

[54] **PUSHBUTTON ELECTRICAL SWITCH UNIT**

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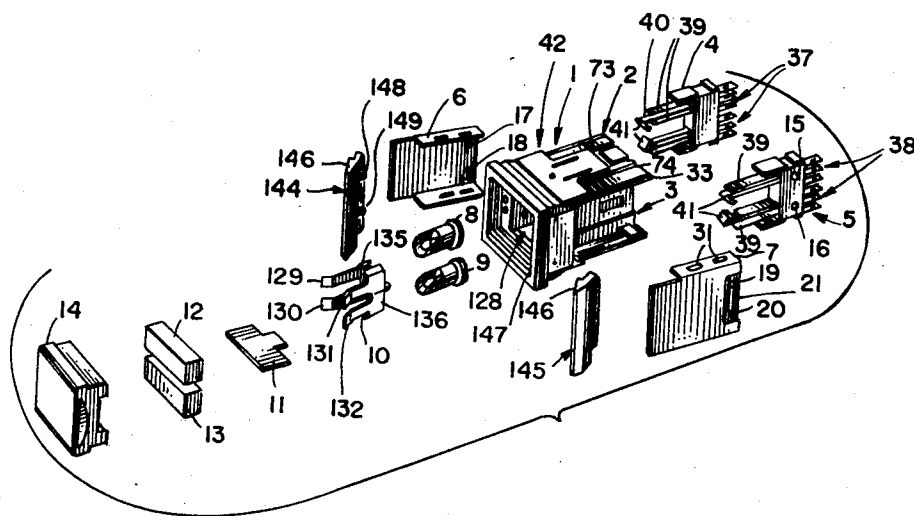
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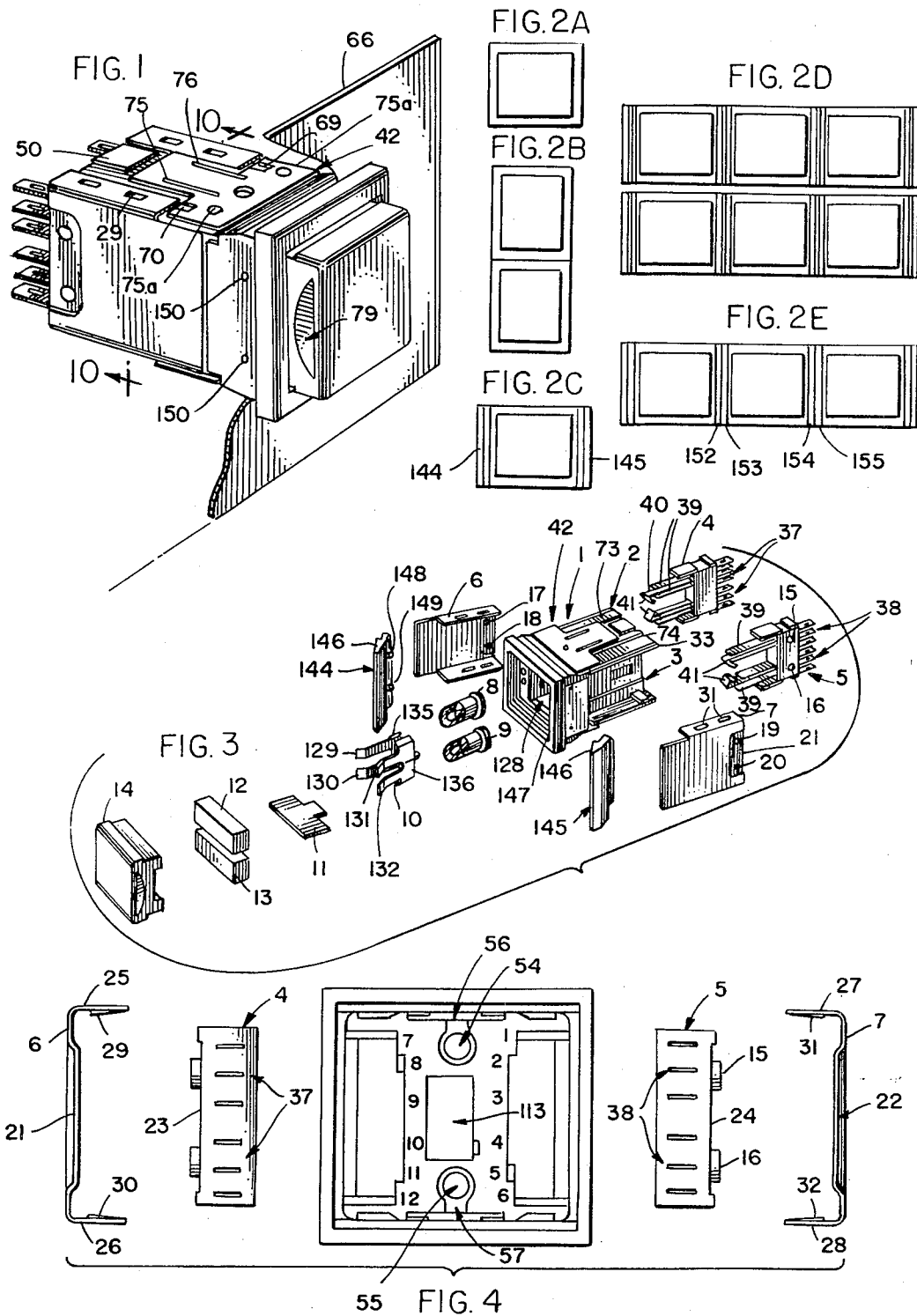
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[57] **ABSTRACT**

Push button electrical switch units adapted for use in panels are provided which have unique clamp mounting brackets permitting the switch to be mounted and removed from the front of a panel and eliminating the need for loose hardware, mounting sleeves and complicated assembly. The switch structure also provides for lamps to illuminate the push button and can be relamped from the front of the unit. Molded switch modules are simply snapped into the rear of the switch housing and can be changed or added at any time by removing the switch unit from the front of the mounting panel.

10 Claims, 15 Drawing Figures





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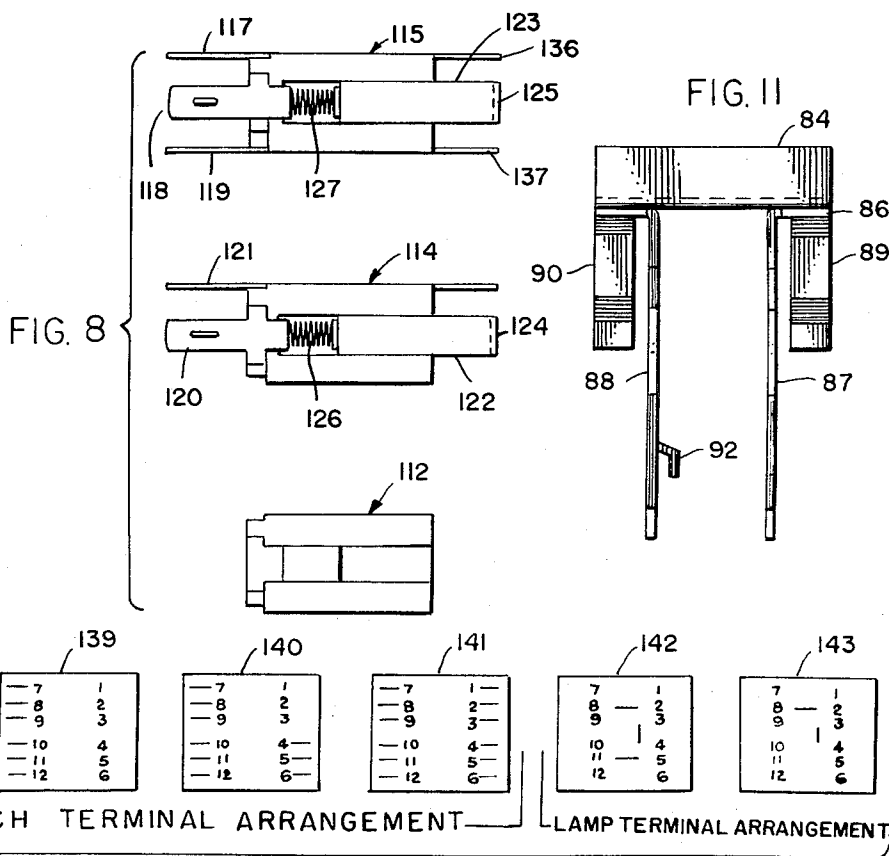
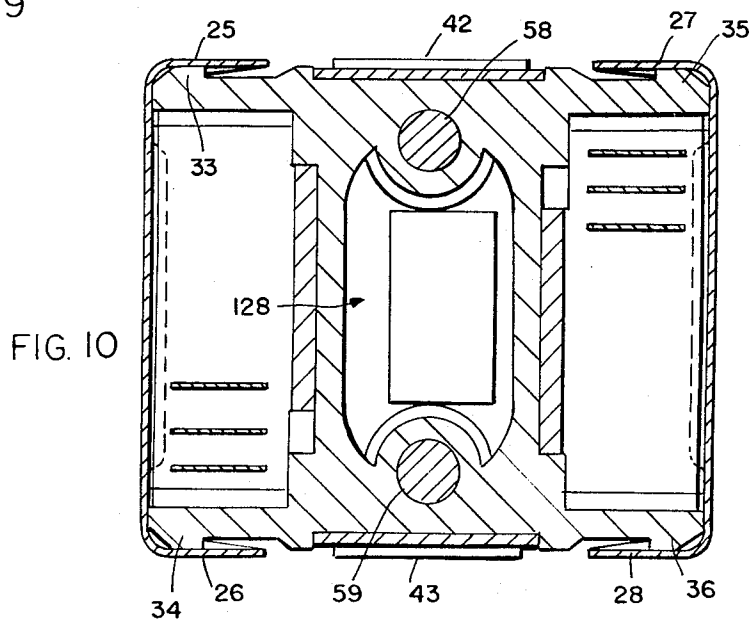


FIG. 9



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PUSHBUTTON ELECTRICAL SWITCH UNIT

BACKGROUND OF THE INVENTION

Various types of push button electrical switch units have heretofore been proposed which are adapted to be mounted in panels. One of the problems heretofore encountered with such units is the difficulty of mounting them and removing them. It would be desirable to provide a push button electrical switch unit which is completely enclosed, lighted and capable of being mounted and removed from the front of a panel. It would also be desirable to provide a push button switch of the type described which has long life, highly reliable, leaf spring switching in the form of molded modules that can easily be removed from the switch unit and replaced. It would also be desirable to have a switch unit of the type described which is versatile and can be used for different types of switching varying from single pole-single throw switching to 4-pole-double throw switching.

OBJECTS

One of the objects of the present invention is to provide a completely enclosed push button switch with or without illumination of the push button and with molded modular, highly reliable leaf spring switching.

Another object of the invention is to provide new and improved push button electrical switch units which can be mounted and demounted from the front of a panel.

Still a further object of the invention is to provide a push button electrical switch having a new and improved panel mounting mechanism.

Another object of the invention is to provide new and improved pushbutton electrical switches which are compact, have a new and improved structure which simplifies the assembly of the switch, and provide low profile mounting brackets or clips.

Another object of the invention is to provide new and improved illuminated pushbutton electrical switches which can be re-lamped from the front of the panel.

A further object of the invention is to provide new and improved electrical switches having different types of pushbutton structures such as push-lock/push-release, or momentary functions.

An additional object of the invention is to provide pushbutton electrical switch units having barriers which assist in spacing the switches and preventing the inadvertent actuation of two buttons simultaneously.

Other objects and advantages of the invention will appear from the following description in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 represents a perspective view of an assembled pushbutton electrical switch unit embodying the invention shown mounted in a panel with parts broken away;

FIGS. 2A, 2B, 2C, 2D and 2E illustrate various types of panel mountings with switch units of the type herein described with or without barriers;

FIG. 3 is an exploded view in perspective of elements of one type of switch unit provided in accordance with the invention;

FIG. 4 is an exploded bottom plan view of the switch housing, molded switch modules and switch module covers;

FIG. 5 is a side view of the switch housing showing in addition the coil spring which is used to bias the yoke assembly and a retaining pin used to hold the lamp terminal in place;

FIG. 6 is a view of the housing shown in FIG. 5 turned through an angle of 90°, illustrating the yoke assembly which is actuated by the pushbutton, showing the biasing spring and lamp terminal retaining pin in place;

FIG. 7 is an exploded side elevational view of the switch housing, mounting clips, yoke assembly, lamp socket, pushbutton, and mounting screws;

FIG. 8 shows lamp terminal arrangements for single socket, twin lamp sockets and unlighted pushbutton switches;

FIG. 9 shows switch terminal arrangements and lamp terminal arrangements from left to right for single pole-double throw, two pole-double throw, three pole-double throw, four pole-double throw, twin lamp sockets and single lamp sockets, respectively; and

FIG. 10 is a cross section taken through lines 10—10 of FIG. 1.

FIG. 11 is a view of the yoke which is operated by the pushbutton to actuate the switches.

BRIEF SUMMARY OF THE INVENTION

In accordance with the invention a pushbutton electrical switch unit is provided which is adapted for use in panels and has unique clamp mounting brackets permitting the switch to be mounted and removed from the front of a panel and eliminating the need for loose hardware, mounting sleeves and complicated assembly. The switch structure also provides for lamps to illuminate the pushbuttons and can be re-lamped from the front of the unit. The illumination can also be divided. In addition, new and improved barriers can be provided in order to prevent accidentally pressing the wrong button. Molded switch modules are simply snapped into the rear of the switch housing where they are retained by retaining clips and can be changed or added at any time by removing the switch unit from the front of the mounting panel and by removing the retaining clips from the molded switch modules.

An important feature of the invention is that the pushbutton itself is made from translucent or transparent plastic which is slightly flexible and is mounted in the top of a yoke and lifter assembly from which it can be removed by pressing against the opposite sides of the pushbutton.

Another feature of the invention is that the housing is elongated and of generally rectangular cross section with two recesses and two parallel, generally planar sides, the recessed sides being adapted to receive the molded switch modules in a press fit relationship and the generally planar sides having four ribs thereon and each being adapted to receive a mounting bracket, which mounting bracket is connected to a guide member and the guide member is adapted to be moved in and out toward and away from the push-button by means of a machine screw internally mounted within the housing. The machine screws which operate the mounting brackets are accessible by removing the

pushbutton and any lamp assembly used to illuminate the pushbutton. Thus by removing the pushbutton and the lamp assembly it is possible to insert a screw driver into the housing and tighten or loosen each mounting bracket. The sides of the housing containing the mounting brackets have a sloping surface which permits the mounting brackets to lie flat along the housing when they are loosened and thereby also permit the switch unit to be withdrawn from the front of a panel on which it is mounted. When it is desired to replace the switch unit in the panel, the entire unit is inserted in the panel opening with the mounting brackets in their lowermost position and the mounting screws are tightened with a screw driver causing the mounting brackets to be cammed outwardly over the sloping sides of the housing and to contact the inner surface of the mounting panel. The lamp and lamp socket can then be replaced followed by the pushbutton which snaps into place in an undercut portion of the yoke assembly.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 3 a partially assembled housing is generally shown at 1 with a generally planar side 2 and a recessed side 3, the cross section being generally rectangular. Molded switch modules 4 and 5 are adapted to be inserted into the recessed sides and are held in place by retaining clips 6 and 7 made of spring metal or other suitable material. In the unit illustrated twin lamps 8 and 9 are held in place by means of lamp socket 10. If desired an opaque divider 11 can be inserted in the lamp socket between the lamps 8 and 9 and differently colored filters 12 and 13 can be used to illuminate the pushbutton 14 in two different colors.

Each of the switch modules 4 and 5 has a pair of projecting portions 15 and 16 (FIG. 3 and 4) molded thereon which are adapted to fit into holes 17,18 and 19,20 in retaining clips 6 and 7. The holes 17,18 and 19,20 are disposed in a slightly depressed area of each retaining clip, as shown at 21,22. When the retaining clips are in place, the depressed portions 21,22 press against the outer sides 23,24 of the modules 4,5. In the embodiment shown, the retaining clips 6,7 are made of a resilient material, preferably metal, and each of the sides 25, 26, 27, 28 will move outwardly when the clips 6 and 7 are pressed against the housing 1. Each of the sides 25, 26, 27, and 28 of the clips 6,7 also contains a pair of inwardly extending portions 29, 30, 31, 32 which are cut out on three sides and pressed inwardly. The innermost side of each cut out inwardly extending portion slides over the outwardly extending edges 33, 34, 35 and 36 (See FIG. 10) of housing 1 until it snaps into place over said edges thereby retaining each of the modules 4 and 5 in place. To remove the modules a screw driver or similar instrument is used to pry one of each pair of sides 25, 26 and 27,28 outwardly until one pair of elements 29, 30, 31, 32 on each clip is disengaged from edges 33, 34, 35, 36.

The modules 4 and 5 are preferably molded from nylon or other electrically insulating polymeric material and have the terminals 37,38 projecting from one end. Each switch module also has one or more pairs of spring metal electrical contactors and an intermediate actuating element, as illustrated by contactors 39,39 and actuating element 40 in FIG. 3. The actuating ele-

ments have a downwardly and inwardly extending bent end 41 which is cammed outwardly in response to inward pressure against the pushbutton, as hereinafter described.

Each pushbutton assembly has two T-shaped mounting brackets 42,43 (FIG. 7) connected to guide members 44,45. Each of the guide members 44,45 has an internally threaded circular portion 46,47 connected by a neck portion 48,49 to a wider portion 50,51. The lower ends of the mounting brackets 42,43 are bifurcated to provide openings to receive said neck portions 48,49 and are turned up at 52,53 to hold the guide members 44,45 in place. The circular portions 46,47 of guide members 44,45 are inserted in the openings 54,55 in the housing (FIG. 4) with the neck portions 48,49 in the openings 56,57. The screws 58,59 are inserted into the housing from the top with the threaded portions projecting into openings 54,55 and engaging the internally threaded portions of guide members 44,45 (FIG. 7).

When the screws 58,59 are turned clockwise, the guide members 44,45 are moved upwardly causing the mounting brackets 42,43 to move upwardly toward the underside 60 of the outer rim or flanged portion 61 of the housing. The tops 62,63 of the T-shaped mounting brackets 42,43 are cammed outwardly over sloping portions 64,65 as they move upwardly and clamp against the underside of panel 66 (FIG. 1) causing the outer side of panel 66 to be clamped against the underside 60 of rim 61 thereby holding the pushbutton unit in place.

To remove the pushbutton unit from the panel, screws 58,59 are turned counterclockwise thereby causing mounting brackets 42,43 to be retracted until tops 62,63 are below the sloping portions 64,65 and the outer sides are in the same plane as areas 67,68 of the upper part of the housing. The entire pushbutton unit can then be removed by grasping rim 61 and pulling it outwardly through the panel opening.

Each of the mounting brackets 42,43 has pressed-in positions 69,70 which serve as guide members (FIG. 1) by travelling in the shallow channels 71,72 formed by edges 33,34 and outwardly extending parallel ribs 73,74 (FIG. 5). The mounting brackets are strengthened by inwardly extending ribs 75,76 (FIG. 1) which are accommodated by channels 77,78 (FIG. 5). The ribs 75,76 can also serve as guide members. In addition, dimples 75a and 76a are provided.

The pushbutton 14 is preferably molded from a translucent plastic material which is slightly resilient. It has finger-nail holes 79 on opposite sides and upwardly and outwardly extending portions 80,81 on opposite sides. The central part is hollow. Hence, when the pushbutton is pressed downwardly into the cavity 82 the sides 80,81 will yield and the inwardly extending portions 83,84 will pass over the upper ends of 80,81 and hold the pushbutton in place. In order to remove the pushbutton, the sides of the pushbutton are pressed inward at the finger-nail holes until the upper ends of elements 80,81 will pass the inwardly extending portions 83,84. The pushbutton can then be pulled outward from cavity 82.

The pushbutton cavity 82 is at the top of a yoke and lifter assembly 85 (FIGS. 6, 7 and 11) which actuates the switches. The yoke comprises a horizontal member

86 and two downwardly depending plates 87,88 having switch actuating members 89,90. Plate 88 is provided with a slot 91 and a pressed-in portion 92 engaging the top of a return coil spring 93. The bottom of spring 93 rests on the bottom of an opening 94 in the housing which is rectangular and slightly longer than slot 91. When pushbutton 14 is pressed inwardly spring 93 normally tends to return the yoke and pushbutton to their original position provided no detent mechanism is used. Without a detent, the switching is momentary. The plate 88 contains a side recess, the bottom edge of which 95 impinges against abutment 96 of the housing and acts as a stop.

In the pushbutton unit illustrated in the drawings, the yoke plate 87 contains an opening 97 having a horizontal portion 98 and a vertical portion 99 (FIG. 7). The housing contains a recess 100 which consists of a shallow recess having a horizontal leg 101 and a vertical leg 102, a somewhat deeper rectangular recess 103, and a deeper T-shaped recess having a horizontal leg 104 and a vertical leg 105. A triangular portion 106 of the housing projects into the lower portion of the T-shaped recess. A pawl 107 is mounted to float in said recess with centrally disposed pins projecting from opposite sides thereof. One of said pins, not shown, is disposed in said T-shaped recess and the pin 108 projects into the opening 97 in yoke plate 87. A fine wire spring 109 is fixed at one end at 110. The side 111 impinges against pin 108 normally biasing the pawl 107 toward the fulcrum projection 106 and holding the pin 108 against the bottom edge of the vertical portion 99 of recess 97 in yoke plate 87.

When button 14 is pressed, pin 108 moves upwardly in vertical leg 99 of recess 97 until it reaches horizontal leg 98 at which point pawl 107 tilts to the right and pin 108 moves laterally into the horizontal portion 98 of the opening 97. When the pushbutton 14 is released, the portion 111 of spring 109 holds pin 108 against the lower edge of opening 98. When button 14 is pressed a second time, pin 108 falls to the left due to the fact that pawl 107 is off-center on fulcrum 106, thereby permitting the yoke assembly and pushbutton to rise under the influence of spring 93.

In the embodiment shown in the drawings, the user has the option of: (1) no lamp, (2) single lamp, or (3) twin lamp units. In the no lamp unit the fixture 112 (FIG. 8) is inserted in opening 113 (see FIG. 4); in the single lamp unit, fixture 114 is used; and in the twin lamp unit, fixture 115 is used. A pin or set screw 116 (FIGS. 5 and 6) is used to hold the said fixture in place. As shown in the case of the twin lamp fixture, the three terminals 117, 118 and 119 project from the central bottom portion of the housing. In a single lamp fixture the two terminals 120 and 121 project from the bottom of the housing.

The fixtures 114 and 115 have center posts 122, 123 which have ends 124, 125 bent at right angles. These center posts are slidable in the fixtures and normally are biased outwardly by springs 126,127. A twin lamp socket 10 or a single lamp socket 10a (FIG. 7) is inserted into the opening 128 (FIGS. 3 and 10). The lamp socket comprises two pairs of prongs 129,130, 131 and 132 (FIG. 3) made of a resilient material, preferably spring metal. Each prong has a pressed out portion as shown at 133 (FIG. 7). The interior sides of

opening 128 in the housing are undercut to receive the pressed out portions 133 of the lamp socket when the latter is slightly compressed before being inserted into opening 128 and then allowed to expand after the bottom member 134 of the socket contacts the center post 125 of the lamp fixture. When the lamp socket is expanded it is prevented from coming out of the opening 128 in the housing by the engagement of said undercut portions and said pressed out portions and the pressure applied by spring 127 (or spring 126). The lamps are held by side members 135 and 136 with the center lamp terminals contacting posts 136,137 (FIG. 8). To remove the lamp sockets and associated lamps the prongs 129, 130, 131 and 132 are compressed thereby disengaging the pressed out portions 133 from the undercut sides of opening 128 and permitting the lamp sockets and associated lamps to be withdrawn.

As shown in FIG. 9 the number of switch terminals can vary from two through twelve consistent with the requirements of single or double throw switching as indicated at 138, 139, 140 and 141. The lamp terminal arrangement for twin lamps is shown at 142 and for a single lamp at 143.

As shown in FIGS. 2A and 2B, the pushbutton units can be arranged on a panel as a single unit (FIG. 2A), or as an assembly (FIG. 2B) of two or more units.

A further feature of the invention involves the use of barriers with the switches. Thus, in FIG. 2C, barriers 144 and 145 are used. As shown in FIG. 3, these barriers consist of an upwardly projecting triangular portion 146 which is undercut to fit over the top 147 of the housing. Each barrier unit has a pair of outwardly extending studs 148,149 which are adapted to be inserted in the holes 150,151 in the housing (see FIG. 1). In FIG. 3 and in the plan shown in FIG. 2C the barrier units can be referred to as "end barriers". The part which extends above the top 147 of the housing resembles an isosceles triangle. Where "center barriers" are used as in FIG. 2E the barriers 152, 153, 154 and 155 have a vertical outer side so that the portion of each extending above the top of the housing resembles a right triangle. FIG. 2D illustrates another arrangement of barrier mounted pushbutton units.

The barriers are molded of plastic and may be used to separate the switches and prevent accidental operation of adjacent switches. They also serve as a visual separation in identifying a single unit or group of switches. All of the barriers seat flush against the sides of the switch housing. They are also made in different colors. The barriers can be grasped to pull the pushbutton unit from a panel after the mounting brackets have been loosened.

MODE OF OPERATION

In the embodiment illustrated in the drawings, when the pushbutton 14 is pressed inwardly it causes the yoke and lifter assembly 85 to move downwardly against the pressure of spring 93. As the yoke and lifter assembly moves downwardly the switch actuating members 89,90 engage the switch actuating spring elements 41, thereby making contact with switch arms 39 and either opening or closing predetermined electrical circuits through the switch terminals 37 and 38.

As the yoke and lifter assembly continues to move downwardly the pin 108 on the pawl 107 moves up-

wardly in vertical leg 99 of recess 97 until it reaches horizontal leg 98, at which point pawl 107 tilts to the right and pin 108 moves laterally into the horizontal portion 98 of the opening 97. When the pushbutton 14 is released the portion 111 of spring 109 holds pin 108 against the lower edge of opening 98. This holds the actuating members 89, 90 in contact with the switch blade actuating elements thereby maintaining the setting of the switches in the switch modules. As previously explained when pushbutton 14 is pressed a second time pin 108 falls to the left due to the fact that pawl 107 is off center on fulcrum 106 thereby permitting the yoke assembly and pushbutton to rise under the influence of spring 93.

When it is desired to remove the pushbutton assembly from the opening of a panel, the pushbutton is pressed inwardly on the sides containing the fingernail holds 79 and then removed from the top of the yoke assembly. The lamp sockets and lamps are then removed in the manner previously explained and the clamping brackets 42,43 are loosened by turning machine screws 58,59 counterclockwise. Machine screws 58,59 extend into the openings or bores 54,55 and engage the internally threaded portions of guide members 44,45. When the screws 58,59 are turned counterclockwise the mounting brackets 42,43 are moved downwardly. This forces the tops 62,63 of the clamping brackets 42,43 down the vertical sides 67,68 of the housing over the sloping surfaces 64,65 until the outsides of the clamping brackets 42,43 are in substantially the same plane as surfaces 67,68. The pushbutton unit can then be withdrawn either by grasping it by the rim 61 or by the barriers if barriers have been applied to the unit.

When it is desired to insert the pushbutton unit into a panel opening the reverse procedure is adopted, that is, the unit is inserted into the panel opening and the screws 58,59 are turned clockwise until the tops of the mounting brackets establish contact with the underside of the panel. The lamp sockets, lamps and push-button are then reinserted.

The invention provides a completely enclosed, lighted pushbutton switch with highly reliable leaf spring switching. The housing and many of the parts are capable of being made from molded plastic materials. The mounting bracket mechanism makes it possible to mount and dismount the pushbutton units from the front of a panel. The pushbutton units can also be re-lamped from the front of the panel. The barriers provided in accordance with the invention assist in spacing the switches and preventing inadvertent actuation of two buttons simultaneously. An important feature of the invention resides in the low profile mounting brackets or clips which make it possible to mount the switch housings adjacent to each other in either a vertical or horizontal fashion in such a manner as to completely hide the mounting panel. The low profile is made possible by the sloping surfaces 64,65 of the housing. The dimples 75a,76a on the underside of the mounting clips or brackets are also important not only in facilitating the movement of the mounting clips or brackets over the sloping areas of the housing but also in preventing the mounting clips from wedging between the panel opening and the housing.

In addition, an advantage of the invention resides in the manner in which the molded stack modules are in-

terlocked with their retaining clips, which also serve as dust covers. It will be noted that they lock each other in place.

The switches are especially useful for industrial, commercial or military control panels, for example, general business machines, scientific and military computer directed equipment, tape and card perforators, and other data input and control applications.

The invention is hereby claimed as follows:

1. An electrical switch unit comprising a housing having a top opening therein surrounded by a flanged portion adapted to fit over the edges of a panel opening, clamping members mounted on said housing and movable toward and away from said flanged portion, said clamping members being adapted to clamp said panel between said clamping members and said flanged portion, means forming a sloping area on said housing to cam said clamping members outwardly as they move toward said flanged portion and inwardly as they move away from said flanged portion, said clamping members containing indentations extending inwardly and adapted to prevent wedging of said clamping members in said panel opening, and means accessible through said top opening operable to so move said clamping members.

2. A unit as claimed in claim 1 in which said clamping members are T-shaped and said indentations are in the form of dimples in the horizontal portion of said T-shaped members.

3. A pushbutton electrical switch unit comprising an elongated housing of generally rectangular cross section having two recessed sides, two parallel generally planar sides, a top and a bottom, said top having an opening therein, a removable pushbutton mounted in said opening, a flange extending laterally from said opening adapted to fit over a panel when said unit is inserted in a panel opening, the recesses in said recessed sides each opening rearwardly and adapted to receive molded switch modules, the inner walls of said recesses defining a central passageway running longitudinally and open at both the top and bottom ends, means forming a bore on opposite sides of said central passageway adjacent said planar sides, each said bore being adapted to receive a machine screw and each bore having a slot extending longitudinally in the adjacent planar side of said housing, said planar sides containing parallel longitudinally extending ribs laterally disposed on opposite sides of said slots defining a central guideway and two lateral guideways on each planar side, a T-shaped clamping bracket mounted with the vertical part in said central guideway and the horizontal part toward the top of said housing, a slidable guide member having an internally threaded portion mounted to move in said bore and having an external portion secured to the lower part of said T-shaped clamping bracket, a machine screw mounted for rotation in said bore and in the internally threaded portion of said guide member with the head outward and accessible through the opening in the top of said housing, means forming a sloping area on each of said planar sides whereby when said screw is rotated in one direction said T-shaped member is advanced and cammed outwardly so as to engage the inside of said panel and hold said switch unit in place and when said screw is rotated in the opposite direction said T-shaped

member is retracted so as to permit said switch unit to be withdrawn from said panel, and switch actuating means operatively associated with said pushbutton to actuate the switches in said switch modules.

4. A switch unit as claimed in claim 3 in which said central passageway contains a removable lamp and lamp socket, together with electrical contacts connected to terminals extending through said opening in the bottom of said central passageway of said housing, said lamp being adapted when energized to illuminate said pushbutton.

5. A switch unit as claimed in claim 3 in which each of said switch modules is retained in place by a switch module retaining cover which clamps against opposing sides of said housing, said module and said cover having interfitting connections.

6. A switch unit as claimed in claim 3 which comprises barrier means connected flush to one or more sides of said housing and extending upwardly.

7. A switch unit as claimed in claim 3 in which said switch actuating means comprises a yoke and lifter assembly comprising a horizontal member having two downwardly depending plates, each carrying a switch actuating member to actuate the switches in said switch modules, one of said plates having an opening therein extending vertically, a portion of said plate being bent inwardly to project into said opening, a coil spring engaged with said inwardly bent portion and seated on the bottom of an opening in the housing to normally bias said switch actuating means outwardly, the second of said plates containing a vertically and a horizontally intersecting aperture, and a spring pressed pawl mounted in an opening in the housing and having a pin project-

ing into said aperture in said second plate adapted to lock the switch actuating means in its innermost position.

8. An electrical switch unit comprising a molded housing with a recess therein adapted to receive a molded switch module, a molded switch module adapted to be received by said recess, said molded switch module having an outer face with outwardly extending projections and opposing sides substantially at right angles to said outer face, said opposing sides of said switch module having passageways therein and said recess in said housing having projecting portions engaging said passageways in a tight fit, and a retaining cover adapted to interlock with said housing and containing a recessed portion with openings therein adapted to receive said projections on the outer surface of said switch module in a close fit.

9. A unit as claimed in claim 8 in which said retaining cover comprises an outer face and two opposing sides substantially at right angles to said outer face, said opposing sides extending inwardly and clamping against the outer sides of the recessed portion of said housing, said cover entirely covering the actuating elements and electrical contacting members of said switch module.

10. A unit as claimed in claim 8 in which the inwardly extending sides of said retaining cover contain indentations adapted to engage the outer sides of said housing and fit in recesses in said outer sides of said housing, said cover being removable only by displacing at least one of said inwardly extending sides of said cover outwardly from said housing.

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