

Nov. 29, 1966

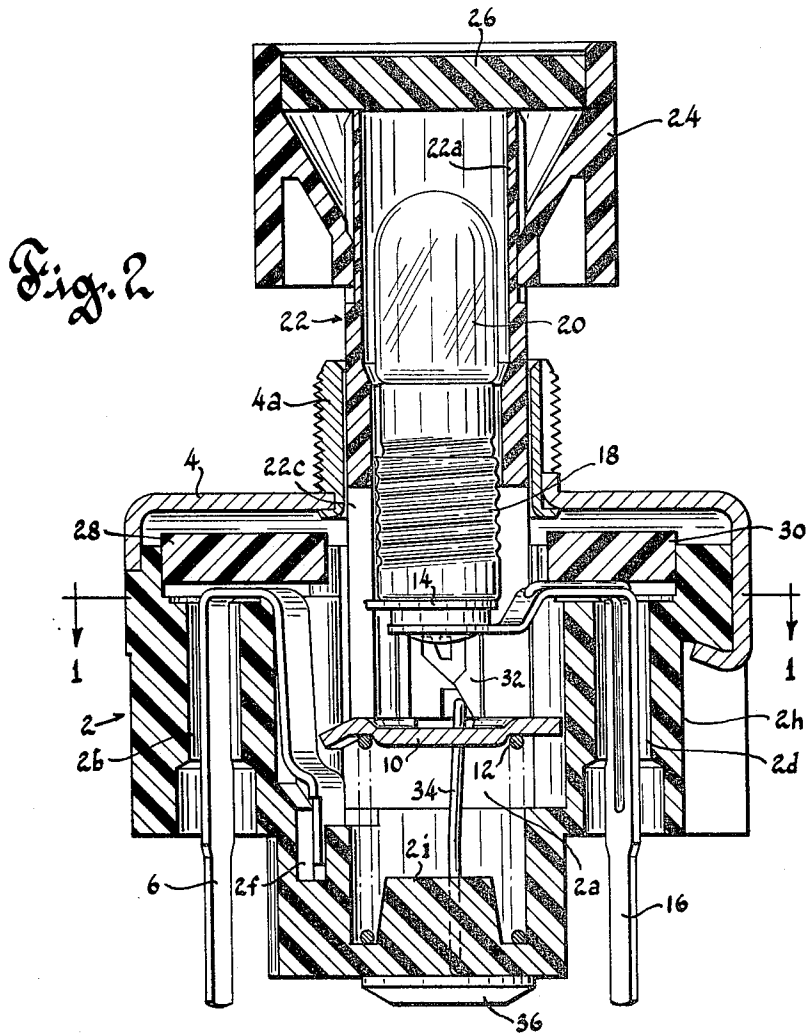
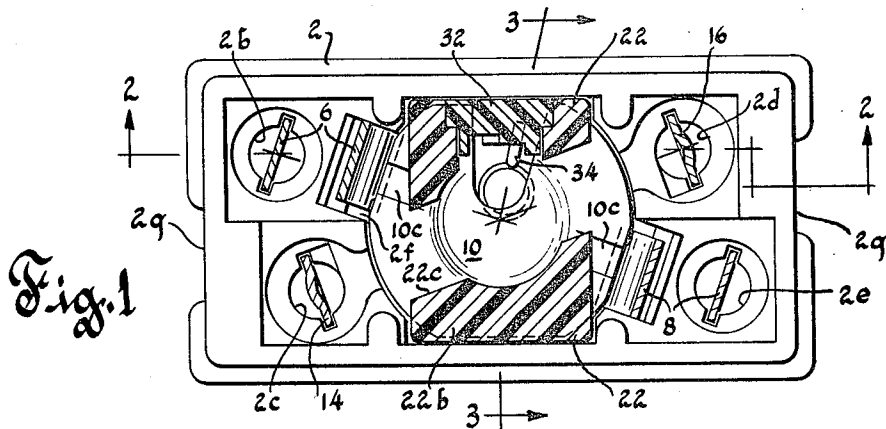
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3,288,973

PUSH-PUSH SWITCH CONVERTIBLE TO MOMENTARY SWITCH

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

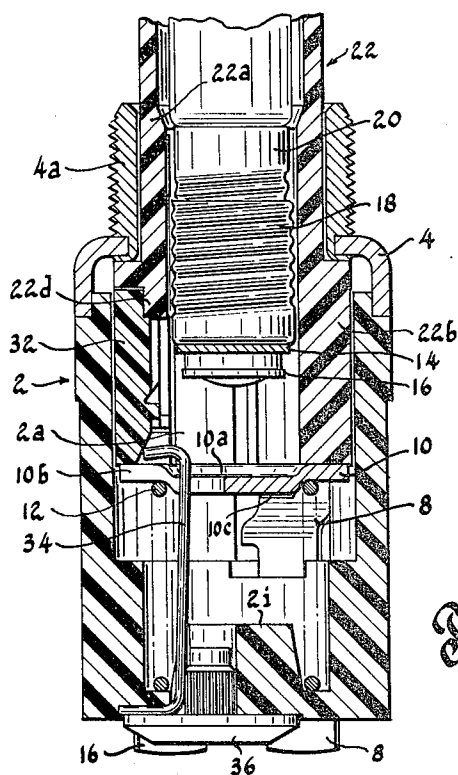


Fig. 3

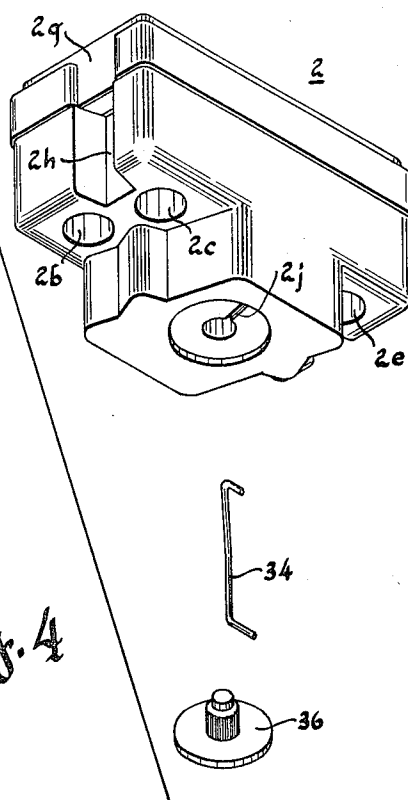


Fig. 4

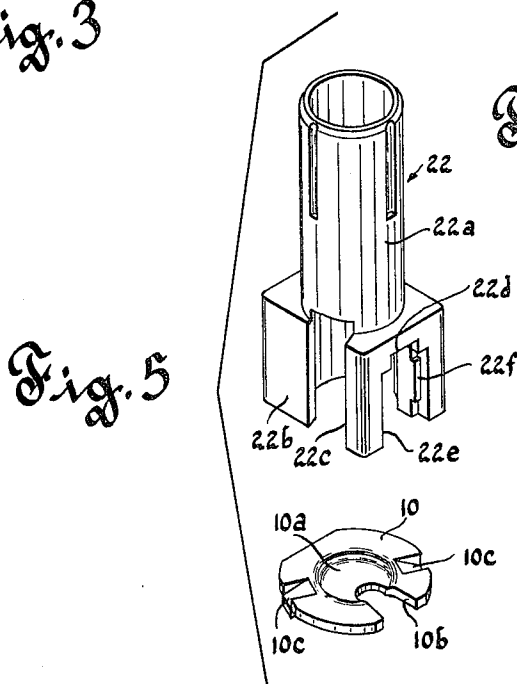


Fig. 5

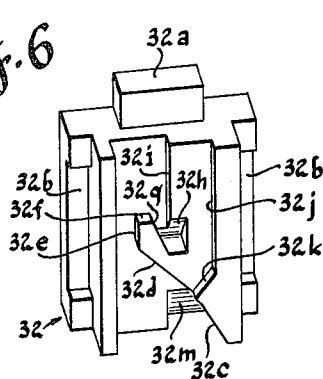


Fig. 6

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This invention relates to pushbutton switch mechanisms and more particularly to pushbutton switch latching mechanisms of the push-to-latch and push-to-unlatch type.

While not limited thereto, the invention is especially applicable to converting pushbutton switches of the spring biased plunger type from momentary operation to push-push operation.

An object of the invention is to provide an improved pushbutton switch mechanism for latching a reciprocable member.

A more specific object of the invention is to provide an improved latch mechanism for alternately latching and releasing a spring biased reciprocable switch plunger upon successive actuations thereof.

Another specific object of the invention is to provide an improved latch mechanism for a push-push switch.

Another specific object of the invention is to provide a pushbutton switch with improved means for alternately latching and releasing the plunger on successive depressions thereof.

Another specific object of the invention is to provide an improved push-push switch which can readily be converted into a momentary pushbutton switch.

Another specific object is to provide an insertable latch mechanism of utmost simplicity for a plunger switch.

Another specific object of the invention is to provide means for converting a momentary pushbutton switch to a latching push-push switch with minimum modifications.

A further specific object is to provide a push-push switch mechanism which is simple in construction and easy to assemble.

Other objects and advantages of the invention will hereinafter appear.

According to the invention, there is provided for a pushbutton switch an insulating base having a central switch cavity therein and a plurality of terminal openings on opposite sides of the cavity. A pair of stationary contact-terminals have contacts hanging into the cavity and terminals hanging through a pair of openings below the base. A return spring rests in the cavity and supports a movable contact which may be pressed down by a pushbutton assembly slidably mounted in an upstanding bushing secured to a metal frame attached to the base. The pushbutton assembly has a removable cap mounting a translucent top plate and a hollow plunger supporting the cap. A lamp socket having a lamp bulb therein is supported within the hollow plunger by a pair of contactor-terminals extending through a pair of the openings in the base. A nylon insert is locked in one wall of the plunger and has a wall type push-push cam surface on the inner surface thereof. A spring wire secured in the bottom of the base by a plug extends upwardly and terminates in a hook which cooperates with the walls of the cam surface of the nylon insert to latch the pushbutton down when it is pushed once and released and to allow the return spring to restore the pushbutton to its upper position when it is pushed a second time and released. The switch can be converted from push-push latching action to momentary push action by removing the spring wire hook, the cam insert or both.

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These and other objects and advantages of the invention and the manner of obtaining them will best be understood by reference to the following detailed description of an embodiment of a pushbutton switch mechanism for an electric switch taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a sectional view through the upper portions of the contact-terminals and connector terminals and through the lower portion of the pushbutton plunger at approximately line 1—1 of FIG. 2 showing the top of the base and the movable contacts in elevation;

FIG. 2 is a sectional view of the whole switch at line 2—2 of FIG. 1;

FIG. 3 is a sectional view of the switch except the pushbutton cap at line 3—3 of FIG. 1;

FIG. 4 is an isometric view of the base, the latch hook and the plug;

FIG. 5 is an isometric view of the pushbutton plunger and movable contact; and

FIG. 6 is an isometric view of the internal cam face of the latch insert.

Referring to FIGS. 1 and 2, there is shown a pushbutton switch having an insulating base 2 covered at its top by a metal frame 4. Two stationary contact-terminals 6 and 8 are mounted in the base and are arranged for bridging engagement by a movable contact 10 biased upwardly by a helical compression spring 12. Two connector-terminals 14 and 16 are mounted in the base and support a lamp holder or socket 18 having a lamp bulb 20 threaded therein. A pushbutton assembly comprising a hollow insulating plunger 22, a cap 24 and a translucent indicating plate 26 is arranged for actuating the movable contact. And two insulating retainers 28 and 30 are placed on top of the contact terminals and connector terminals to insulate them from the frame.

A latch mechanism is enclosed with the base. This latch mechanism comprises a latch insert 32 mounted on the plunger, a spring wire hook 34 for cooperating with the cam walls of the latch insert and a plug 36 for securing the wire hook within the base.

As shown in FIGS. 1, 2 and 3, base 2 comprises a rectangular molding of plastic insulating material having a central cavity 2a open at the top and a pair of vertical holes 2b and 2c spaced apart on the left side and another pair of vertical holes 2d and 2e spaced apart on the right side of the central cavity extending through from shoulders below the top peripheral rim of the base to a shoulder above and about the bottom of the base. Generally inverted U-shaped stationary contact terminals 6 and 8 hang over the walls between the central switch cavity and the two diagonally disposed holes 2b and 2e with the terminal portions thereof extending through the holes to the exterior of the base therebelow for connection to an external circuit. The contact portions thereof extend downwardly at opposite sides of and within the central cavity and are prestressed toward the respective terminal portions and the lower ends thereof are held behind abutments by being inserted in slots 2f in the base.

Lamp socket 18 is internally threaded to receive lamp bulb 20 and is provided at its bottom with internal and external insulating washers riveted to one another through an enlarged hole in the bottom of the socket to clamp connector terminal 14, through an enlarged hole therein, between the bottom of the socket and the external insulating washer and to clamp connector terminal 16 between the latter and the lower head of the rivet. As will be apparent, this construction electrically connects terminal 14 to the socket and insulates it from the rivet and electrically connects terminal 16 to the rivet and insulates it from the socket to provide a circuit for the lamp bulb. Connector terminals 14 and 16 extend laterally from the

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lamp socket and down through the other two diagonally disposed holes 2c and 2d to the exterior of the base therebelow for connection to an external circuit. A pair of insulating retainers 28 and 30 are placed between the upper horizontal portions of the contact-terminals and connector-terminals and the frame to keep the terminals pressed down in their holes.

Frame 4 is provided with an externally threaded upstanding bushing 4a at its center forming a sliding guide for the pushbutton plunger and adapted for receiving a washer and nut for mounting the switch in a hole in a panel. Frame 4 covers the top of the base, its downwardly bent edges being seated in a groove about the top rim of the base, and the left and right ends thereof are provided with integral narrow straps which are bent down into vertical grooves 2g in the ends of the base. The extreme narrowed ends of these straps are then bent inwardly into undercut deeper grooves 2h in the ends of the base to rigidly secure the frame to the base and to hold the pushbutton in assembled position.

Plunger 22 of the pushbutton assembly is provided with a round tubular upper portion 22a which extends through and above bushing 4a around stationary bulb 20 and a substantially rectangular lower end portion 22b within the base cavity below the frame as shown in FIGS. 1-3. This lower rectangular portion of the plunger is provided with an axial hole opening into the tubular upper portion and a diagonal slot 22c lined with holes 2c and 2d in the base as shown in FIG. 1 extending up from the lower end to the round tubular portion as shown in FIG. 2 to provide clearance for the lamp connector terminals when the plunger is depressed.

The exterior of the upper tubular portion 22a is provided with four angularly arranged grooves parallel to its axis and extending down from the top end for frictionally receiving internal ribs of cap 24 to secure the cap to the upper end of the plunger. When the cap is pressed down into the grooves on the plunger, the plunger moves down until the movable contact stops against bottom shoulders within the base above the spring well. The cap then slides onto the plunger until it stops against the upper end of bushing 4a at which point the upper end of the plunger abuts or very nearly abuts the lower surface of indicating plate 26.

The bottom of cavity 2a is round and deeper than the remainder of the cavity to provide a spring well for receiving the lower end of movable contact return spring 12 and is provided with an upstanding frusto-conical projection 2i molded therein which projects up within the lower end of the helical spring. Movable contact disk 10 rests on the upper end of spring 12 and has its center portion 10a offset downwardly to maintain it registered relative to the upper end of the spring as shown in FIGS. 2 and 3.

The lower end of plunger 22 rests on movable contact disk 10 and pushes the movable contact into sliding engagement to bridge stationary contacts 6 and 8 when the pushbutton is pressed. Opposite peripheral portions of the movable contact disk are sheared and bent downwardly to provide cam surfaces 10c slidably engaging the stationary contacts. For a normally open switch, the stationary contacts are offset inwardly at their lower ends as shown in FIG. 2 for sliding engagement by the movable contact disk when it is depressed. For normally closed contacts, the stationary contacts are formed as shown in FIG. 8 of my copending application Serial No. 73,414, filed December 2, 1960, now Patent No. 3,192,352, dated June 29, 1965.

An important aspect of the invention resides in the provision of latching means for maintaining the pushbutton depressed after a first pressing thereof and for allowing the spring to restore the pushbutton after a second pressing thereof. For this purpose, latch insert 32 is rigidly and removably mounted in the rear wall of the lower, rectangular portion of the plunger. The top edge

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of this insert is provided with a rectangular projection 32a shown in FIG. 6 which fits into a complementary notch 22d in the wall of the plunger shown in FIG. 5 so that the insert will fit only in its proper upright position in slot 22e. To fix the insert in slot 22e and to prevent vertical dislodgement thereof, complementary interfitting means are provided at the lateral edges thereof. For this purpose, slot 22e is provided with an elongated raised portion 22f at each side thereof snugly fitting into a complementary groove 32b in the sides of the insert to lock the latter to the plunger when it is held in place by the smooth interior wall of the base as shown in FIG. 3.

The inner wall of insert 32 is provided with a wall type cam surface for guiding the point of a latch hook relative to the cam surface in a substantially heart-shaped path. To mount the latch hook so that its upper point is biased against the cam surface of the latch insert, the bottom of the base is provided with an off-center hole for insertion of headed frictional plug 36. As shown in FIG. 3, the lower end of wire hook 34 is bent at a 90 degree angle for receipt in a radial groove 2j (FIG. 4) in the bottom of the base extending from the plug hole at substantially 13 degrees to the right from the vertical plane in FIG. 1. The peripheral side of the plug hole is also provided with a vertical groove for the lower vertical portion of hook 34 as shown in FIGS. 1 and 3 to securely hold the hook in an upright position when plug 36 is forced into the hole in the bottom of the base. In this manner, the spring hook is rigidly mounted in the bottom of the base so that its upper end cannot be moved except by bending the hook and when released it will spring back to its former position.

As shown in FIGS. 3 and 4, the upper end of the spring wire 34 is bent a little more than 90 degrees in the same lateral direction and in the same plane as the lower bend. Also the upper half of this hook is bent at about its midpoint substantially 7 degrees to the right when viewed with the points pointing away as in FIG. 2. This structure provides a hook which, when facing the wall type cam surface of the latch insert, is canted slightly to the right and is turned slightly to the right to properly bias the hook against the inclined wall of the cam surface. Also the end of the hook has its corners rounded so that it will ride on the raised wall without cutting.

The movable contact disk is provided with a slot 10b, FIG. 5, to provide clearance for the upper end of the latch hook as shown in FIG. 3.

As shown in FIG. 6, the inner surface of latch insert 32 is provided with a double level cam edge or wall 32c extending from near the lower right-hand corner toward the center at a 60 degree angle from the horizontal and against which spring wire hook 34 is normally biased. About half-way to the middle of the insert, this wall 32c reduces to a single level wall 32d which angles slightly downwardly from the 60 degree angle to a substantially 45 degree angle relative to the horizontal lower edge of the insert. This wall 32d extends past the center line of the insert where it is provided with a vertical wall section 32e continuing into a horizontal wall 32f to the right and then downwardly and to the right in an angular wall 32g at 22 degrees with the vertical center line up to the vertical center line of the insert. About midway down this angular wall 32g, the surface of the insert is provided with a downwardly and rearwardly extending angular surface 32h at a 40 degree angle from the vertical surface of the insert all the way to the lower end of wall 32g to form a depression in the surface of the insert. Along the vertical center line above this depression, the right-hand side of the insert surface rises abruptly to the plane of the single level walls forming a wall 32i, and angular surface 32h is wide enough to the right of the center line to provide an inclined path to this single level. To the right of cam surface 32h and spaced therefrom, the single level surface rises abruptly to the plane of double level wall 32c forming a downwardly extending vertical wall 32j which

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terminates below depression 32*h* in an angular wall 32*k* extending downwardly and to the left to and perpendicular to the lower end of angular wall 32*d*. The surface of the insert adjacent wall 32*c* is provided with a depression inclining rearwardly and downwardly to provide a surface 32*m* against which the point of the hook normally rests.

When the pushbutton is pressed, movable contact 10 moves down against the force of spring 12 into sliding engagement with stationary contacts 6 and 8. Cam insert 32 moves down with the plunger. Cam surface 32*m* moves the hook inwardly and angular walls 32*c* and 32*d* ride on the point of the hook and deflect the hook in the left-hand direction according to FIGS. 1, 2 and 6. Vertical wall 32*e* then rides on the hook and the hook snaps in the right-hand direction over wall 32*f* against vertical wall 32*i*. When the pushbutton is now released, return spring 12 moves the movable contact and the pushbutton assembly a short distance up while the movable contact remains in engagement with the stationary contacts. Insert 32 moves slightly up with the plunger and wall 32*i* rides on the point of the hook and the point enters into and engages the horizontal bottom of the recess formed by surface 32*h* to prevent further upward movement of the pushbutton assembly. The bias of the hook causes its point to move to the right-hand side of recess 32*h* against the vertical wall. The switch is now latched closed and another depression and release of the pushbutton is necessary to reopen the contacts.

When the pushbutton is pressed a second time, inclined surface 32*h* moves the point of the hook out of this recess onto the first level of the cam. When the hook emerges from this recess, the bias causes it to snap toward the right against wall 32*j*. When the pushbutton is now released to allow it to restore upwardly, walls 32*j* and 32*k* ride on the point of the hook, inclined wall 32*k* again biasing the hook to the left. The point of the hook then enters in the corner between wall 32*c* and surface 32*m* back to its original position.

While the apparatus hereinbefore described is effectively adapted to fulfill the objects stated, it is to be understood that I do not intend to confine my invention to the particular preferred embodiment of pushbutton switch mechanism disclosed, inasmuch as it is susceptible to various modifications without departing from the scope of the appended claims.

I claim:

1. A pushbutton switch of the latching type comprising:
 - an insulating base having an open-top cavity therein;
 - stationary contacts within said cavity having connector terminals extending through said base to the exterior thereof and being adapted for connecting the stationary contacts to an external circuit;
 - spring biased movable contact means in said cavity for engaging said stationary contacts to complete an electrical connection;
 - a cover for said base having a bushing therein;
 - a pushbutton having a hollow plunger slidably extending through said bushing into said cavity for actuating said movable contact means from normal to operated position;
 - a latch insert mounted in an aperture in one wall of the lower portion of said plunger within said cavity and having a latching face directed inwardly and being held in said plunger aperture by an adjacent wall of said base;
 - and a latch hook mounted in the bottom of said base and extending within said hollow plunger into engagement with the latching face of said latch insert for latching said switch in operated position when said pushbutton is depressed and being operable to release said switch to allow spring-return thereof to its normal position in response to further depression of said pushbutton thereby to provide a switch of

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the push-push type and said latch insert being removable from said aperture to convert said switch to momentary type.

2. In a pushbutton switch, the combination comprising:
 - a switch housing comprising an insulating base having a cavity therein and a plurality of openings extending through said base adjacent side portions of said cavity;
 - stationary contacts in said cavity including connector terminals extending through some of said openings outside said base and adapted for connection to an external circuit;
 - resiliently biased movable contact means in said cavity for engaging said stationary contacts to complete an electrical connection;
 - a plunger extending into said cavity for actuating said movable contact means from normal to operated position;
 - said housing further comprising a frame covering said cavity and the adjacent ends of said openings in the base and comprising a bushing for slidably supporting said plunger for reciprocal movement;
 - a removable latch held in a slot in the lower end portion of said plunger;
 - and a latch hook mounted in the bottom of said cavity in said base and being biased into engagement with said latch for latching said movable contact in operated position when said plunger is depressed and releasing said latch to allow restoration of said movable contact to normal position upon further depression of said plunger.
3. The invention defined in claim 2, wherein said base also comprises:
 - a hole in the bottom of said cavity through which said latch hook extends into said cavity;
 - and a plug for said hole for rigidly securing said latch hook to said base and into biased engagement with said latch.
4. The invention defined in claim 3, wherein said base further comprises:
 - a groove in the bottom of said base extending radially from said hole;
 - and said latch hook having a bent-over lower end portion held in said groove by said plug to prevent said latch hook from turning.
5. The invention defined in claim 2, wherein said movable contact means comprises:
 - an electrically conductive member having a configuration substantially matching the configuration of said cavity to be guided by the cavity when actuated and having a slot to provide clearance for said latch hook extending therethrough.
6. The invention defined in claim 2, wherein said latch comprises:
 - an insert having lugs received in complementary notches in the sides of said slot in said plunger and being held in said slot by a wall of said cavity along which said insert slides when said plunger is depressed.
7. The invention defined in claim 2, wherein said latch comprises:
 - a molded member having a wall type latching face including camming walls for guiding said hook to a latching shoulder upon first depression and release of said plunger and additional camming walls and surfaces for guiding said hook from said shoulder to its starting point upon additional depression and release of said plunger.
8. The invention defined in claim 2, wherein said plunger comprises:
 - an opening thereinto from the end within said base cavity for providing clearance for said latch hook and adapted for accommodating an indicator lamp.

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