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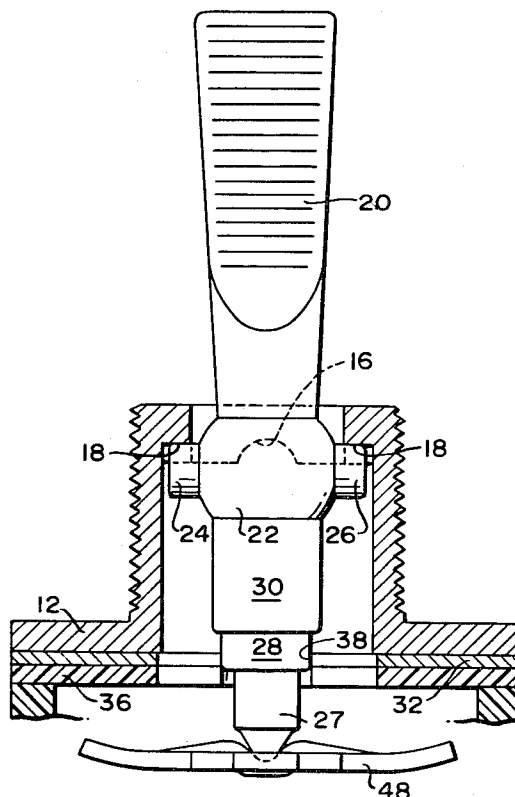
[54] **LOCKING TOGGLE SWITCH**
8 Claims, 10 Drawing Figs.

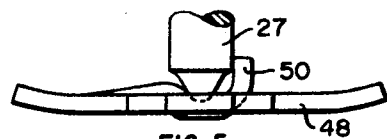
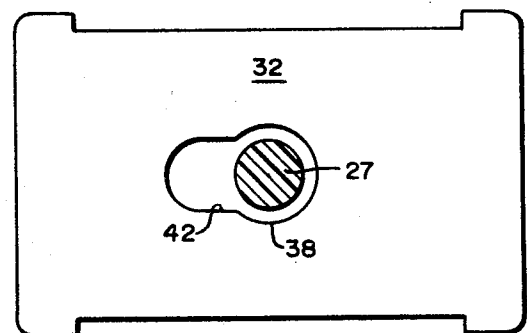
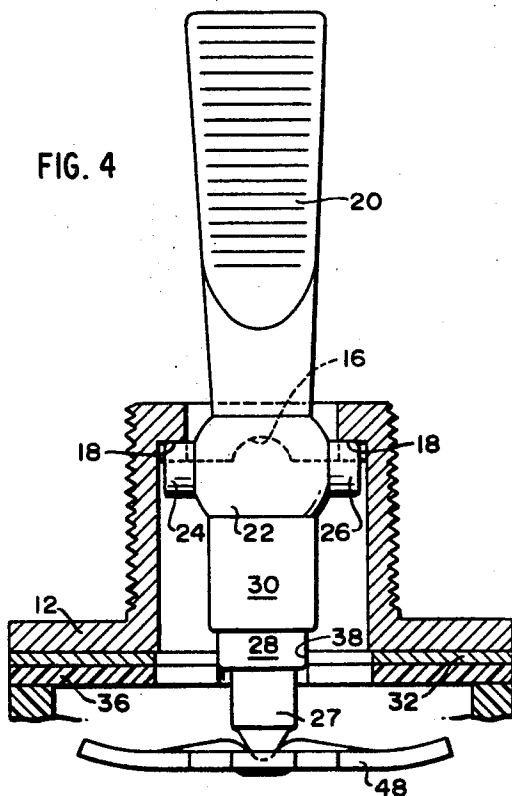
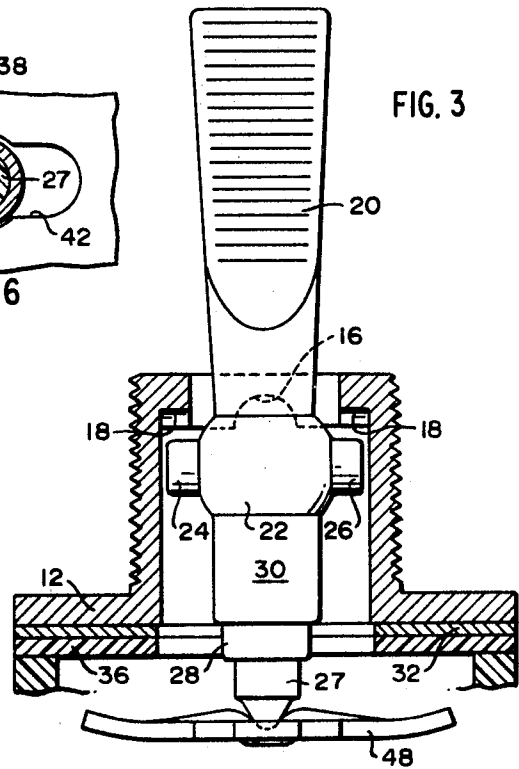
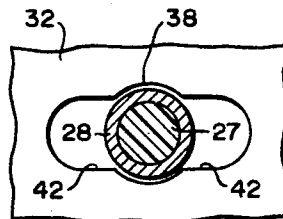
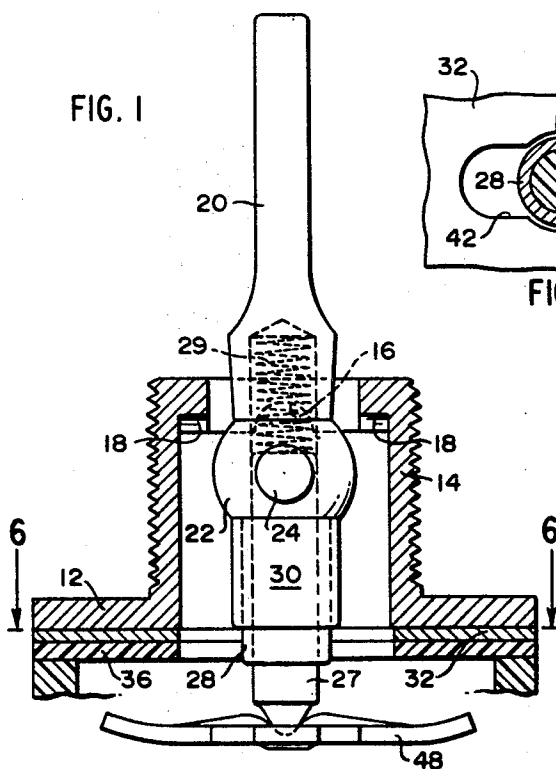
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ABSTRACT: A toggle switch designed to prevent accidental actuation. The switch may be locked against operation by pushing the toggle into the body of the switch and turning it through 90°. Conversely, the toggle must be pushed and twisted through 90° to return the toggle from the locked position into the normal operating position. The mechanism by which the locking feature is obtained utilizes the toggle pivots and operating grooves normally found in toggle switches but adds a second set of grooves perpendicular to the normal operating grooves and into which the toggle pivots may be shifted. The conventional spring used for plunger pressure in a toggle switch also serves to hold the toggle pivots in either set of grooves. In an alternative embodiment, the switch may be of the double-throw type capable of being locked in any position, the toggle being captured in the same manner as in the single-throw version by being pushed into the body of the switch and turned through 90°.





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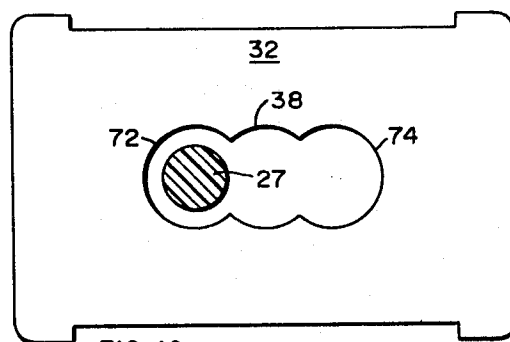
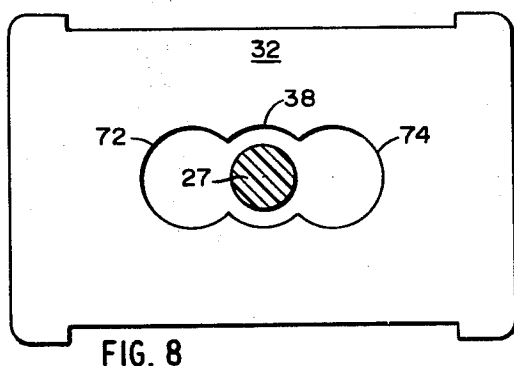
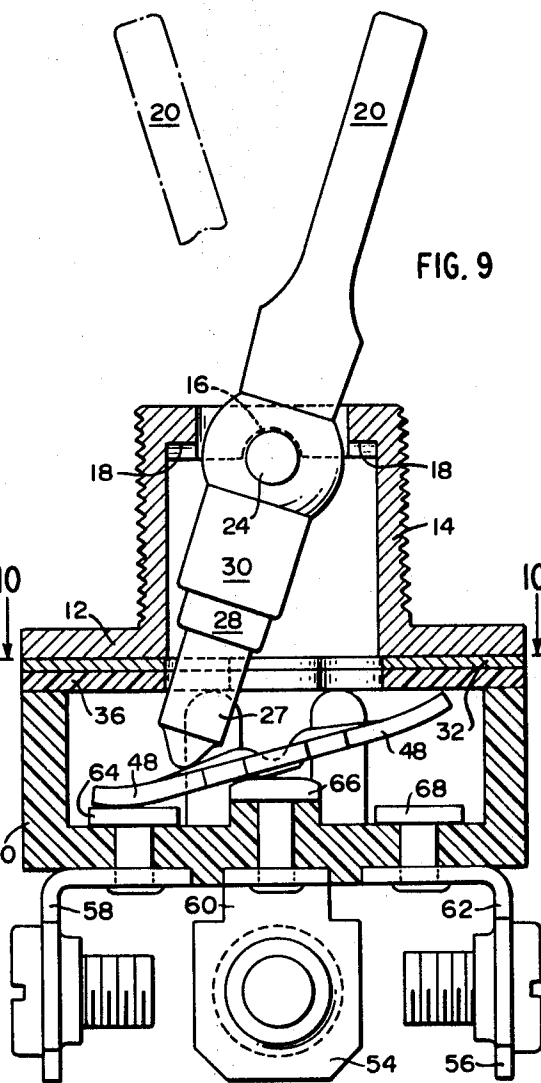
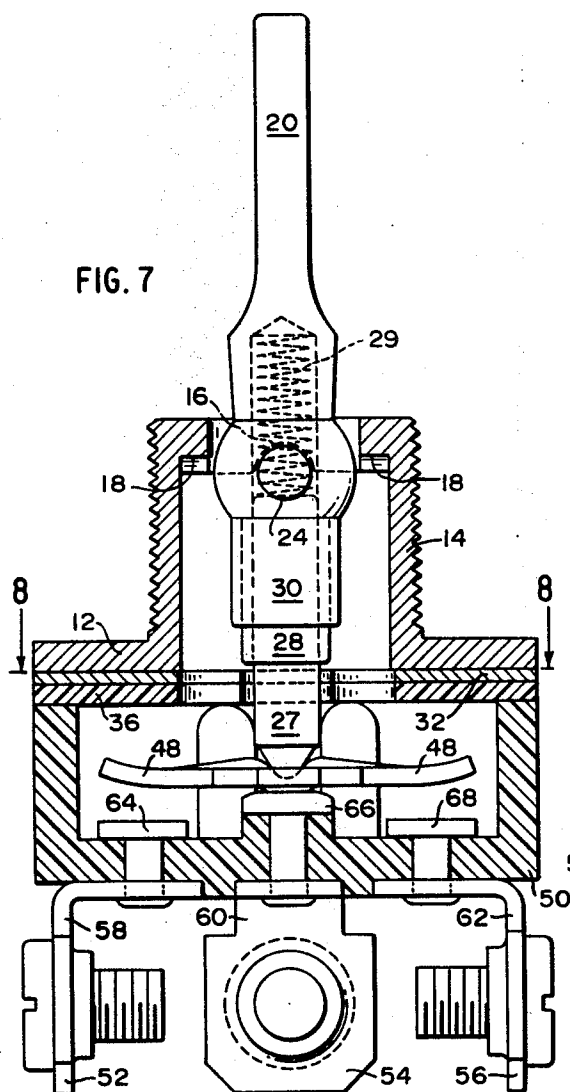


FIG. 10

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LOCKING TOGGLE SWITCH

BACKGROUND OF THE INVENTION

Perhaps the most common switch in use is the toggle switch which finds application in innumerable devices. Also, of course, the varieties of toggle switches in use are almost unlimited. However, in some situations accidental actuation of a toggle switch can lead to unfortunate or even disastrous consequences. It is in such environments that the present invention finds its greatest utility. Certainly, for example, it is desirable to prevent the accidental actuation of a toggle switch in an aircraft control, and it may be equally important to prevent such accidental actuation of a toggle switch on an electrical control board or even on a chain saw.

The danger of accidental actuation of a toggle switch is inherent because of its protruding handle, and that fact has not gone unrecognized. Numerous protective devices have been designed and sold to avoid the problem. Unfortunately, however, most such devices are complex, and they are frequently expensive. For example, a toggle switch provided with a hinged cover that must be lifted before the toggle may be actuated has achieved some acceptance in the market, but it is relatively expensive, wasteful of material and inconvenient for many installations.

SUMMARY OF THE INVENTION

In overall external appearance, the embodiments of the present invention are similar to conventional toggle switches. The locking feature is internally incorporated in the toggle switch, and no additional external members are required with the possible exception of a faceplate on which operating instructions may be printed. Moreover, the locking feature may be built into any type of switch irrespective of the number of poles or whether or not the switch is single-throw or double-throw. The switching action may be momentary contact or maintained contact. In its simplest form the switch has an "OFF" position in which the toggle extends vertically from the switch housing, and that is the position in which locking is provided. In other more elaborate forms locking may also be had in "ON" positions. It is also desirable for ease of operation that a flat toggle handle be used.

The basic upper housing of the switch may be die-cast with a threaded stem extending from the upper surface of the upper housing. Within the upper housing and on the bottom surface of the stem, two sets of aligned grooves are formed in such a fashion that one set of aligned grooves is perpendicular to the other. The set of grooves corresponding to those normally used for operating the toggle is formed in the usual manner, and the set of grooves perpendicular to the conventional grooves is somewhat shallower for reasons detailed below. The toggle itself is preferably a conventional flat-handled toggle which is modified by the formation of two steps or shoulders at points beneath the spherical pivoting section.

In the basic embodiment of the invention a steel plate slotted to accommodate and guide the plunger of the toggle is provided in the assembly, as is an insulation plate having the same configuration. In both plates, the center of the slot is enlarged to form a round opening through which first step or shoulder on the toggle may pass, the second step or shoulder limiting the extension of the toggle through the central opening in the steel plate.

In alternative forms of the invention, the locking and insulation plates have three aligned intersecting openings in each one of which the toggle may be captured.

For a better understanding of the present invention, the following detailed description of preferred embodiments of the invention should be read with reference to the attached drawing in which:

FIG. 1 is a sectional elevation of single-pole, single-throw toggle switch incorporating the locking feature of the present invention;

FIG. 2 is a view of a locking plate useful in a toggle switch such as that of FIG. 1;

FIG. 3 is a view in section of the toggle switch of FIG. 1, the toggle being turned through 90°;

FIG. 4 is a further sectional view of the embodiment of FIG. 1 and 2, the toggle, however, being in the locked "OFF" position;

FIG. 5 is a view of a rocking wiper for use in a toggle switch; FIG. 6 is an alternative form of the locking plate of FIG. 2;

FIG. 7 is a view in section of a double-throw switch incorporating the invention;

FIG. 8 shows the locking plate preferred for the switch of FIG. 7, the toggle being centered;

FIG. 9 shows the switch in section at 90° to the view of FIG. 7, the toggle having been actuated, and

FIG. 10 shows the position of the toggle relative to the locking plate in the unlocked actuated position.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1 and 2 there may be seen a die-cast upper housing member 12 from the upper surface of which a threaded hollow stem 14 extends. At the base of the stem, recessed within the housing member 12, two sets of aligned grooves are formed, a relatively deep set of grooves running perpendicular to the long dimension of the housing member 12, and the other relatively shallow set of grooves running parallel to the long dimension of the housing member 12 and perpendicular to the first set of grooves. These grooves may be designated the operating grooves 16 and the locking grooves 18. A toggle having a flat handle 20 extends through and is retained in the stem 14. Immediately below the flat handle 20 is a generally spherical pivot base 22 from which pivot pins 24 and 26 extend at diametrically opposite points.

The toggle terminates in an insulating plunger 27 which is inserted in the hollow toggle body 28. A compression spring 29 within the hollow toggle body permits the plunger 27 to be pushed or telescoped into the toggle body when pressure is exerted against the extremity of the plunger.

The outer cylindrical toggle body may be formed with an enlarged length 30, or a sleeve may be pressed over it to form the enlarged length. As a result, two shoulders are formed, one where the plunger emerges from the toggle body and one where the toggle body 28 meets the enlargement or sleeve 30.

A rectangular plate 32, preferably of hardened steel, fits within tabs, (not shown), on the lower surface of the upper housing member 12 for alignment. A similar plate 36 made of insulating material fits beneath the plate 32. Similar circular central openings 38 are formed in the plates 32 and 36. These openings are aligned and are of a diameter slightly larger than that of the toggle body 28. A slot 42 extends outwardly along the long dimensions of the plates, and it is of a width slightly greater than the diameter of the plunger 27 and slightly less than that of the toggle body 28.

A rocking wiper 48 is disposed in a lower housing or switch body 50 which may be joined to the upper housing member 12 in any conventional manner. The wiper is arranged to assume either of two positions and, in one position, it completes a circuit between contact points disposed in the lower housing 50. As is conventional in the toggle switch art, the pivoting of the toggle causes the wiper to rock, the spring-biased plunger imparting an overcenter snap action.

In both FIGS. 1 and 2, the toggle is shown pressed into the switch body, and the toggle body 28 is captured in the opening 38. In FIG. 4, however, the toggle has been allowed to respond to the pressure of the spring 29, and the pivot pins 24 and 26 are disposed in the locking grooves 18. The grooves 18 are shallower than the operating grooves 16, and the toggle body 28 is captured in the opening 38 of the plate 32.

FIGS. 5 and 6 illustrate alternative components that may be used for the wiper 48 and the rectangular plates 32 respectively. Of course, the insulating rectangular plate 36 would match the locking plate 32, having the same outline in the alternative embodiment as that shown in FIG. 6. Switching and locking action are the same as in the preferred embodiment. However, the plate 32 has a slot extending in both directions along its

long dimension and the wiper 48 has a stop tab 56 struck up from its upper surface to prevent the plunger 27 from moving beyond the central opening in a direction opposite to that in which switching contact is made.

Understanding of the operation of the single-throw toggle switch described is aided by a consideration of some typical dimensions. For example, considering the toggle plunger 27, its outside diameter is small enough to clear the width of the slot 42, the slot having a width of 0.072 inches to 0.076 inches. The toggle body 28 has an outside diameter greater than the slot width and, in fact, may be 0.154 inches to 0.160 inches. The enlarged section or sleeve 30 may be 0.186 inches to 0.192 inches.

The opening 38 in which the toggle body 28 is designed to be captured may be 0.164 inches to 0.170 inches. Of course, the length of the toggle, especially from the pivot pins to the end of the toggle body 28, must be calculated with the difference of the depths of the respective sets of grooves 16 and 18 in mind in order that capture and release of the toggle body 28 from the opening 38 occurs depending upon whether the pivot pins are in the locking grooves 18 or in the operating grooves 16. Also, the distance that the toggle body 28 extends from the sleeve 30 is of importance to maintain necessary clearance in switching action and to limit the insertion of the toggle body 28 into the opening 38 when the toggle is pushed into the switch body to initiate or terminate locking action.

In FIG. 7 through 9, a double-throw version of the locking switch is illustrated. The double-throw switch could, of course, have the same features as the single-throw switch described above; that is, the locking feature could be incorporated only in the central or "OFF" position. However, as is explained in greater detail below, locking is available in the illustrated embodiment not only in the central "OFF" position but also in the two "ON" positions.

Many of the individual components of the double-throw switch are similar to their counterparts in the single-throw switch, and they have been numbered accordingly. Some additional detail is also shown in order that the operation of the double-throw switch may be more easily comprehended. For example, the lower housing 50 and the method by which electrical connection is made through the lower housing is shown in greater detail. The housing 50 may be of any one of numerous insulating materials such as Bakelite and three electrical terminals 52, 54, and 56 carried by suitable L-shaped brackets 58, 60, and 62 respectively are riveted through the bottom of the lower housing 50. The rivet caps 64, 66, and 68 serve as electrical contact points within the switch.

In FIG. 7, the switch is shown in the "OFF" position but the pivot pins, of which pin 24 may be seen, are held in the operating grooves 16 by the action of the spring 29. The switch is unlocked and ready for actuation as shown. In FIG. 9, the switch is shown after actuation. It will be noted that the wiper 48 is in contact with the electrical contact point 64. Of course, the central area of the wiper arm remains in contact with the electrical contact 66 to complete a circuit through the terminals 52 and 54. Of course, if the toggle 20 is thrown in the opposite direction, as shown in phantom in FIG. 9, the wiper 48 is in electrical contact with the contact point 68 to establish a circuit through the terminals 54 and 56.

The mechanism by which locking is achieved in each of the three positions may be better understood by a consideration of FIG. 8 and 10. FIG. 8 is a section, as noted, taken along the lines 8—8 of FIG. 7. The plunger 27 may be seen to be centrally disposed in the enlarged central opening 38 which, of course, is continuous through the locking plate 32 and the insulating plate 36. However, in this instance, the opening consists of three circular enlargements which meet and overlap to some extent. To one side of the enlarged central opening 38 is another enlargement 72 and to the other side of the enlarged central opening 38 is a third enlargement 74. If it is desired to lock the switch in the "OFF" positions, the toggle 20 is turned through 90° and pushed into the body of the switch causing the toggle body 28 to enter the opening 38. When the toggle is

permitted to rise from the body of the switch, the pivot pins become engaged in the locking grooves 18 which, being shallower than the operating grooves 16, do not permit the toggle body 28 to clear the opening 38. Thus, the toggle body 28 is captured by the locking plate 32, and the switch is incapable of actuation in that position.

In similar manner, as may be appreciated by a consideration of FIG. 9 and 10, the switch may be locked in an "ON" position by turning the toggle through 90° and once again permitting the pivot pins to rise into and become engaged by the locking grooves 18. In FIG. 10, as in FIG. 8, the plunger 27 may be seen to clear the opening 72 in the same manner as it clears the opening 38. In fact, the plunger 27 is sufficiently small that it will clear the narrowest width where the circular openings meet. However, when locking is desired, the toggle body 28 is captured by the opening 72 to hold the switch in the "ON" position in exactly the same manner as the switch is held in the "OFF" position by engagement of the body 28 by the opening 38. Of course, the same result is attained when the toggle is in the phantom position shown in FIG. 9, in which position the toggle body 28 is captured by the enlarged circular opening 74 in the locking plate.

Preferred embodiments of the invention have been shown and described. However, as will be obvious upon a reading of the foregoing specification, the concepts underlying the invention are applicable to numerous varieties of toggle switches. Only minor modifications would be required to utilize the invention in multiple pole switches either of the three-position or two-position type. Similarly, momentary or maintained contact is possible as are combinations of the two. The invention should be limited only by the scope of the appended claims.

1. A locking toggle switch comprising a lower housing, electrical contacts and a cooperating wiper disposed in said lower housing, second a toggle having oppositely extending pivot pins formed thereon and an end disposed in said lower housing for actuating said wiper, an upper housing, means for supporting said pivot pins in said upper housing in one plane to permit pivoting motion of said toggle and actuation of said wiper and means for supporting said pivot pins in said upper housing in a second plane normal to said one plane means disposed in said upper housing for capturing said toggle when said pivot pins are disposed in said second means to lock said toggle against pivoting motion and said wiper against actuation.

2. A toggle switch as defined in claim 1 wherein said means for supporting said pivot pins in said one plane comprises a first set of relatively deep aligned grooves formed within said upper housing, said pivot pins being rotatable in said first set of aligned grooves.

3. A toggle switch as defined in claim 2 wherein said means for supporting said pivot pins in a second plane to lock said toggle comprise a second set of relatively shallow aligned grooves normal to said first set of aligned grooves formed within said upper housing.

4. A toggle switch as defined in claim 3 wherein said toggle-capturing means comprises means forming an opening, said toggle including an enlarged section, said enlarged section extending into said opening when said pivot pins are disposed in said second set of aligned grooves.

5. In a locking toggle switch having an upper and a lower housing, a toggle, electrical contacts and a wiper disposed in said lower housing and having an end of said toggle disposed in said lower housing to actuate said wiper, the combination of a rectangular plate disposed in said upper housing and having a generally keyhole-shaped opening formed therein, the larger circular portion of said keyhole being adjacent the said pivot of said plate and said housing, the smaller slotted portion of said keyhole-shaped opening extending longitudinally and centrally of said plate, said toggle having a plunger of diameter smaller than the width of said slot extending therethrough and contacting said wiper, said toggle having a cylindrical body surrounding said plunger and being of diameter larger than the width of said slot and smaller than the diameter of said central

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opening, said toggle also having a pair of pivot pins extending oppositely outward from the body thereof, said upper housing having a first set of relatively deep aligned grooves formed in a lower surface thereof to accommodate said pivot pins, said toggle body being free of said central opening when said pivot pins are disposed in said first set of aligned grooves, said upper housing also having a second set of relatively shallow aligned grooves formed in a lower surface thereof in a plane perpendicular to that of said first set of aligned grooves, said cylindrical body of said toggle extending into said central opening when said pivot pins are disposed in said second set of aligned grooves, whereby said toggle may be pivoted to actuate said wiper when said pivot pins are disposed in said first set of aligned grooves and is locked against pivoting when said pivot pins are disposed in said second set of aligned grooves.

6. In a locking toggle switch having an upper and a lower housing, a toggle, electrical contacts and a wiper disposed in said lower housing and having an end of said toggle disposed in said lower housing to actuate said wiper, the combination of a plate disposed between said upper and lower housing having a slot which includes an enlarged central opening formed therein, first means for supporting said toggle in said upper housing, an end of said toggle being disposed in and normally

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free to move in said slot to permit actuation of said wiper, said toggle having an enlarged section above said end, and second means displaced from said first means for supporting said toggle in said upper housing with said enlarged section captured in said enlarged central opening.

7. In a locking toggle switch as defined in claim 6, the combination wherein said pivot means for supporting said toggle comprises relatively deep grooves in a lower surface of said upper housing, said toggle having pivot pins extending therefrom and rotatable in said grooves, said second means comprising relatively shallow grooves formed in said lower surface.

8. In a locking toggle switch as defined in claim 4, the combination wherein said toggle-capturing means comprises a plate disposed in said upper housing, said plate having a plurality of openings formed therein, said openings constituting overlapping circular apertures the narrowest widths of which are narrower than said enlarged section, said openings each being of greater diameter than that of said enlarged section, whereby said toggle is immovable from any of said openings when said pivot pins are disposed in said second set of aligned grooves.

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