United States Patent [19]

Ando

[11] **3,731,028**

[45] **May 1, 1973**

[54] **RELEASABLE LOCKING MECHANISM FOR PUSHBUTTON SWITCH WITH PILOT-LAMP ASSEMBLY**

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[30] **Foreign Application Priority Data**

Mar. 31, 1971 Japan 46/23077

[52] **U.S. Cl.** ..... **200/167 A,** 200/168 R

[51] **Int. Cl.** **H01h 9/02**

[58] **Field of Search** ..... 200/167 A, 168 R

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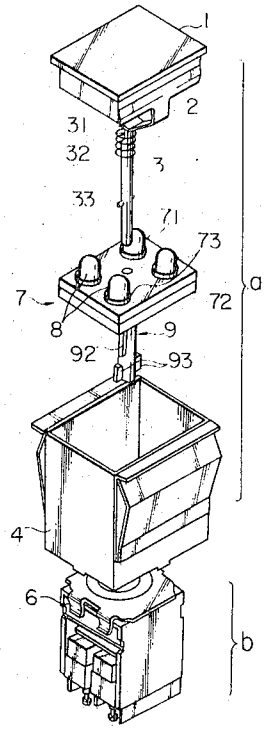
Assistant Examiner—William J. Smith
Attorney—Karl F. Ross

[57] **ABSTRACT**

A four-sided pushbutton **1** projecting from the top of a housing **4** is secured to a switch actuating rod **3** traversing a lamp holder **7** which supports the sockets of four pilot lamps **8,** this holder consisting of two superposed and fixedly interconnected plates **71, 72** rotatably bracketing a flange **91** of a guide sleeve **9** for the rod in axially fixed position with reference to the holder. Upon depression of the pushbutton, the lower end of the rod operates a switch structure *b;* a cross-pin **33** on the rod normally engages in a pair of diametrically opposite longitudinal slots **92** of the sleeve to entrain the latter rotatorily for detaching a pair of lugs **93** at the foot of the sleeve from respective shoulders **52** in a depending neck **5** of the housing whereby, upon sufficient withdrawal of the pushbutton from the housing to enable its rotation, the lamp holder, the sleeve and the pushbutton with its rod can be bodily extracted from the housing as the cross-pin rises to the top of the slots at the level of the flange **91** to bear from below upon the upper holder plate **71.** Such rotation is prevented in a lower position of the pin **33** by a projection **72***d* depending from the lower holder plate **72;** another projection **43,** rising from the housing bottom, coacts with the depending projection **72***d* to insure correct reinsertion of the extracted unit into the housing. Proper relative orientation of the pushbutton and the pilot lamps is insured by an indexing spring **74** which normally fits into an elongate notch **31** on one side of the rod **3** to allow depression of the pushbutton **1** but which falls into another, lower notch **34** on the opposite side of the rod, blocking a descent thereof, if the pushbutton is rotated in the wrong sense to re-engage the lugs **93** of the sleeve with the shoulders **52.**

8 Claims, 19 Drawing Figures



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6 Sheets-Sheet 1

Fig. 1

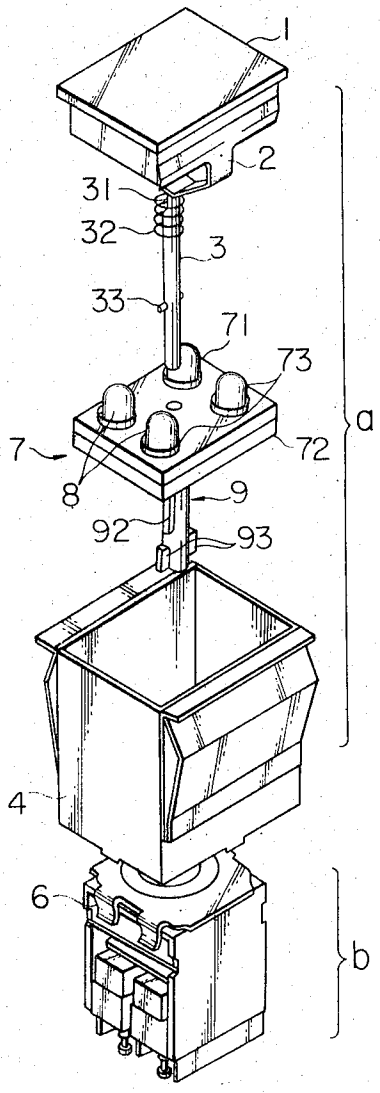
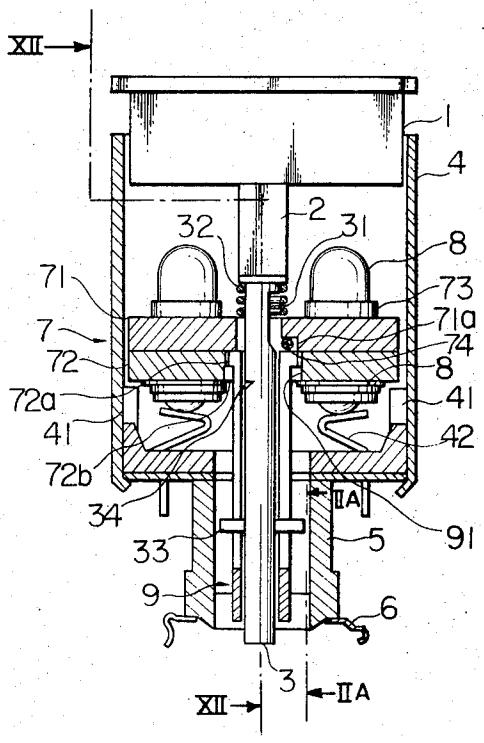


Fig. 2



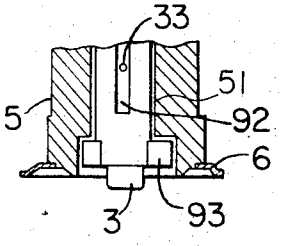


Fig. 2A

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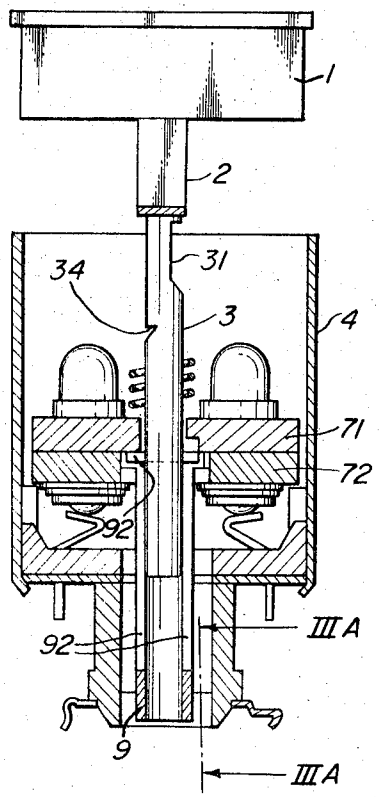
Fig. 3



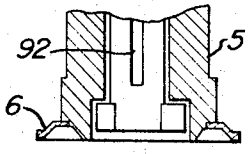
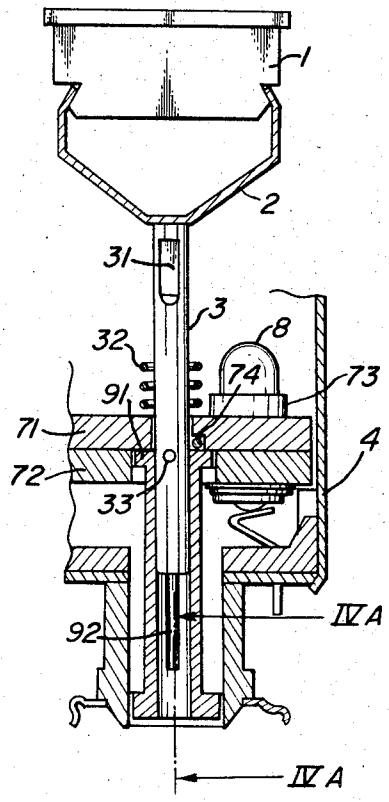


Fig. 3A

Fig. 4



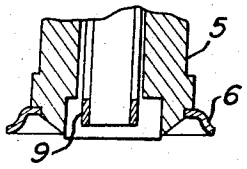


Fig. 4A

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Fig. 5

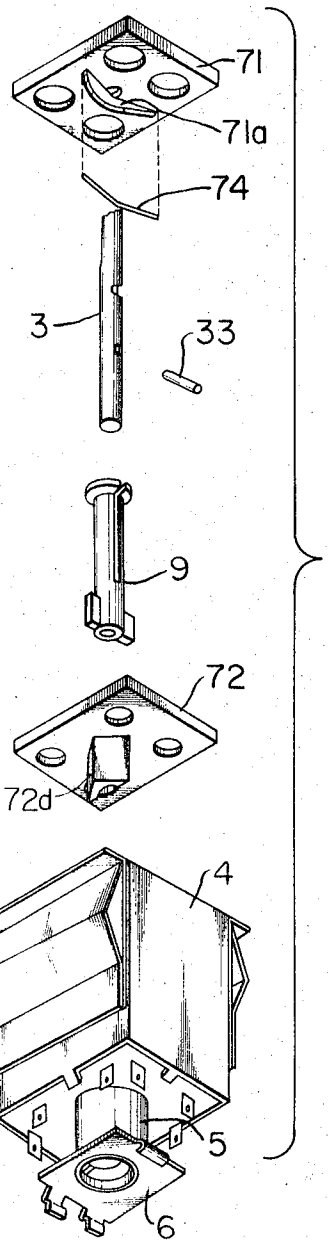

Fig. 6(A)

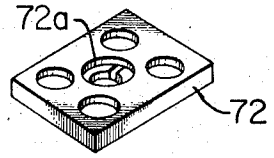

Fig. 6(B)

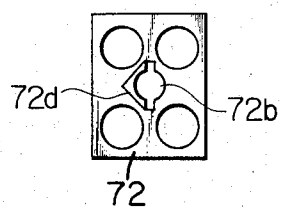

Fig. 7

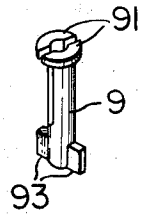

Fig. 8(A)

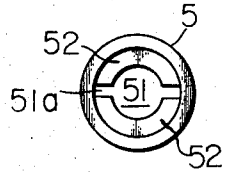

Fig. 8(B)

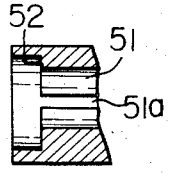

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Fig. 9

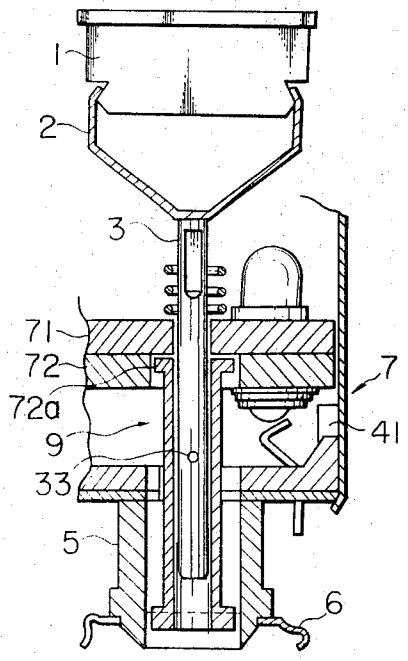

Fig. 10(A)

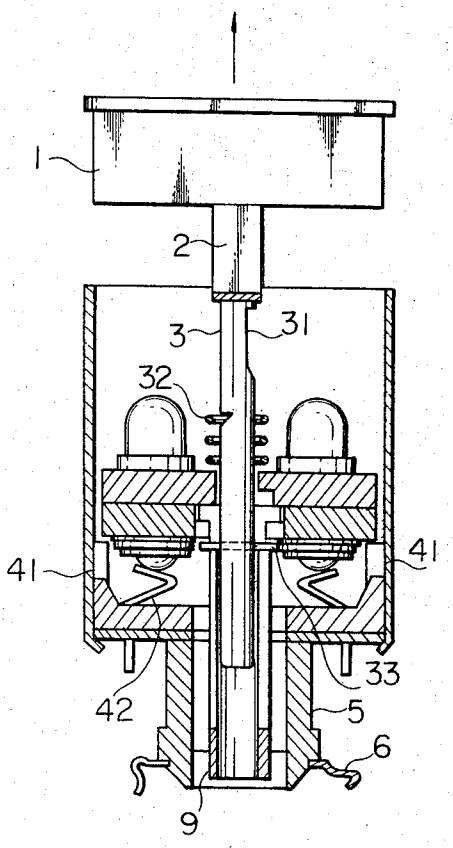

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Fig. 10(B)

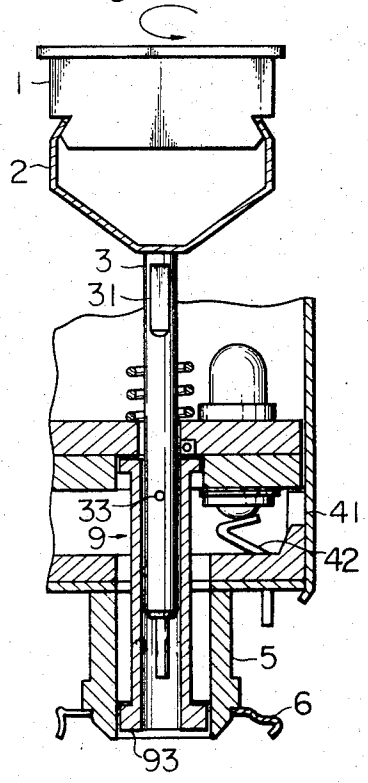

Fig. 11

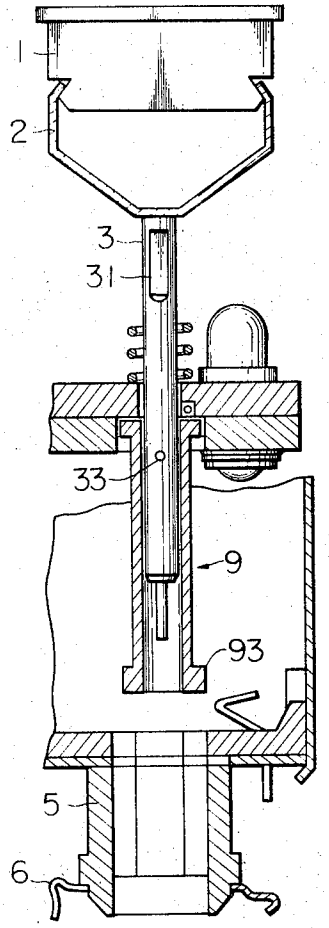

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Fig. 12

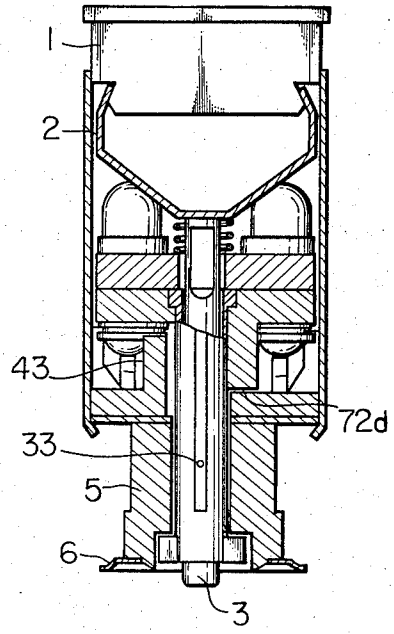
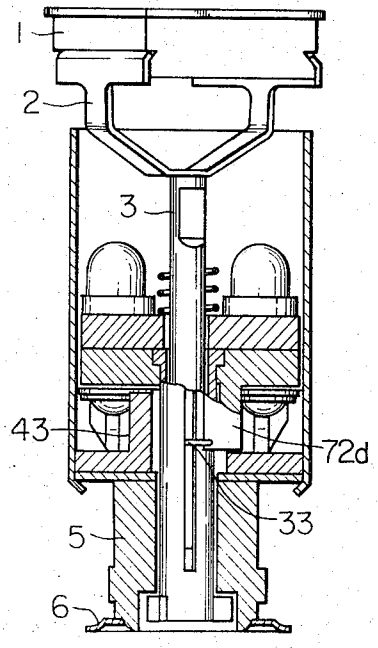


Fig. 13



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RELEASABLE LOCKING MECHANISM FOR PUSHBUTTON SWITCH WITH PILOT-LAMP ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to a pushbutton switch provided with pilot lamps.

A conventional pushbutton switch, having a plurality of pilot lamps disposed within the housing thereof, has the drawback that a special tool is necessary for changing the lamps which requires considerable effort; also, the switching mechanism is liable to be inadvertently actuated when the switch is remounted after the changing of a lamp.

OBJECTS OF THE INVENTION

The general object of my invention is to provide an easily actuatable and releasable locking mechanism for a pushbutton switch of the type described, serving to facilitate the extraction of the switch actuator and the pilot lamps from the housing for the purpose of replacement of a defective lamp.

A more specific object is to provide means in such locking mechanism for preventing any incorrect reinsertion of the extracted assembly into the housing.

SUMMARY OF THE INVENTION

These objects are realized, in accordance with my invention, by the provision of a lamp holder which is removably seated in the housing between a slidable pushbutton, projecting from one end (specifically the upper end) of the housing, and a switch structure at the opposite (lower) housing end, the pushbutton being secured to a push rod which traverses the lamp holder to operate the switch structure upon an inward (i.e. downward) depression of the pushbutton. A guide sleeve for this rod, normally coupled with it for joint rotation, is rotatably mounted on the lamp holder in an axially (i.e. vertically) fixed position and extends downwardly from the lamp holder, terminating in anchor means in the form of a pair of retaining lugs normally locking it to the housing. Rotation of the sleeve to release the retaining lugs from the housing is possible upon a removal of the pushbutton with its rod to a partly withdrawn (i.e. elevated) position in which a transverse formation on the push rod, such as a cross-pin, positively engages the lamp holder for enabling axial extraction of the pushbutton, rod, sleeve and lamp holder as a unit from the housing and subsequent reinsertion of the unit after replacement of one or more burnt-out lamps. The cross-pin, which forms part of the rotary coupling between the rod and the sleeve by being normally received in a pair of diametrically opposite longitudinal slots of the latter, has outwardly projecting tips engageable by blocking means in the form of a projection depending from the lamp holder to prevent rotation of the rod and sleeve whenever the pushbutton is in other than the aforedescribed partly withdrawn position, i.e. unless the pin is received in an annular recess formed in the lamp holder around the push rod; to this end the lamp holder advantageously comprises two vertically juxtaposed and rigidly interconnected plates between which this recess is formed, e.g. on the upper surface of the lower plate. Thus, the sleeve and the lamp holder retain their correct relative position during extraction to insure that the retaining lugs at the foot of the sleeve re-engage respective shoulders on the housing as the lamp holder returns to its seat.

According to another feature of my invention, misalignment of the lamp holder with the housing upon reinsertion is prevented by the aforementioned depending projection which confronts, upon incorrect insertion, a boss rising within the housing. In the correct position of the lamp holder, the rising boss and the depending projection are relatively offset.

Pursuant to a further feature of this invention, the push rod is provided on one side with an elongate notch engageable by detent means in the form of an arcuate spring, lodged within the lamp holder, in the proper relative angular position of the pushbutton and the lamp holder; another notch on the opposite side of the push rod, longitudinally (i.e. vertically) offset from the first one, is engageable by the detent spring in a diametrically opposite relative angular position to prevent operative insertion of the pushbutton into the housing if the cross-pin was rotated in the wrong direction within its annular recess during reanchoring of the sleeve to the housing.

BRIEF DESCRIPTION OF THE DRAWING

The above and other features of my invention will be described in detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is a perspective exploded view of a pushbutton switch embodying a locking mechanism according to this invention;

FIG. 2 is an axial sectional view of the pushbutton assembly of the switch shown in FIG. 1;

FIG. 3 is a view similar to FIG. 2 with the pushbutton assembly partly lifted from the normal position thereof;

FIG. 4 is a view of the pushbutton lifted into the partly withdrawn position of FIG. 3 but rotated by 90° with reference thereto;

FIGS. 2(A), 3(A) and 4(A) are fragmentary cross-sectional views taken on lines IIA—IIA, IIIA—IIIA and IVA—IVA of FIGS. 2, 3 and 4, respectively;

FIG. 5 is a perspective exploded view of the main elements of the switch;

FIGS. 6A and 6B are a perspective view and a plan view of a plate included in the assembly;

FIG. 7 is a perspective view of a guide sleeve forming part of the assembly;

FIGS. 8(A) and 8(B) are a bottom view and a fragmentary longitudinal section of a neck depending from the pushbutton housing;

FIGS. 9, 10(A), 10(B) and 11 are views similar to that of FIG. 3 illustrating various steps in disassembling and reassembling the switch;

FIG. 12 is a sectional view taken on the lines XII—XII of FIG. 2; and

FIG. 13 is another sectional view illustrating the operation of the locking mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1, the pushbutton switch according to my invention comprises an actuating portion *a* and a switch structure *b*.

The actuating portion *a* includes a transparent pushbutton **1** of rectangular outline having indicator markings (not shown) on the upper surface thereof. A bail-shaped handle **2** is clipped onto pushbutton **1** in such a manner as to be detachable therefrom transversely but not by axial motion. Fixed to this handle **2** is a push rod **3** for operating the switch structure *b*.

An upwardly open prismatic housing **4** has its underside secured to a neck **5** depending therefrom, neck **5** terminating in a base **6** gripping the switch structure *b*.

A lamp holder **7**, consisting of an upper plate **71** and a lower plate **72** fixed to each other (e.g. by ultrasonic welding), is removably inserted into the bottom portion of housing **4** so as to seat on lugs **41** provided within housing **4**. Push rod **3** is slidably guided through a keyhole **72***b*, formed in the lower plate **72**, and has an elongate notch **31** at one side engaged by an arcuate detent spring **74** which is fitted into an undercut **71***a* provided in the bottom surface of upper plate **71**. A return spring **32** is inserted between the upper surface of plate **71** and the bottom surface of handle **2**.

Each of four pilot lamps **8** is removably fitted from below into a respective socket **73** of lamp holder **7**, the bottom of each pilot lamp abutting one of several terminal strips **42** (only two shown) provided on the bottom of housing **4**.

A guide sleeve **9**, into which push rod **3** is slidably inserted, is formed at its top with a flange **91** received in an annular recess **72***a* on the upper surface of lower plate **72**, sleeve **9** being thus axially fixed with reference to lamp holder **7**. A pair of longitudinal slots **92** are formed in sleeve **9**, except for the lower portion thereof, and are slidably engaged by a cross-pin **33** which is fixed to push rod **3** and passes diametrically therethrough below notch **31**. Sleeve **9** is slidably guided in neck **5** and is provided at its foot with a pair of lugs **93** designed to clear a keyhole **51** and engage a corresponding pair of recessed shoulders **52** on the underside of neck **5** whereby lamp holder **7** is securely anchored to housing **4**.

Push rod **3** is furthermore provided with another notch **34** below notch **31** and diametrically opposite thereto, whereby the correct angular orientation of pushbutton **1** with reference to lamp holder **7** can be unequivocally determined as more fully described hereinafter.

The operation of this pushbutton switch will now be explained. In the operative condition of the switch as shown in FIG. **2**, lamp holder **7** is fixedly anchored to housing **4** by means of sleeve **9**, and push rod **3** is in a depressed position in which the notch **31** is engaged by the arcuate spring **74**. If pushbutton **1** is now pressed, push rod **3** is lowered against the force of spring **32** to protrude downwardly from the bottom end of sleeve **9** whereby the switching mechanism *b* is operated. When the pushbutton **1** be released, it is returned together with rod **3** to its elevated position by the restoring force of return spring **32**, this operation being generally similar to that of any conventional pushbutton switch.

If it is necessary to change any pilot lamps **8** that has been burnt out, spring **74** must first be cammed out of the downwardly beveled notch **31** by lifting the pushbutton **1** into a partly withdrawn position as shown in FIG. **3**. If pushbutton **1** is then turned counterclockwise by 90°, push rod **3** is rotated therewith as shown in FIG. **4**, and entrains the sleeve **9** because cross-pin **33** is engaged in the slots **92**, whereby the retaining lugs **93** step off the shoulders **52** to align themselves with diametrically opposite slits **51***a* of keyhole **51**. If pushbutton **1** is further lifted in this position, push rod **3**, sleeve **9** and lamp holder **7** will be lifted as a unit therewith to be disengaged from housing **4**. It may be noted that cross-pin **33** now bears from below upon the bottom surface of upper plate **71** which is therefore also lifted. Accordingly, any burnt-out pilot lamp **8** may readily be pulled out from its socket **73** to be replaced by a new one.

After replacement of the defective pilot lamp **8**, lamp holder **7** may be reinserted into housing **4** with all other parts reoccupying their original position; if pushbutton **1** is thereafter depressed, the relationship shown in FIG. **4** will be attained. In this condition, cross-pin **33** does not properly line up with keyhole **72***b* so that the downward movement of push rod **3** will be prevented. If pushbutton **1** is turned clockwise by 90° to rotate push rod **3** before being depressed, pin **33** will pass through keyhole **72***b* and sleeve **9** will also be turned to re-engage its retaining lugs **93**, which have passed through keyhole **51**, with shoulders **52** to prevent a withdrawal of sleeve **9** from keyhole **51** whereby lamp holder **7** will be held seated on lugs **41** by means of flange **91**.

If pushbutton **1** is further depressed in this position, push rod **3** will be lowered to make arcuate spring **74** enter the notch **31** so as to prevent a withdrawal of the rod unless an external force is applied thereto, thereby restoring the working condition shown in FIG. **2**. As the downward pressure necessary for this re-engagement is very slight, there will be no danger of untimely actuation of the switching mechanism *b*.

If, when lamp holder **7** is to be inserted into housing **4** after a pilot lamp **8** has been changed, push rod **3** were erroneously rotated counterclockwise by 90° with pushbutton **1** depressed, push rod **3** could not be lowered because arcuate spring **74** would enter the notch **34**, so that there is no danger that lamp holder **7** could be incorrectly positioned with reference to elements **1** – **3** whereby pilot lamp **8** would have a connection other than that marked on pushbutton **1**.

Additional means insuring correct reassembly include a boss or projection **43** rising from the bottom of housing **4**, and another projection **72***d* depending from the underside of lower plate **72** between the slots of keyhole **72***b*. Thus, if lamp holder **7** is normally positioned with respect to the housing, the two projections **43** and **72***d* are relatively offset by 180° about the axis of rod **3** and neck **5** (see FIG. **12**); if, however, lamp holder **7** were inserted into housing **4** in a position reversed with reference to its normal orientation, the two projections would buck each other so that lamp holder **7** could not be inserted any further into housing **4** so that terminal strips **42** would not reach the pilot lamps **8**. Furthermore, projection **72***d* permits push rod **3** to rotate with respect to lamp holder **7** only when cross-pin **33** is situated within recess **72***a* in lower plate **72**.

If projections **72***d* were omitted, pushbutton **1** might be rotated counterclockwise by 90° (FIG. **9**) without having been sufficiently lifted to let the pin **33** pass through keyhole **72***b* into contact with the underside of

upper plate 71 within recess 72*a*, whereby a subsequent upward pull as shown in FIG. 10(A) would bring the pin 33 up against the underside of lower plate 72 as shown in FIG. 10 (B). In this case the lamp holder 7 would be slidable with respect to push rod 3 between cross-pin 33 and handle 2. Accordingly, of lamp holder 7 were then reinserted into lamp holder 7, push rod 3 would be lowered but lamp holder 7 would not be positively entrained by pin 33; sleeve 9 would therefore tend to remain above the level at which its lugs 93 could engage the shoulders 52, resulting in unsatisfactory contact between pilot lamps 8 and terminal strips 42. However, with the tips of pin 33 sliding along the vertical edges of projection 72*d* as shown in FIG. 13, a rotation of pushbutton 1 is prevented until that pin 33 has been raised to the level of recess 72*a* and positively interlocks with lamp holder 7 for joint axial displacement.

I claim:

1. A pushbutton switch comprising:

a housing;

a pushbutton slidably held in said housing and projecting from one end thereof;

switch means secured to said housing at the opposite end thereof;

a lamp holder removably seated in said housing;

a guide member rotatably mounted on said lamp holder in axially fixed position, said guide member extending from said lamp holder toward said opposite end;

a push rod guided in said member and secured to said pushbutton, said rod traversing said lamp holder for operating said switch means upon inward depression of said pushbutton;

coupling means normally interconnecting said rod and said guide member for joint rotation, said guide member being provided with anchor means normally locking same to said housing, said anchor means being releasable upon rotation of said guide member through a predetermined angle relative to said housing, said coupling means including a transverse formation on said rod positively engageable with said lamp holder in a partly withdrawn position of said pushbutton and said rod for enabling axial extraction of said pushbutton, rod, guide member and lamp holder from said housing as a unit and subsequent reinsertion of said unit into said housing; and

blocking means on said lamp holder engageable with said formation for preventing rotation of said guide member and rod in a position other than said partly withdrawn position, thereby inhibiting the release of said anchor means until said formation positively engages said lamp holder.

2. A pushbutton switch as defined in claim 1 wherein said guide member is a sleeve and said formation is a cross-pin received in a pair of diametrically opposite longitudinal slots of said sleeve upon inward displacement of said pushbutton from said partly withdrawn position.

3. A pushbutton switch as defined in claim 2 wherein said cross-pin has tips projecting outwardly through said slots, said blocking means comprising a projection extending from said lamp holder toward said opposite end and engaging said tips upon inward displacement of said pushbutton from said partly withdrawn position.

4. A pushbutton switch as defined in claim 3 wherein said lamp holder comprises a first plate confronting said one end and a second plate confronting said opposite end, said plates being fixedly interconnected and forming between them an annular recess around said rod communicating with said slots, said cross-pin being rotatable in said recess upon removal of said pushbutton to said partly withdrawn position.

5. A pushbutton switch as defined in claim 4 wherein said housing is provided with a boss normally offset from said projection but confronting same upon angular misalignment of said lamp holder with said housing.

6. A pushbutton switch as defined in claim 5 wherein said cross-pin is rotatable in said recess in either direction, further comprising resilient detent means on said lamp holder, said rod being provided on one side with an elongate notch engageable by said detent means in a correct relative angular position of said pushbutton and said lamp holder, said rod being provided on the opposite side with another notch longitudinally offset from said elongate notch for engagement by said detent means to prevent operative insertion of said pushbutton in an incorrect position thereof relative to said housing.

7. A pushbutton switch as defined in claim 6 wherein said detent means comprises an arcuate spring received in an undercut of said first plate adjacent said recess.

8. A pushbutton switch as defined in claim 7 wherein each of said notches has a beveled edge remote from said pushbutton to enable outward camming of said arcuate spring upon removal of said pushbutton to said partly withdrawn position.

* * * * *