Dec. 21, 1954 A. R. KOCH 2,697,364

OVERTRAVEL PLUNGER ACTUATOR

Filed July 5, 1951

Fig. 1.

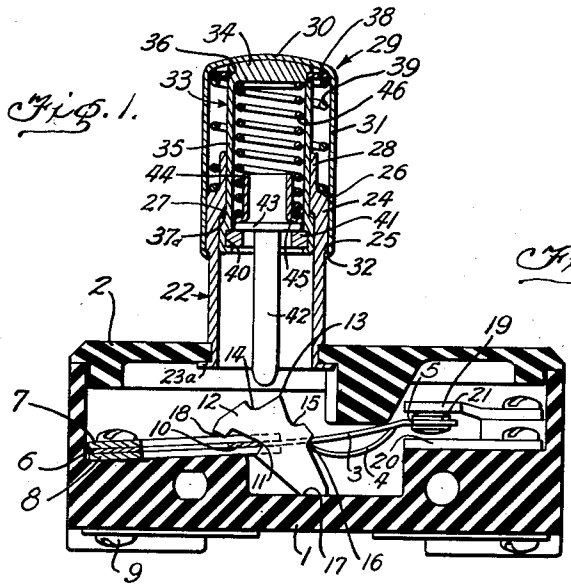


Fig. 2.

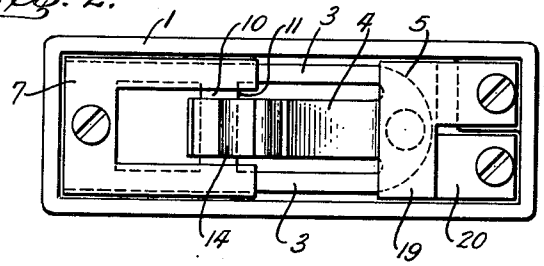


Fig. 3.

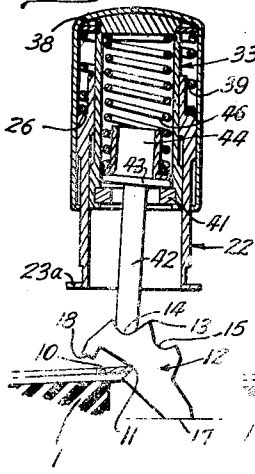


Fig. 4.

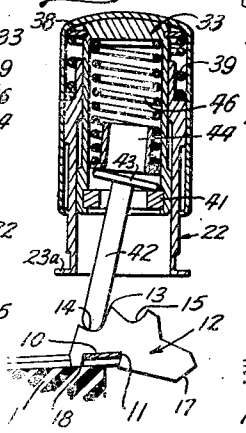


Fig. 5.

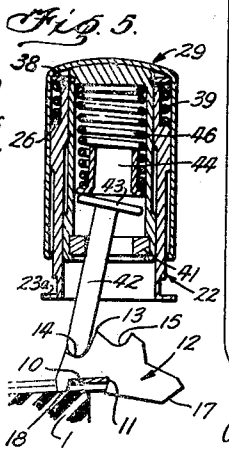
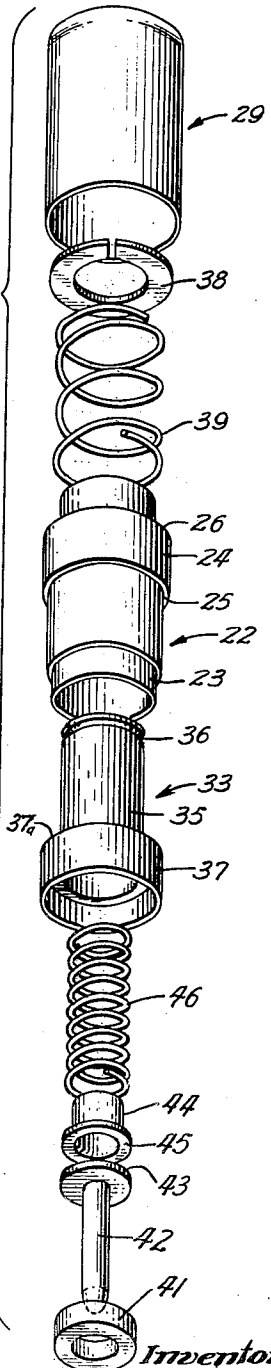


Fig. 6.



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OVERTRAVEL PLUNGER ACTUATOR

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Application July 5, 1951, Serial No. 235,321

3 Claims. (Cl. 74—503)

This invention relates to an actuator for controlling the operation of an alternate action mechanism, such, for example, as a toggle operated switch.

It is an object of this invention to provide a novel reciprocable actuator having incorporated in it means providing for overtravel of its operating parts.

It is also an object of this invention to provide an actuator of novel construction having a reciprocable driving member which may be deflected away from its normal line of action.

Another object of this invention is to provide a novel actuator having a reciprocable operating button and a driving member which may be deflected out of the line of action of the operating button.

Another object of this invention is to provide a novel actuator having a minimum of exposed parts, and which is compact in size and readily adapted for use on switches of standard size and shape.

Another object of this invention is to provide a novel reciprocable actuator whose parts are free to rotate about the line of reciprocation of the actuator without affecting their operation.

A further object of this invention is to provide a novel reciprocable actuator for a toggle-operated switch wherein the actuator is constructed to have overtravel after the toggle has been actuated to its limiting position.

Other and further objects and advantages of the invention will be apparent from the following description of a preferred embodiment thereof.

In the drawings:

Figure 1 is a cross-sectional elevation of a toggle-operated switch and the actuator of the present invention in its normal position;

Fig. 2 is a top view of the switch of Figure 1 with the cover and actuator removed;

Fig. 3 is a fragmentary sectional view similar to Figure 1 showing the actuator after its operating button has been initially depressed to cause the driving pin to engage the toggle;

Fig. 4 is a view similar to Fig. 3 showing a later position of the actuator after the toggle has been moved by the actuator from one limiting position to the other;

Fig. 5 is a view similar to Fig. 3 showing the actuator at its full overtravel position, and

Fig. 6 is an exploded perspective view of the actuator according to the present invention illustrating the parts of the actuator before assembly.

The switch with which the actuator of the present invention is here shown is enclosed within an insulating housing comprising a base **1** and a cover plate **2**. The snap spring system employed in the switch comprises spaced parallel elongated leaf spring tension members **3** and a leaf spring compression member **4** interconnected at an end **5**, which is free to move, and a mounted end **6** at which the other ends of the spaced tension members are interconnected. A pair of upper and lower U-shaped anchors **7** and **8**, which are formed of conductive material, hold the mounted end of the snap spring and are suitably connected to the external electrical circuit at terminal **9**. A transverse bridging arm **10** interconnects the tension members **3** in spaced relation from the mounted ends thereof and at its straight edge **11** forms a pivot for the toggle **12**.

The toggle is formed with an upper ridge **13** separating two valleys **14**, **15**, and a peripheral groove **16** spaced from the toggle pivot and forming a pivotal seat for the free end of the compression member **4**. A lower flat face

17 is formed on the toggle beyond the groove **16** and is adapted to abut against the base of the switch housing to limit the toggle movement in one direction. A lower flat face **18** on the toggle at the other side of the pivot thereof is positioned to engage the housing base to limit the toggle movement in the opposite direction.

A pair of spaced, opposed upper and lower contacts **19** and **20** are suitably fixedly mounted on the base and are connected to the external electrical circuit. A mobile contact **21** is mounted on the free end of the snap spring to be movable between the opposed fixed contacts. The compression member **4** of the snap spring is pivotally supported in bowed compression at its seat **16** on the toggle such that movement of the toggle between its limiting positions moves the compression member through an axis of maximum stress, causing the mobile contact on free end of the snap spring to move with a snap action from a stable position engaging one of the fixed contacts through a position of unstable equilibrium to another stable position engaging the other fixed contact. The snap spring remains in this position until the toggle is actuated to return to its original limiting position.

The actuator of the present invention includes a fixed sleeve or bushing **22** formed with a peripheral lower reduced portion **23** which is dimensioned to fit snugly in a hole formed in the housing cover **2** above the toggle. The lower end of the reduced portion **23** is riveted over during assembly to form a bottom flange **23***a* to retain the bushing in the cover plate **2**. Toward its upper end the fixed sleeve is formed with a peripheral transversely protruding portion **24** to define a lower downwardly-facing shoulder **25** and an upper upwardly-facing shoulder **26**. The fixed sleeve is also formed with an internal downwardly-facing transverse shoulder **27** disposed toward its upper end. The periphery of the sleeve is reduced above the upper outer shoulder **26** to form a narrower upper end **28**, and the internal bore of the sleeve is smaller above the internal shoulder **27**.

A tubular operating button **29** is formed with a closed upper end **30** and a depending tubular portion **31** closely and slidably surrounding the sleeve protrusion **24**. During assembly the lower end of the operating button is crimped in around its periphery to form an annular inwardly-extending transverse lip **32** operative to engage the lower sleeve shoulder **25** and thereby limit upward movement of the operating button along the fixed sleeve. The crimped-in lower end of the operating button closely surrounds the lower end of the fixed sleeve and is freely slidable therealong.

A tubular plunger **33** is formed with a closed upper end **34** abutting against the inside of the closed upper end **30** of the operating button and a depending tubular portion **35**. Adjacent its upper end the plunger is formed with a peripheral groove **36**. As its lower end the plunger protrudes outwardly at **37** to define an upper peripheral shoulder **37***a*. The lower protruding plunger portion **37** is closely received within the lower portion of the bore formed in fixed sleeve **22** and is slidable therealong, while the upper end of the plunger is closely received within the upper, reduced-diameter bore portion in the sleeve above the internal sleeve shoulder **27**.

A split washer **38** is mounted on the upper peripheral groove **36** in the plunger and snugly engages the interior of the operating button **29** at the top thereof. A return coil spring **39** has its lower end seated against the upper peripheral shoulder **26** on the fixed sleeve and has its upper end seated against the lower face of washer **38**. The coil spring is under compression to bias the operating button **29** and the plunger **33** to the extreme upper limit of movement along the fixed sleeve **22**. The washer also defines an inwardly extending transverse portion on the operating button positioned to abut against the upper end of the fixed sleeve to limit downward movement of the operating button and the plunger along the fixed sleeve.

The tubular plunger **33** is formed with an internal annular groove **40** adjacent its lower end to receive a washer **41**. This groove is formed by turning over the lower lip of the plunger **33** at its lower end during assembly. The driver for engaging the switch toggle includes an elongated stem **42** which depends below the plunger

and an integral enlarged transverse head 43 retained within the tubular plunger by the washer 41. A tubular guide member 44 is formed with a lower outwardly extending flange 45 which bears against the flat upper face of driver head 43. An overtravel coil spring 46 is received closely within the tubular plunger, with its upper end seated against the closed top of the plunger and its lower end seated against the top of the lower flange 45 on the guide member. The upstanding tubular portion of the guide member is closely received within the convolutions of coil spring 46.

In the operation of the invention, with the toggle and snap spring of the switch in the position of Fig. 1, the operating button 29 is depressed to move the lower rounded end of the driver 42 into engagement with the inclined toggle surface between the upper ridge 13 and the valley 14 thereon. The lower end of the driver stem 42 rides down this inclined surface into the valley at 14, at which position the driver is tilted from its normal line of reciprocation, as shown in Fig. 3.

As further downward movement of the operating button 29 and the tubular plunger 33 takes place any further downward movement of driver 42 is limited by its engagement with the toggle. The driver 42 is tilted even further to rotate the toggle 12 about its pivot 11 and effect the snap action movement of the mobile switch contact 21 away from upper fixed contact 19 into engagement with lower fixed contact 20. The downward movement of the operating button 29 along fixed sleeve 22 of course results in compression of the return coil spring 39. Also, the overtravel of the operating button 29 and the tubular plunger 33, after downward movement of the driver has been stopped by completion of the toggle movement, causes the driver head 43 and guide member 44 to be displaced upward within the bore of the plunger to compress the overtravel coil spring 46 positioned therein. The concurrent tilting of the driver stem 42 is not directly transmitted to the coil spring 46 because of the interposition of the separate guide member 44 disposed between the coil spring and the driver head 43. Because the overtravel coil spring 46 closely surrounds the upper end of the guide member 44 and because the plunger 33 closely surrounds the spring 46, the overtravel coil spring effectively restrains any tendency of the guide member 44 to tilt substantially and the guide member moves substantially directly upward within the tubular plunger to effect substantially equal compression of the overtravel spring 46 around the circumference of the latter.

During continued overtravel of the operating button 29 during depression thereof the tubular plunger 33 continues to move downward relative to the driver 42, so that the overtravel spring 46 within the plunger is compressed further. Overtravel of the operating button is limited by washer 38 abutting against the top of the fixed sleeve 22 to prevent any further movement of the operating button downward along the fixed sleeve.

When the downward force on the operating button 29 is released, the return coil spring 39 acting between the washer 38 and the upper sleeve shoulder 26 returns the plunger and the operating button to the normal limiting position upward along sleeve 22. As the plunger moves upward, the overtravel spring 46 acts against the driver head 43 to return the latter to its normal position seated against washer 41. When fully retracted the actuator again assumes the position shown in Fig. 1. The toggle remains in the position to which it has been displaced until the next time the actuator is depressed.

By virtue of the described construction and mode of operation of the illustrated form of the invention, there is provided a reciprocable switch actuator whose switch engaging portion is operative to be deflected by engagement with the switch operator away from the path of reciprocation of the actuator, while the operating button of the actuator overtravels along its path of reciprocation. In addition, the entire actuator is compact in size, has a minimum of exposed parts, and positions all of its parts free to rotate about the line of reciprocation of the actuator without affecting its operation.

While there has been disclosed a preferred form of the actuator of the present invention and a particular use thereof in an alternate action, snap-acting switch, it is to be understood that variations in the illustrated form of the actuator may be resorted to without departing from the spirit and scope of the invention.

I claim:

1. In an actuating mechanism, in combination, a fixed sleeve formed with an outer peripheral protrusion intermediate its length defining a lower continuous downwardly-facing transverse peripheral shoulder and an upper continuous upwardly-facing transverse peripheral shoulder, an operating button comprising a closed upper end and a depending tubular portion enclosing said fixed sleeve and slidable therealong and formed with an inturned lower end operative to abut against said lower shoulder on the fixed sleeve to limit upward movement of the operating button along the fixed sleeve, a plunger slidably disposed within said fixed sleeve and formed with an upwardly-facing transverse shoulder, said fixed sleeve being formed intermediate its length with an internal downwardly-facing transverse shoulder interposed in the path of upward movement of said plunger shoulder and located along the sleeve to limit upward movement of said plunger, an annular washer carried on the upper end of said plunger and snugly received within said operating button at the upper end thereof and operative to engage the upper end of the fixed sleeve to limit downward movement of the plunger and the operating button therealong, and a coil spring disposed in the annular space surrounding said plunger and enclosed within said operating button, said coil spring having its lower end seated against said upper shoulder on the fixed sleeve and having its upper end seated against said washer, said coil spring being under compression between said upper sleeve shoulder and said washer to resiliently urge the operating button and the plunger to the extreme upward limit of movement thereof along the fixed sleeeve.

2. An actuating mechanism comprising the combination of a fixed sleeve formed with an outer protrusion intermediate its length to define a lower downwardly-facing shoulder, an upper upwardly-facing shoulder spaced thereabove, and narrower peripheral sleeve portions above and below said protrusion, an operating button comprising a tubular depending portion disposed about said fixed sleeve to be slidable therealong and formed with inturned transverse protrusions at its lower end operable to engage said lower shoulder on the fixed sleeve to limit upward movement of the operating button along the fixed sleeve, an inwardly-extending abutment portion positioned toward the upper end of the operating button and movable in unison therewith operative to abut against the upper end of the fixed sleeve to limit downward movement of the operating button along the fixed sleeve, a return coil spring under compression between said upper shoulder on the fixed sleeve and said abutment portion on the operating button to resiliently urge said operating button to its upward limit of movement along the fixed sleeve, a hollow plunger reciprocable within the fixed sleeve and movable in unison with the operating button, said plunger being formed with an inwardly-extending transverse portion adjacent its upper end and an inwardly-extending transverse annular portion adjacent its lower end, a driver formed with a stem extending downward through said inwardly-extending annular portion at the lower end of the tubular plunger and formed with an enlarged transverse head positioned loosely within said tubular plunger above said inwardly-extending annular portion at the lower end thereof, a separate guide member disposed above said head on the driver and positioned slidably within said tubular plunger and formed with a neck extending upwardly within said tubular plunger, and an overtravel coil spring within said tubular plunger under compression between said inwardly-extending transverse portion adjacent the upper end thereof and said guide member to resiliently urge said head on the driver downward into abutting relation with said inwardly-extending annular portion at the lower end of the tubular plunger, said overtravel coil spring closely surrounding said neck on the guide member to restrain tilting of the guide member when the driver is tilted.

3. An actuating mechanism comprising the combination of a fixed sleeve formed with an outer peripheral protrusion intermediate its length defining a lower downwardly facing transverse shoulder and an upwardly facing transverse shoulder, an operating button comprising a closed upper end and a depending tubular portion closely surrounding said outer protrusion on the fixed sleeve and slidable therealong and formed with an inturned lower end operative to abut against said lower shoulder on the fixed sleeve to limit upward movement of the operating

button along the fixed sleeve, a reciprocable tubular plunger slidably disposed within said fixed sleeve and at its upper end abutting against the closed upper end of the operating button, an annular washer carried on the upper end of the plunger and snugly received within said operating button at the upper end thereof and operative to engage the upper end of the fixed sleeve to limit downward movement of the plunger and the operating button along the fixed sleeve, a return coil spring disposed in the annular space surrounding said plunger and disposed within said operating button, said return coil spring having its lower end seated against said upper shoulder on the fixed sleeve and having its upper end seated against said washer, said return coil spring being under compression to resiliently urge the operating button and the plunger to the extreme upward limit of movement thereof along the fixed sleeve, said tubular plunger being closed at its upper end and at its lower end carrying an inwardly-extending annular washer, a driver formed with an elongated stem extending downward through said inwardly extending washer and formed at its upper end with an enlarged transverse head disposed loosely within said tubular plunger above said inwardly extending washer at the lower end thereof, an overtravel coil

spring disposed closely within said plunger and having its upper end seated against the closed upper end of the plunger, and a guide member formed with an upwardly-extending neck received closely within said overtravel coil spring and a lower outwardly-extending annular flange abutting against the lower end of the overtravel coil spring, said guide member being separate from said stem and being resiliently urged by the overtravel coil spring to engage said head on the driver and urge the driver downward, said guide member being operative to move substantially directly upward within the tubular plunger to equalize the compression on the overtravel coil spring in response to tilting movement of the driver.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
871,110	Comings	Nov. 19, 1907
1,051,219	Graban	Jan. 21, 1913
1,569,416	Bates	Jan. 12, 1926
1,935,234	White	Nov. 14, 1933
2,047,950	Douglas	July 21, 1936
2,295,484	Krieger	Sept. 8, 1942