United States Patent

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[54] **TOGGLE SWITCH**
9 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **200/67,** 200/172, 200/68
[51] **Int. Cl.** **H01h 13/28**
[50] **Field of Search** 200/67, 67.7, 68, 172

[56] **References Cited**

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ABSTRACT: A toggle switch which has an operating lever extending through and pivoted in a threaded mounting barrel. In a longitudinal bore of the lever there is a compression spring and a plunger the latter being acted on by the spring and engaging a movable switch contact. The pivotal mounting of the lever comprises two ball bearings disposed at opposite sides of the lever and carried respectively in pairs of registered sockets and the lever and barrel, said sockets being external to the longitudinal bore of the lever whereby space is readily available in the bore for the plunger and spring.

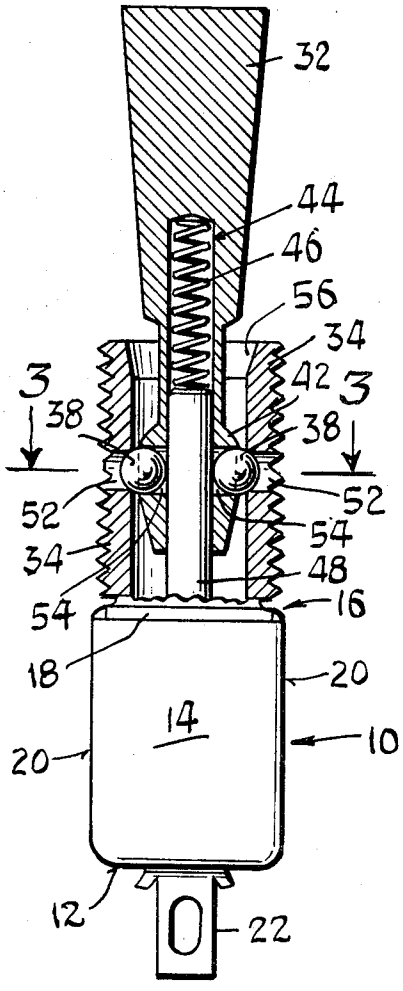


Fig. 1

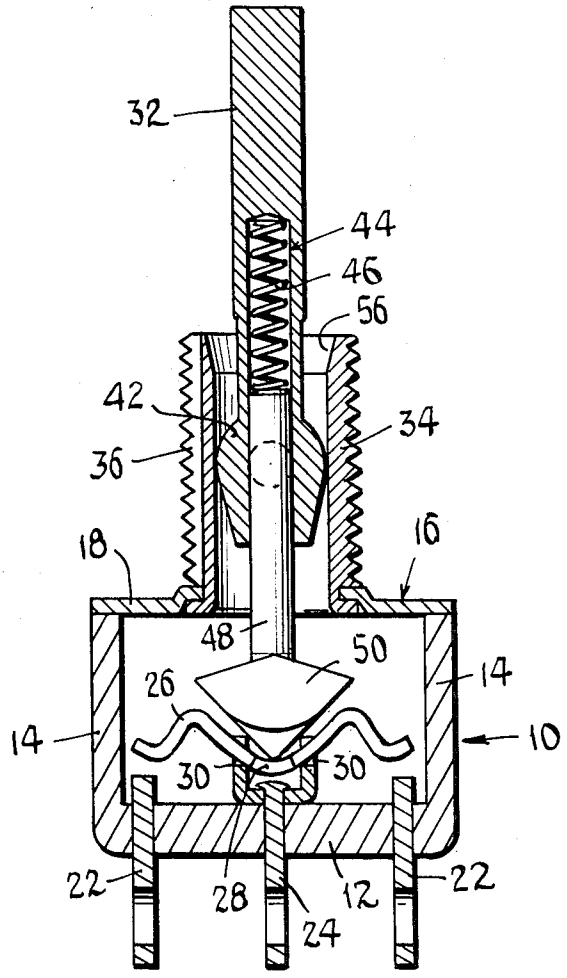


Fig. 2

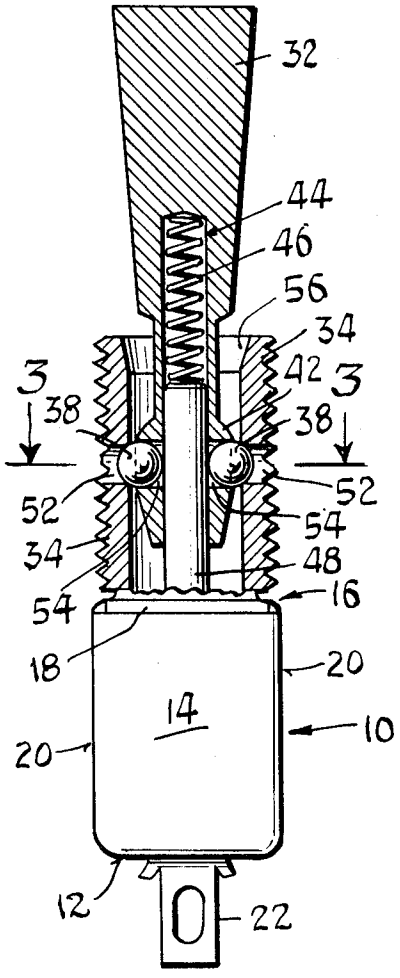
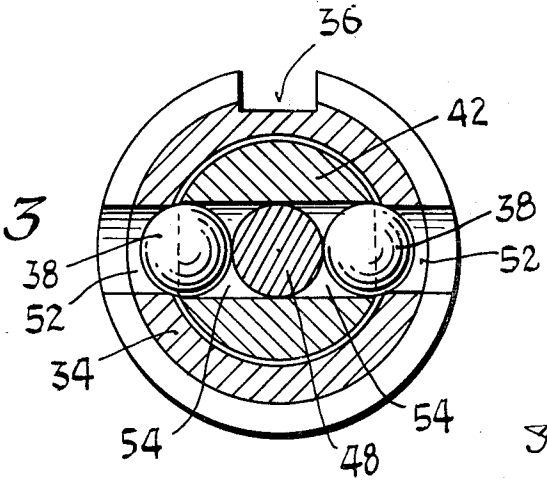


Fig. 3



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TOGGLE SWITCH

CROSS REFERENCES TO RELATED APPLICATIONS

1. Copending application of Frank J. Plumb, Ser. No. 784,640 filed Dec. 18, 1968 and entitled "Sub-Miniature Toggle Switch."

BACKGROUND

This invention relates to toggle switches wherein an operating lever extends through a mounting bushing or barrel member, and more particularly to an assembly in such switches which involves the pivotal mounting of the lever in the barrel. The invention is especially useful in those circumstances where the switches are manufactured in subminiature sizes.

Heretofore it has been a usual procedure to pivotally mount the operating lever of a toggle switch of the above type by a single pivot pin passing completely through the lever and barrel, and to provide at the inner end of the lever a yieldable plunger, ball or other member to engage and operate the movable switching part. Normally the size of a standard switch and the appreciable available space in the switch housing enabled such a construction to be effected without conflict between the various components that were involved. With the advent of miniaturization and requirements to reduce sizes, the problem of maintaining of a satisfactory, soft-acting, spring-biased member on the lever, for operating the movable switching part became difficult. Adjoining components would interfere with each other, tolerances got overly critical, and the functioning and performance either deteriorated or else could not meet the standards that were established and considered necessary. Obtaining the necessary room for the spring-acting part of the lever while at the same time effecting the small overall dimensions and keeping the necessary physical strength and smooth action in the lever mounting seemed to constitute objectives not possible to readily attain.

SUMMARY

The above difficulties involved with prior switch constructions when effecting reductions to subminiature sizes are overcome by the present invention, one object being the provision of a subminiature toggle switch having a lever part pivoted in a mounting barrel part, wherein the lever part has a reliable and soft-acting spring means and at the same time is secured by a reliable and friction resistant pivot means that withstands relatively heavy operating forces and is characterized by a long life. This is accomplished by effecting the pivotal securement through the use of two pivots comprised as ball bearings, as distinguished from the prior conventional single pin. Further, the invention calls for seating the bearings preferably more fully in the lever part, and for constructing the lever part to have an increased girth or thickened portion where it receives the bearings. By use of the two ball bearings and the increased lever girth, the lever part may be provided with a unimpeded relatively long, longitudinal bore for accommodating with adequate room a coil spring and plunger assemblage constituting that lever portion which yieldably engages the movable switching part. Thus interference is avoided between the lever mounting on the one hand and the yieldable means of the lever on the other hand, while at the same time adequate space is had for these assemblages to be ruggedly constructed and to have the desired operating characteristics.

Other objects and advantages of the invention reside in an improved assembly method for a switch as above characterized, and an improved switch construction which has a relatively high capacity or rating, is simple in structure and assembly, economical to fabricate and trouble-free in operation.

Still other features and advantages will hereinafter appear.

In the drawings, which show one embodiment of the invention:

FIG. 1 is an enlarged fragmentary axial sectional view of the present improved toggle switch, taken in a place which contains the switch contacts and which is normal to the pivotal axis of the lever,

FIG. 2 is an enlarged fragmentary axial sectional view of the switch, taken in a plane which includes the pivotal axis of the lever, and

FIG. 3 is a transverse section, taken on the line 3–3 of FIG. 2.

The improved toggle switch of this invention comprises a usual type of molded plastic cup-shaped casing or housing 10 which includes a bottom wall 12 and sidewalls 14, said casing being provided with a usual U-shaped metal cover member 16 comprising a top closure plate 18 and depending sidewall portions 20.

Embedded in the bottom wall 12 of the casing 10 in a known manner are stationary switch contacts 22 and a saddle assemblage 24 on which latter there is rockably carried a usual type of metal switching member or teeter plate 26. The plate 26 has oppositely disposed side lugs 28 which are received between upstanding ear portions 30 of the saddle assemblage 24. It will be understood that tilting of the bridging or switching member 26 in one direction or the other will electrically connect the terminal of the saddle assemblage 24 with either of the two stationary contacts 22, as the case may be.

The tilting of the switching member 26 occurs in response to movement of a switch lever or handle part 32 which is pivotally mounted in an externally threaded mounting bushing or barrel part 34 secured to the closure portion 18 of the cover member 16 in the usual manner. The barrel part 34 also has the usual external, longitudinal keying slots 36, as seen in FIG. 1.

In accordance with the present invention, the pivotal mounting of the lever part 32 in the barrel part 34 is effected by the provision of two ball bearings 38 as distinguished from the prior conventional single pin mounting.

Additionally, the lever part 32 is constructed to have an increased girth or thickened portion 42 at the place where it receives the two pivot balls 38. By use of the two ball bearings 38 and the increased girth 42, the lever part 32 may now be provided with a relatively long longitudinal bore 44 for accommodating with adequate room a helical compression coil spring 46, and also a plunger member 48, the latter being provided with a head 50 adapted to engage the teeter plate or switching member 26 of the switch assemblage.

The relatively small ball bearings 38 as shown in FIGS. 2 and 3, do not extend into the longitudinal bore 44 of the lever but instead terminate short of such bore whereby there is avoided any obstruction between the pivotal lever mounting on the one hand and the yieldable means or plunger assemblage 46, 48 of the lever on the other hand. At the same time, adequate space is now had for the ball bearing pivot assemblage and for the plunger assemblage whereby these may be ruggedly constructed and arranged to have the desired operating characteristics. It will be noted that the coil spring 46 may have an appreciable length as illustrated, as well as that the plunger 48 may have great length whereby there is insured a smooth movement and an advantageous soft spring action, without any binding of the plunger which would inactivate it.

Preferably the balls 38 have a loose running fit in the enlarged portion 42 of the lever and are to an extent frictionally seized by the walls of the barrel part 34. As seen in FIG. 2, the barrel part 34 has aligned transverse apertures 52 constituting recesses or sockets for partially receiving the balls 38, and the portion 42 of the lever 32 has correspondingly aligned transverse apertures 54 constituting recesses or sockets for slidably receiving the balls. The apertures 54 are slightly larger than the balls 38 whereas the apertures 52 are of slightly smaller diameter than the balls 38.

The top end of the barrel part 34 has a flared mouth 56 in its bore to provide additional clearance for the lever 32, and also for assembly purposes later to be explained. Also, the configuration of the portion 42 of the lever is tapered or conical to provide the necessary clearance within the lower portion of the bore of the barrel 34.

The long bearing provided for the plunger 48 insures against the possibility of such plunger binding as it is retracted or advanced during the pivotal movement of the lever 34, and the

relatively great length of the coil spring 46 enables the latter to have the stated soft action while at the same time providing adequate bias to the plunger.

It will be observed from an inspection of FIG. 1 that the conical head portion 50 of the plunger 48 can have a sliding engagement with the top surface of the switching member 26. Such engagement results in appreciable lateral forces being exerted on the plunger 48. However, due to the relatively great length of the plunger and the long bearing which it has in the bore 44 of the lever 32, I have found that there is no binding of the plunger which could cause it to malfunction, even after an extended period of service in excess of 100,000 cycles of operation. Instead, the longitudinal movement of the plunger 48 is characterized by a smooth action, and the force exerted by the spring 46 will adequately extend the plunger as such movement is permitted by the positioning of the switching member 36. Accordingly, the deep longitudinal bore 44 in the lever 32, well past the pivotal area of the lever, insures a reliable action of the plunger while at the same time enabling a desirable simplicity to be had in the lever and plunger construction.

From FIGS. 2 and 3 it will be observed that the balls 38 are substantially each one-half contained in the lever 32 and sockets 54 thereof, and are each substantially less than one-half contained in the sockets 52 of the barrel 34, the latter being due to the smaller diameter of the apertures 52. Only a limited frictional seizing of the balls 38 in the sockets 52 occurs since the balls are of hardened steel and since the sharp edges of the sockets 52 do not bite into the balls but instead burnish over and permit sliding. However, complete turning freedom of the balls 38 in the sockets 54 is had. The balls 38 can press inward against the plunger 48 but they do not unduly restrain movement of the latter, as has been determined by actual extended testing. The polished ball and plunger surfaces undoubtedly are a factor in this action.

Referring to FIG. 2, the slip fit of the balls 38 in the walls of the lever 32 can be controlled as to snugness by exercising a control over the diameter of the transverse apertures 54 as well as over the outside diametric dimension of the balls. Ball bearings of the kind indicated are closely controlled as to their O.D. dimensions and accordingly with the construction shown a very snug slip fit may be had of the pivot balls 38 in the lever 32. The centering of the balls 38 in the smaller diameter apertures 52 eliminate slip therein, whereby there is provided a nonyielding sturdy pivotal support about which the lever 32 can pivot, without requiring the pivots to pass through the longitudinal bore 44 of the lever.

It will be seen that the plunger 48 locks the balls 38 in the illustrated pivotal positions, making it impossible to remove the lever 32 from the barrel 34 unless the plunger 48 is first removed from the lever.

Assembly of the lever and barrel may be advantageously effected as follows: The spring 46 is inserted in the lever 32 and thick grease is forced into the sockets 54. The balls 38 are pressed into the sockets 54, being retained therein by the grease which also retains the spring. This assemblage is then forced into the barrel 32 through the top or front end thereof. The taper 56 of the barrel cams inward the balls 38 between the spring convolutions. As the balls 38 reach the sockets 52 they are forced outward and into the latter by the spring which tends to return to its more compact, initial configuration. The plunger 48 is now inserted in the bore 44, displacing the spring 46 and occupying the space between the balls 38 whereby it locks the latter in their illustrated pivotal positions. Thereafter the assembled lever, barrel and plunger can be applied to the remainder of the switch, comprising the casing 10 and switching elements assembled thereto. The invention thus provides a novel and advantageous method of assembly of a switch of the instant kind, as distinguished from an assembly which contemplates inserting the balls from the exterior of the barrel 34 and thereafter displacing the material thereof to form sockets of reduced diameter for the balls.

It will now be understood from the foregoing that I leave provided a novel and improved toggle switch construction involving an operating lever, low friction pivotal mounting means for the same, and yieldable switch actuator constituting part of the lever, and a novel assembly method for the same. The construction provides adequate room for the various components without adverse interference, and enables a simple straightforward mechanical construction to be had with the attendant advantages of reliability and sturdiness of the pivotal mounting, together with a smooth yielding action of the spring-charged plunger.

Variations and modifications are possible, and portions of the improvement may be used without others.

I claim:

1. A toggle switch comprising, in combination:
a. a switch base,
b. a cylindrical mounting barrel part connected to said base, for mounting the same on a support,
c. an actuating lever part extending through said barrel part, one end of the lever part projecting from the barrel part for manual actuation,
d. said lever part having a pair of outwardly opening, oppositely disposed bearing sockets intermediate its ends,
e. said barrel part having in its inner surface a pair of inwardly disposed sockets registered respectively with the bearing sockets of the lever part, and
f. a pair of ball bearings disposed in the sockets of the barrel and lever parts, pivotally mounting the lever part in the barrel part,
g. the sockets of one of said parts having substantially circular line contacts with the associated ball bearings.

2. A switch as in claim 1, wherein:
a. the ball bearings are each substantially one-half contained in the sockets of the lever.

3. A switch as in claim 2, wherein:
a. the lever comprises an enlarged cross section at the location of the bearing sockets.

4. A switch as in claim 1, wherein:
a. the sockets of the lever comprise a transverse bore completely through the lever, in which bore the ball bearings are loosely received,
b. said lever having a longitudinal bore intersecting the transverse bore, said lever including a movable plunger carried in said longitudinal bore and engageable with a switch contact,
c. said plunger engaging the ball bearings in the transverse bore and constituting stops for said ball bearings.

5. A switch as in claim 4, wherein:
a. the ball bearings are each substantially one-half contained in the sockets of the lever.

6. A toggle switch comprising, in combination:
a. a switch base,
b. a mounting barrel connected to said base, for mounting the same on a support,
c. an actuating lever extending through said barrel, one end of the lever projecting from the barrel for manual actuation,
d. said lever having a pair of outwardly opening, oppositely disposed bearing sockets intermediate its ends,
e. said barrel having a pair of inwardly disposed sockets registered respectively with the bearing sockets of the lever, and
f. a pair of ball bearings disposed in the sockets of the barrel and lever, pivotally mounting the latter in the barrel,
g. said ball bearings being each substantially less than

7. A switch as in claim 6, wherein:
a. the sockets in the barrel comprise cylindrical bores,
b. said ball bearings having substantially circular line contacts with said barrel sockets.

8. A toggle switch comprising, in combination:
a. a switch base,
b. a mounting barrel connected to said base, for mounting the same on a support,

c. an actuating lever extending through said barrel, one end of the lever projecting from the barrel for manual actuation,
d. said lever having a pair of outwardly opening, oppositely disposed bearing sockets intermediate its ends,
e. said barrel having a pair of inwardly disposed sockets registered respectively with the bearing sockets of the lever, and
f. a pair of ball bearings disposed in the sockets of the barrel and lever, pivotally mounting the latter in the barrel,
g. said sockets of the lever comprising a transverse bore completely through the lever, in which bore the ball bearings are loosely received,
h. said ball bearings being each substantially less than one-half contained in the sockets of the barrel.

9. A toggle switch comprising, in combination:
a. a switch base,

b. a mounting barrel connected to said base, for mounting the same on a support,
c. an actuating lever extending through said barrel, one end of the lever projecting from the barrel for manual actuation,
d. said lever having a pair of outwardly opening, oppositely disposed bearing sockets intermediate its ends,
e. said barrel having a pair of inwardly disposed sockets registered respectively with the bearing sockets of the lever, and
f. a pair of ball bearings disposed in the sockets of the barrel and lever, pivotally mounting the latter in the barrel,
g. said ball bearings being each substantially one-half contained in the sockets of the lever, and being each substantially less than one-half contained in the sockets of the barrel.