United States Patent

Carling

[15] **3,641,291**

[45] **Feb. 8, 1972**

[54] **TOGGLE ACTUATOR ASSEMBLY FOR ELECTRIC SWITCH**

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[22] Filed: **Apr. 7, 1971**

[21] Appl. No.: **131,911**

[52] **U.S. Cl.**.....**200/67 G,** 200/172 R, 200/172 B

[51] **Int. Cl.**.....**H01h 13/28**

[58] **Field of Search**.....200/67 A, 67 G, 68, 172 R, 200/172 B

[56] **References Cited**

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[57] **ABSTRACT**

A novel toggle handle actuator structure for an electrical switch wherein means are provided to prevent relative axial rotation between the toggle handle and the actuator while they perform their pivoting function in switching electrical circuits.

9 Claims, 8 Drawing Figures

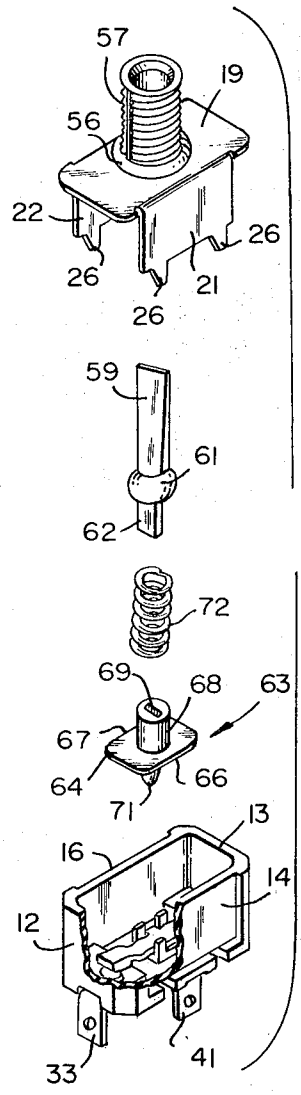


FIG. 1

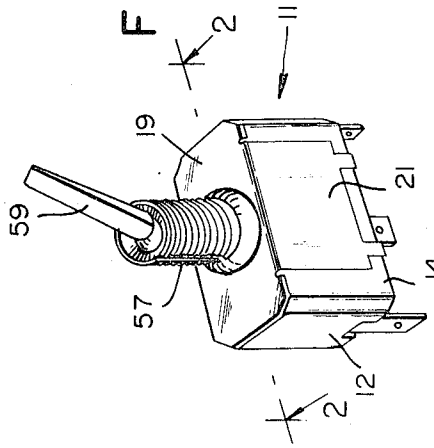


FIG. 3

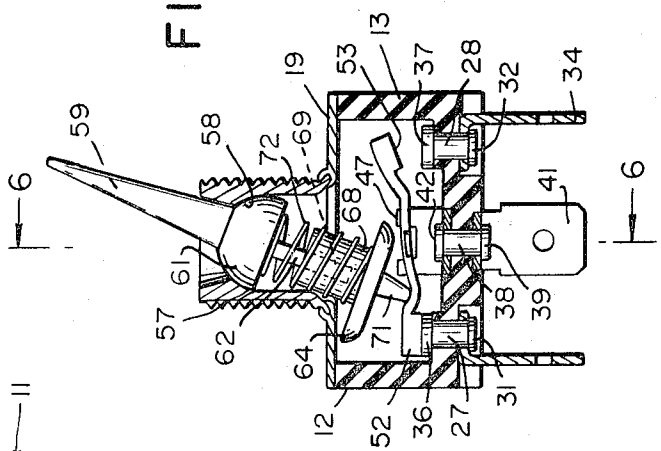
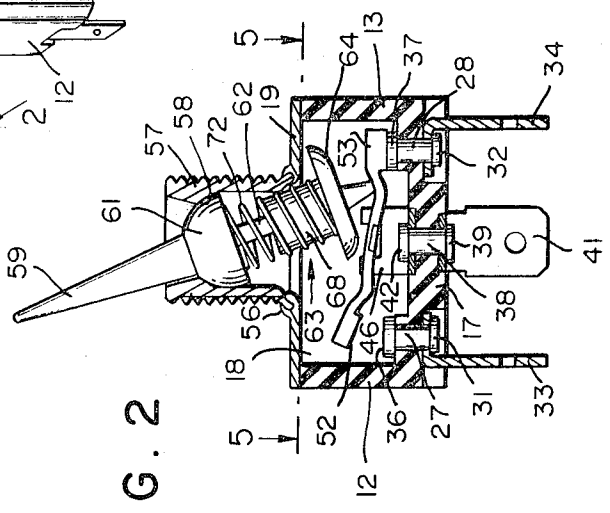


FIG. 2



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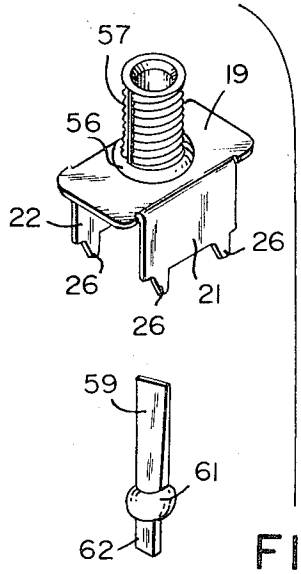


FIG. 4

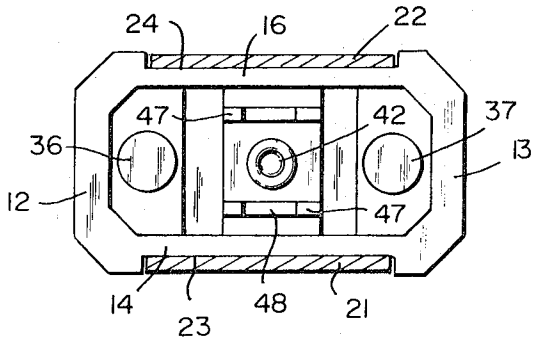


FIG. 5

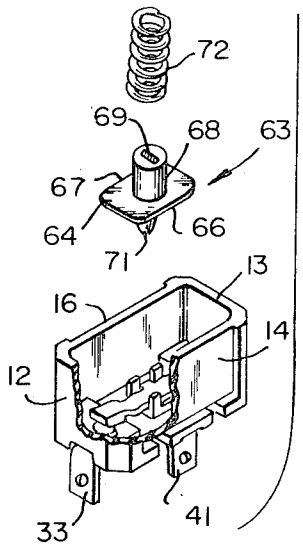
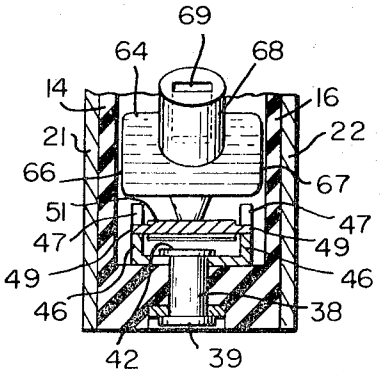


FIG. 6



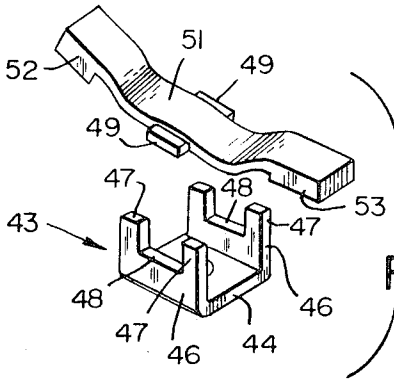


FIG. 7

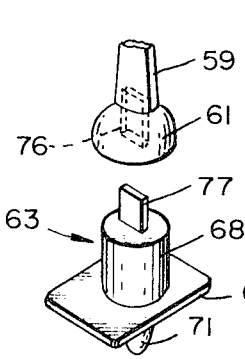


FIG. 8

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TOGGLE ACTUATOR ASSEMBLY FOR ELECTRIC SWITCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electric switches and, more particularly, to a novel toggle handle actuator structure wherein means are provided in the telescopic articulation between the toggle handle and the actuator to prevent rotation of either of said components relative to the other. Further means are provided between the actuator and the switch case for preventing axial rotation of the actuator during its pivoting action within the switch case.

2. Description of the Prior Art

Toggle switches of various types have been disclosed in U.S. Pat. Nos. 3022394, 3031547, 3117197, 3165603, 3165604, 3169172, 3225153, 3225156, 3227820, 3327078, 1666338, 1773595, 1857379, 1997078, 2267203, 2848574, 2926225, 3110781 and 3390237.

Most of these patented toggle switches have actuators for producing the pivoting action of the contact lever whereby portions of said actuators are telescopically movable within the toggle handle and are retained therein by means of a hidden captive spring. Furthermore, several of these prior art actuators are constructed in a manner that permits at least partial axial rotation of the toggle handle element which is a drawback when said handle element is in the form of a flat paddle. Also, because of the complexity or prior art toggle actuator structures, higher materials and labor costs are incurred in producing switches which are to be made by mass production means.

SUMMARY OF THE INVENTION

The present invention comprises a switch in which the pivoting contact lever in the switch case is alternately pivoted by a movable actuator yieldably mounted upon a toggle handle, the actuator body being movable longitudinally as well as vertically within said case and having flat side walls which slidably engage the interior walls of the case whereby the actuator is prevented from rotating during its action so that the toggle handle is also prevented from being rotated. The actuator and the inner end of the toggle handle have corresponding slidable mating elements which, while the toggle handle is pivotable on a single axis, nevertheless permits the actuator to move in both vertical as well as longitudinal directions relative to the switch case while performing its function of pivoting the electrical contact lever within the switch case. A coil spring is interposed between the actuator and the toggle handle externally of said elements whereby said elements may be readily and easily assembled. The corresponding mating elements of the toggle handle and the actuator have similar flat sided cross sections that may be either square, rectangular, triangular, or the like, whereby the toggle handle is prevented form rotating on its axis during its pivoting action and that of the actuator element.

By virtue of the novel structure herein, the apparatus is made up of very simple and inexpensive parts that can be more readily manufactured and assembled by semiskilled or unskilled labor than has been experienced with a good number of prior art toggle switches.

These and other novel features and advantages of the present invention will be described and defined in the following specification and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an embodiment of the switch of the present invention;

FIG. 2 is a vertical central section view taken on line 2—2 of FIG. 1, some parts being shown in elevation, with the toggle handle, actuator, and contact lever in positions where a first electrical circuit controlled by said switch is closed;

FIG. 3 is a view similar to FIG. 1 with the toggle handle, actuator, and contact lever in positions where a second electrical circuit controlled by said switch is closed;

FIG. 4 is an exploded perspective view of the components of the switch shown in FIGS. 1, 2 and 3, some parts being broken away and some parts being omitted;

FIG. 5 is an enlarged view taken on line 5—5 of FIG. 2, some parts being omitted;

FIG. 6 is an enlarged fragmentary view taken on line 6—6 of FIG. 3;

FIG. 7 is an enlarged exploded perspective view of part of the switch structure comprising the contact lever and the yoke upon which the lever is pivotally mounted; and

FIG. 8 is an exploded elevation view of another embodiment of the toggle handle actuator combination of the present invention, some parts being omitted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in detail, there is shown a switch case, generally designated 11, comprising spaced apart end walls 12 and 13, and spaced-apart sidewalls 14 and 16, and a floor 17, said end walls, sidewalls, and floor forming the boxlike switch case enclosing a switch chamber 18. Case 11 is made of a suitable insulating material such as Bakelite, nylon, or the like. The open top of the switch case is enclosed by a sheet metal cap 19 which has a pair of integrally formed, downwardly extending leaves 21 and 22, which lie within respective recesses 23 and 24 in the outer surfaces of respective side walls 14 and 16 of the switch case. Integrally formed at the lower ends of leaves 21 and 22 are spaced-apart pairs of fingers 26 which are bent into corresponding recesses, not shown, in the bottom of the switch case for securing said cap firmly in position on the top of said switch case.

Extending through floor 17 are first and second spaced-apart electrically conductive studs 27 and 28, respectively. The lower ends of studs 27 and 28 extend to the exterior of floor 17 in suitable recesses provided therein and terminate in respective rivet heads 31 and 32 which secure respective electrically conductive terminal lugs 33 and 34 to the bottom of the switch case. The upper ends of studs 27 and 28 terminate in the interior of chamber 18 in the form of integral contact heads 36 and 37, respectively.

Extending through floor 17 intermediate studs 27 and 28 is an electrically conductive stud 38, the lower end of which terminates in a rivet head 39 which secures an electrically conductive common power terminal 41 to the bottom of the switch case.

The upper end of stud 38 terminates in a rivet head 42 which secures an electrically conductive yoke, generally designated 43, to floor 17 of the switch case. Yoke 43 has a flat base 44 and a pair of spaced apart integrally formed, upwardly extending arms 46, each of which terminates in a pair of spaced-apart integrally formed upwardly extending fingers 47. Each arm 46 has a horizontal shoulder 48 bounded by fingers 47, said shoulders 48 each supporting a respective outwardly extending wing 49 formed integrally intermediate the ends of a pivoting contact lever 51. Integrally formed on opposite ends of lever 51 are contact elements 52 and 53 which alternately close and open a respective electrical circuit with respective contact heads 36 and 37.

Cap 19 has a central aperture having an annular lip 56 to which is firmly secured an upwardly extending bushing 57 in the interior of which is formed an annular curved shoulder 58. Extending through bushing 57 is a toggle element comprising a toggle handle 59 and an integrally formed boss or hemisphere 61 thereon, the curved surface of which pivotally and slidably engages curved annular bearing seat or shoulder 58 in the manner of a ball and socket arrangement. Hemisphere 61 has a downwardly extending, integrally formed stem 62 which is rectangular in cross section.

Located within chamber 18 of switch case 11 is an actuator element generally designated 63 and formed of nylon, Bakelite, or other suitable insulating material. Element 63 has a base 64 which is generally rectangular in shape, comprising sidewalls 66 and 67, the dimensions of said base between walls 66 and 67 being very slightly less than the space between the

inner surfaces of walls **14** and **16**, whereby walls **66** and **67** are substantially in sliding engagement with said side walls **14** and **16**.

Base **64** has an integrally formed, upwardly extending stub **68** which has a longitudinal recess **69** which is rectangular in shape and slidably accommodates stem **62** of the toggle element for free longitudinal movement in respect of each other. Base **64** has an integrally formed, downwardly extending nib **71** which is caused to bear downwardly upon lever **51** by virtue of spring **72** freely surrounding stub **68**. The lower end of spring **72** bears downwardly upon the top surface of base **64** and the upper end thereof bears upwardly against the bottom flat surface of toggle hemisphere **61**. The action of spring **72** also causes toggle hemisphere **61** to be urged against and maintained in sliding engagement with annular shoulder **58** in bushing **57**.

In some embodiments of the present invention, the toggle handle actuator assembly may be constructed in the form shown in FIG. **8** where, in place of stem **62**, toggle hemisphere **61** is provided with a longitudinal recess **76** of rectangular cross section which longitudinally and slidably accommodates an integrally formed, upwardly extending stem **77** of rectangular cross section on stub **68** of actuator **63**. As in the case of stem **62** and recess **69**, here also recess **76** and stem **77** have cross section configurations of close-fitting but freely telescoping dimensions whereby axial rotation of the respective components relative to each other is prevented. In the embodiment shown in FIG. **8**, a spring similar to spring **72** would be included for performing the same function as described hereinbefore in connection with the embodiment shown in FIGS. **2**, **3** and **4**.

Since toggle handle **59** is retained on the switch substantially by means of a ball and socket type arrangement (annular shoulder **58** and hemisphere **61**), the noncircular cross-sectional configurations of the telescoping means on said toggle handle and on the actuator permit dispensing with a pivot pin or pivot mounting element for said toggle handle thereby eliminating the structural part and facilitating assembly and disassembly of the switch.

OPERATION

When toggle handle **59** is urged to the left as shown in FIG. **2**, hemisphere **61** moves pivotally relative to annular shoulder **58** and the corresponding pivoting action of stem **62** slidably nested within recess **69** causes actuator element **63** to move pivotally to the right whereby nib **71** causes lever **51** to move pivotally on its wings **49** so that contact element **53** closes the electrical circuit connected to contact head **37**. During this action, the electrical circuit connected to contact head **36** is opened by virtue of contact element **52** moving apart from contact head **36**. When toggle handle **59** is moved to the right as shown in FIG. **3**, the opposite pivoting movement of all of the elements takes place whereby the electrical circuit connected to contact head **37** is opened and contact element **52** of lever **51** closes the electrical circuit with contact head **36**.

Electrically conductive yoke **43** and electrically conductive lever **51** are continually in electrical connection by way of stud **38** and terminal **41** to a common power source whereby the circuits controlled by contact heads **36** and **37** may be alternately and selectively energized.

During the pivotal movement of the actuator element **63** from one end to the other of switch case **11**, actuator **63** is also caused to move vertically and yieldably against the action of spring **72** because of the angled or curved contour of the top surface of lever **51** along which nib **71** moves slidably to cause the pivoting action of said lever on the separate shoulders **48** of yoke **43**.

The lateral dimension between the parallel sidewalls **66** and **67** of base **64** of actuator **63** is slightly less than the dimension between the parallel inner surfaces of walls **14** and **16** whereby actuator **63** is caused to move in a rectilinear path between said walls while, at the same time, any rotation of actuator **63** upon its axis within switch case **11** is prevented. Since stem **62** has substantially the same cross section contour as its close-fitting slidably accommodating recess **69** in actuator **63**, the toggle handle **59** will also be prevented from rotating on its axis.

It is contemplated that toggle stem **62** and actuator recess **69** may also be formed in various cross-sectional contours such as square, triangular, elliptical, or other suitable multisided shapes whereby only longitudinal movement of said stem can take place within said recess so as to prevent any rotation of handle **59** relative to actuator **63**.

By providing a comparatively wide base **64** for actuator **63** and forming nib **71** integrally with said base, the present structure permits the placement of spring **72** externally of the toggle handle and facilitates the assembly of the toggle switch in contrast to the intricate manipulation required in former apparatus where a tiny separate nib is to be mounted slidably within a toggle recess within which is also lodged a captive spring.

By virtue of the structural features of the switch described and claimed herein, there is achieved a novel telescoping or mating arrangement between the actuator and the toggle handle which permits yieldable vertical movement of the actuator responsive to the irregular path said actuator must follow when moving along the curved or angled contact lever. At the same time, said actuator will move properly in a straight rectilinear path between one end portion of the switch case and the other, so that the toggle handle will not be rotated or twisted on its longitudinal axis when it is moved pivotally or is stationary.

While the telescoping or mating arrangement between the toggle handle and the actuator comprising stem **62** and recess **69** (FIGS. **2–4**) or recess **76** and stem **77** (FIG. **8**), is particularly advantageous for a paddle-type toggle handle as illustrated herein, it is contemplated that this arrangement also is useful where round toggle handles are utilized or with toggles having a particular design necessitating that it be kept in a particular alignment without twisting or without rotation on its longitudinal axis. Thus, there is achieved herein a novel switch construction which permits the use of various types of toggle designs with minimal parts and reduced assembly labor.

Although a two-position electrical switch has been disclosed and described herein whereby contact lever **51** is movable alternately into either one of two separate circuit closing positions, it is contemplated within the purview of the present invention that the toggle-actuator assembly herein can also be utilized in the context of three-position switches as disclosed, for example, in U.S. Pat. Nos. 3,031,547 and 3,117,197, and the like.

Although the present invention has been described with reference to particular embodiments and examples, it will be apparent to those skilled in the art that variations and modifications can be substituted therefor without departing from the principles and true spirit of the invention. The "Abstract" given above is for the convenience of technical searchers and is not to be used for interpreting the scope of the invention or claims.

I claim:

1. An electrical switch comprising a case, a support yoke positioned in said case, an electrically conductive contact lever pivotally mounted on said yoke, a toggle handle pivotally mounted on said case, a movable lever actuator in said case for pivotally operating said contact lever, first means on said handle and second means on said actuator cooperating telescopically whereby the pivoting action of said toggle handle produces the pivoting action of said actuator and of said lever, said first means and said second means having slidably mating cross section contours which prevent axial rotation of either the toggle handle or the actuator in respect of the other, spring means between said toggle handle and said actuator for yieldably urging the latter against said contact lever, third means on said actuator and fourth means in the interior of said case, said third and fourth means cooperating with each other

during the pivoting movement of said actuator to prevent the latter from rotating on its axis during its pivoting movement between the end portions of said case.

2. A switch according to claim 1 wherein said toggle handle is mounted in a ball and socket arrangement in respect of said case, and wherein said spring urges said ball and socket arrangement into sliding engagement for the pivoting action of said toggle handle.

3. A switch according to claim 1 wherein said first means comprises a recess in said toggle handle, and said second means comprises a stem on said actuator.

4. A switch according to claim 1 wherein said first means comprises a stem on said toggle handle and said second means comprises a recess in said actuator.

5. A switch according to claim 1 wherein said third means comprises a pair of spaced apart side walls on said actuator and said fourth means comprises the parallel interior spaced apart walls of said case, the adjacent respective side walls of said actuator and of said case being in close sliding proximity to each other.

6. An electrical switch comprising a case, a support yoke positioned in said case, an electrically conductive contact lever pivotally mounted on said yoke, a toggle handle, a curved boss on said toggle handle intermediate the ends thereof, an annular bearing seat in said case, said boss and said seat forming a pivoting juncture for said toggle handle, a movable lever actuator in said case for pivotally operating said contact lever, telescoping means between said toggle handle and said actuator whereby the pivoting movement of said toggle handle causes the pivoting movement of said actuator, said telescoping means having a cross section contour that prevents axial rotation of either said toggle handle or said actuator in respect of the other, spring biasing means between toggle handle and said actuator for yieldably urging the latter against said contact lever and for maintaining the sliding engagement of said boss and said seat, and the sidewalls of said actuator and of the interior walls of said case being in sliding engagement to prevent the axial rotation of said actuator during its pivoting movement between the end portions of said case.

7. A switch according to claim 6 wherein the side walls of the actuator and of the interior of the case are in parallel array.

8. A switch according to claim 6 wherein said telescoping means comprises a stem on one and a recess on the other of said toggle handle and of said actuator, said stem and said recess having similar cross section contours and being longitudinally slidable one within the other.

9. A switch according to claim 8 wherein said cross section contours are noncircular in shape.

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