch actuating means comprises an elongated plunger slidably carried by said mounting and having an end portion exposed from said mounting for engagement by an operator and the like.

3. An external actuator for an electrical switch as defined by claim **1** wherein said operating means comprises a substantially rectangularly shaped member rotatably carried by said switch actuating means intermediate its ends and movable therewith through its axial plane and simultaneously rotatable about a center axis extending transversely to the elongated length of said switch actuating means, into an operative and an inoperative position.

4. An external actuator for an electrical switch as defined by claim **1** wherein said means for rotating said operating means comprises a trip-finger provided by said external switch actuator and which is in the path of travel of said operating means so that upon movement of the same by said switch actuating means in one direction, said trip-finger will engage a portion of said operating means so as to restrict its axial movement and cause the same to rotate about its connection to said switch actuating means to operate said external switch actuator and said electrical switch.

5. An external actuator for an electrical switch as defined by claim **1** and including a means carried by said mounting and said switching actuating means in contact with a portion of said operating means yieldably holding the same in slidable and rotatable contact with said means for rotating said operating means as it moves and rotates into an operative position and an inoperative position upon each successive reciprocal movement of said switch actuating means.

6. An external switch actuator for an electrical switch having a switch housing and an actuator and actuator lever comprising,

(a) a mounting bracket for said switch housing and the external actuator substantially U-shaped to provide spaced apart parallel arms,

(b) means provided by said arms for slidably receiving an external switch actuator,

(c) an elongated external switch actuator slidably carried by said mounting means and having an end portion extending beyond one of said arms for engagement by an operator and the like for effecting axial movement thereof in one direction relative to said actuator and actuator lever,

(d) means carried by said external switch actuator between a portion thereof and one of said arms for reciprocally moving said external switch actuator in an opposite direction.

(e) operating means rotatably carried by said external switch actuator between said arms and having an operative and an inoperative position with respect to said actuator and actuator lever,

(f) a stud shaft extending laterally from one side of said external switch actuator between said arms rotatably mounting said operating means to said external switch actuator, and

(g) means engaging said operating means during its movement with said external switch actuator to alternately rotate the same into an operative position and an inoperative position on each successive reciprocal axial movement of said external switch actuator to operate said actuator and actuator lever and the electrical switch thereof.

7. An external switch actuator for an electrical switch as defined by claim **6** wherein said external switch actuator comprises an elongated plunger slidably journalled through each of said spaced apart parallel arms of said U-shaped mounting bracket.

8. An external switch actuator for an electrical switch as defined by claim **6** wherein said operating means comprises a substantially rectangularly shaped member rotatably carried on said stud shaft between said external switch actuator and said mounting bracket, said member so mounted to said external switch actuator so as to have a long axis which when the member is rotated into its operative position by said rotating means extends transversely to said external switch actuator and a short axis which extends transversely to said external switch actuator when said operative means is rotated into its inoperative position relative to said actuator and actuator lever of said electrical switch.

9. An external switch actuator for an electrical switch as defined by claim **6** wherein said means for rotating said operating means comprises a trip-finger provided by the actuator lever of said electrical switch, said trip-finger so positioned as to be in the path of travel in said operating means so that upon movement of the same by said external switch actuator said trip-finger will engage a portion of said operating means so as to restrict its axial movement and cause the same to rotate about said stud shaft into an operative position and an inoperative position upon each successive reciprocal axial movement of said external switch actuator.

10. An external switch actuator for an electrical switch as defined by claim **6** and including a means carried by said mounting and said switch actuating means in contact with a portion of said operating means yieldably holding the same in slidable and rotatable contact with said means for rotating said operating means as it moves and rotates into an operative position and an inoperative position upon each successive reciprocal movement of said switch actuating means.

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