

[54] ELECTRICAL SWITCH UNIT

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[56] **References Cited**

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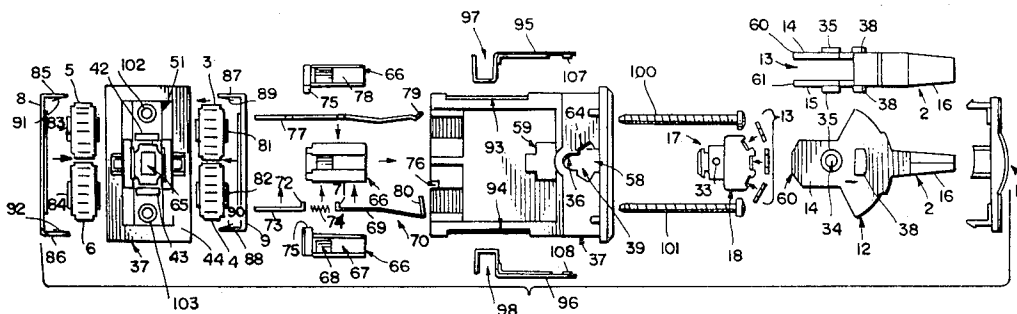
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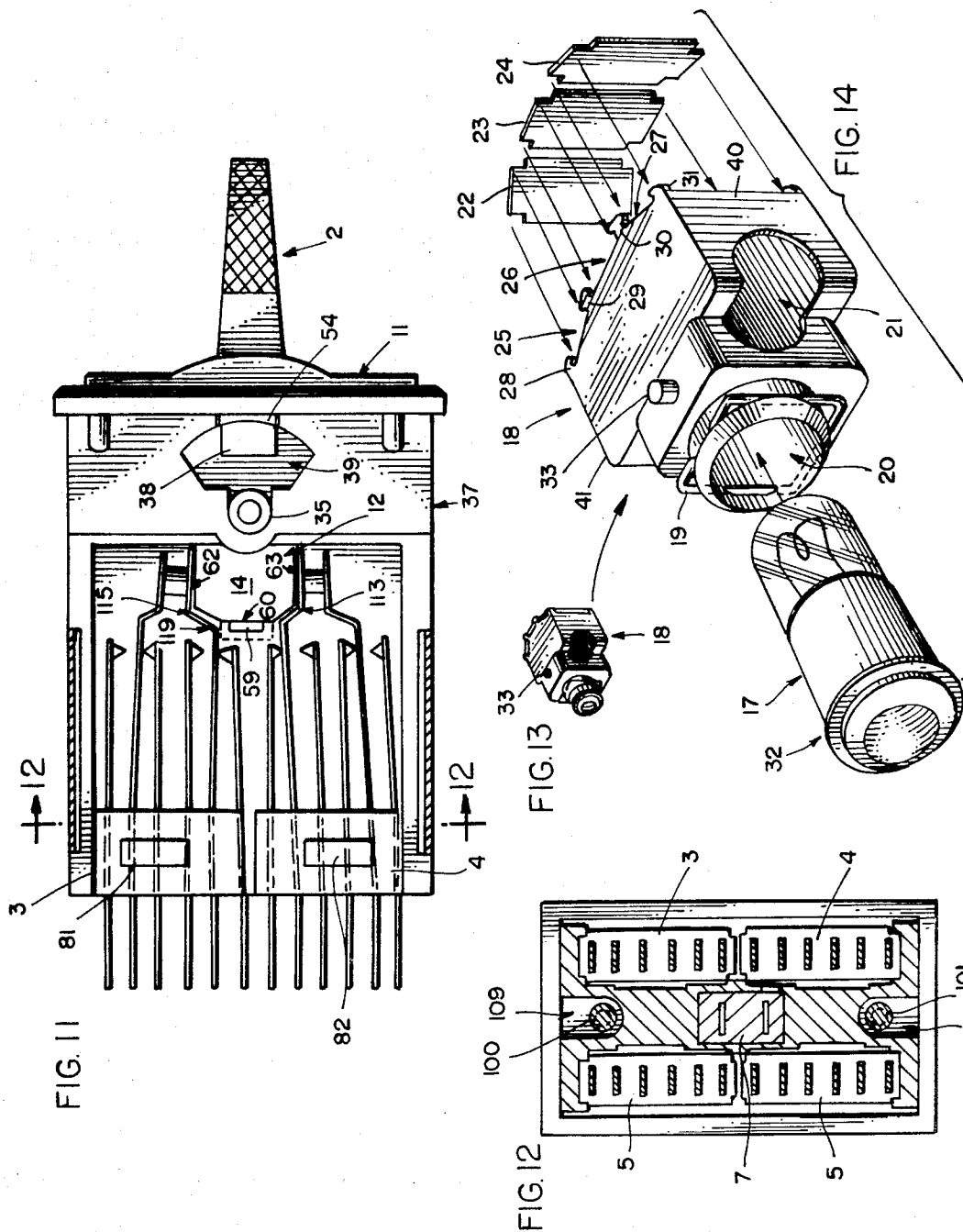
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[57] **ABSTRACT**

A lever-operated illuminated electrical switch unit is provided having front of panel mounting and removal, front of panel relamping, front of panel color changes and front of panel switch module changes. A novel lamp assembly and a novel actuator assembly are provided which can be removed simply by removing an escutcheon plate which snaps into place. Simplified means for mounting the switch unit from the front of a panel are also provided.

8 Claims, 14 Drawing Figures





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ELECTRICAL SWITCH UNIT

BACKGROUND

Various types of electrical switch units have heretofore been proposed which are adapted to be mounted in panels. Panel mounting has always presented problems, especially for illuminated switches where it is sometimes necessary to replace the lamps. It would be desirable to provide electrical switch units which are completely enclosed, lighted and capable of being mounted and removed from the front of the panel. It would also be desirable to provide electrical switch units which can be relamped from the front of the panel. In addition it would be desirable to provide electrical switch units which are lighted in several colors and wherein the colors can be changed from the front of the unit without removing the entire unit from the panel. It would also be desirable to provide switch units of the type described which can be rewired and in which switch modules can be changed by removing the switch unit from the front of the panel.

OBJECTS

One of the objects of the invention is to provide new and improved illuminated electrical switches which can be mounted in a panel and relamped from the front of the panel.

Another object of the invention is to provide a new and improved lever actuated electrical switch in which the lever is illuminated in different colors depending upon its position.

Still another object of the invention is to provide a new and improved lever actuated electrical switch of the type described having color filters adapted to provide different colors at different switch positions and in which the color filters can be replaced from the front of the switch.

An additional object of the invention is to provide an electrical switch having a new and improved panel mounting mechanism.

A further object of the invention is to provide an electrical switch with a new and improved actuating assembly which can readily be removed from the front of the switch and which is adapted to actuate molded modular highly reliable leaf spring switching.

A still further object of the invention is to provide a new and improved electrical switch of the type described having locking or momentary functions.

THE DRAWINGS

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

FIG. 1 is a perspective view of an assembled electrical switch unit embodying the invention;

FIG. 2 is an exploded view of components of one type of switch unit provided in accordance with the invention;

FIGS. 3 to 7 show terminal arrangements of various types which can be employed in an electrical switch unit of the present invention;

FIG. 8 is a side elevational view of one type of lever actuating assembly which can be used in a switch unit embodying the invention;

FIG. 9 is a side elevational view of another type of lever actuating assembly unit which can be used in an electrical switch embodying the invention.

FIG. 10 is a perspective view of an escutcheon plate which is one component of an electrical switch unit provided in accordance with the invention;

FIG. 11 is a side elevational view with some parts removed of the electrical switch unit shown in FIG. 1;

FIG. 12 is a cross sectional view taken along the line 12,12 of FIG. 11;

FIG. 13 is a perspective view of a cage or lamp housing unit containing a lamp and color filters which is mounted in the actuating assembly of an electrical switch unit embodying the invention; and

FIG. 14 is an enlarged exploded view of the lamp cage assembly shown in FIG. 13.

BRIEF SUMMARY OF THE INVENTION

In accordance with the invention, an electrical switch unit is provided having an illuminated actuator removably mounted in a switch housing, means for illuminating the actuator from within the switch housing comprising an actuator assembly having an internal passageway extending inwardly from said actuator, a cage removably mounted in said passageway and a lamp removably mounted in said cage, said cage having an outer and an inner end and sidewalls, the outer end of said cage being disposed toward said actuator and permitting the transmission of light rays to said actuator from said lamp.

In the preferred embodiment of the invention as hereinafter more fully described, the actuator is a lever and the actuator assembly is pivotally mounted with respect to the cage holding a lamp and containing one or more color filters disposed between said lamp and said actuator, which filters are readily removable and replaceable. The actuator is a manually operable lever movable to different positions and the switch housing has means for restraining the movement of the lamp cage during the movement of the lever so that the lever can be illuminated with different colors in different positions.

The invention also provides a novel type of actuator assembly which is bifurcated to form two side members and in which the side members are contoured or shaped and the contoured or shaped portions are adapted to actuate switching mechanisms with either locking or momentary functions.

Another feature of the invention is the provision of a new and simplified panel mounting mechanism for an electrical switch of the type described.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 the electrical switch unit illustrated therein comprises a housing generally illustrated at 1, an operating lever or actuator generally illustrated at 2, four switch modules 3, 4, 5 and 6, each containing six terminals, a 2-terminal lamp illuminating module 7, a pair of cover plates 8 and 9, a mounting mechanism generally indicated at 10 for retaining the switch unit in a panel, and an escutcheon plate 11 for holding the actuating assembly in place.

As shown in FIG. 2, the actuating assembly 12 is formed with a central passageway 13 and is bifurcated so that it contains side members 14 and 15. This as-

sembly is usually molded from an electrically non-conducting plastic material in a single piece which is open at one end so that a light conducting member 16 can be inserted. The light conducting member 16 is usually made from a clear light conducting plastic and the lower end is positioned in the top of passageway 13 so that light rays from lamp 17 are visible in the light conducting member 16 which forms the outer end of the lever actuating assembly.

Lamp 17 is mounted in a cage 18 as shown in greater detail in FIGS. 13 and 14. Cage 18 has a spring clip 19 which is adapted to hold the lamp 17 in place when the latter is inserted in passageway 20 which is an opening in the bottom of the cage. The cage 18 is hollow and contains two side openings 21 for ventilation to permit dissipation of any heat produced by lamp 17. The outer end of cage 18 is provided with three filters 22, 23 and 24, which can be clear or different colors, e.g., the central filter 23 can be clear or orange or it can be omitted, and the other filters 22 and 24 can be red or green or some other color. The filters 22, 23 and 24 are normally made of plastic and are slightly flexible so that they can be snapped into place in the areas 25, 26 and 27 and held there by the undercut members 28, 29, 30 and 31. Each of the filters 22, 23 and 24 can readily be removed by pulling them outwardly and replaced by other filters of the same structure by pressing the latter inwardly until they snap into place beneath the undercut portions of members 28, 29, 30 and 31. The lamp 17 can be readily removed by grasping the base 32 and pulling it outwardly against the pressure of the resilient retaining means 19. A new lamp can be inserted by reversing the procedure.

The cage 18 also contains on opposite sides thereof pivot members 33. Referring to FIG. 2 the pivot members 33 are adapted to be received and to snap into place in openings 34 in actuating assembly 12. Openings 34 are formed in outwardly projecting pivot members 35 on opposite sides of actuating assembly 12. Pivot members 35 are adapted to be received in openings 36 on the opposite sides of housing 37, the lower sides of openings 36 serving as bearings for pivot members 35 of actuating assembly 12. Actuating assembly 12 also contains projecting portions 38 on the opposite sides thereof which are rounded at the top and are adapted to be received in openings 39 on opposite sides of housing 37. Openings 39 serve as guideways for members 38 and limit the back and forth movement of actuating assembly 12 when it is moved either to the right or to the left around pivot members 35. At the same time, during such movement, cage 18 remains stationary as actuating assembly 12 pivots around members 33 of cage 18. Cage 18 remains stationary because the opposing sides 40 and 41 contact the inner surfaces of upright members 42 and 43 which are integrally molded into the upper part of the housing 37 as shown by the exploded plan view in the lower part of FIG. 2.

The top of the housing 37 has a flat surface 44 which is adapted to receive an escutcheon plate 11 as shown in FIG. 10 and at the top of FIG. 2. Opposing sides of the housing contain openings 45 and 46 (see FIG. 1) which extend therethrough and the inner surfaces of said openings are adapted to receive the undercut projecting members 47, 48, 49 and 50 of the escutcheon

plate 11 which are integrally molded with the escutcheon plate and sufficiently resilient to bend inwardly and then snap into place in openings 45 and 46 when the escutcheon plate is inserted into the opening 51 in the top of the housing. At the same time the escutcheon plate can be readily removed by grasping the fingernail slots 52 and 53 of the escutcheon plate and pulling upwardly.

When the escutcheon plate 11 is removed in the manner indicated, the entire actuating assembly, including the cage 18 containing the lamp 17 and the filters, can be removed by grasping the actuator 2 and pulling it outwardly. It is then a simple matter to grasp the base 32 of lamp 17 and remove it and insert a new lamp. Moreover, the cage 18 is free to rotate around pivot members 33 because it is no longer restrained by the upright housing members 42 and 43. By rotating the cage the filters 22, 23 and 24 are exposed near the outer ends of actuating arms 14 and 15 and can easily be removed and replaced. If a white light is desired in the area normally occupied by a filter, the filter can be omitted, provided a white lamp is used. Thus, with a red filter on one side and a green filter on the other and no filter in the center, the end 16 would show the colors red, white and green. Sometimes it is desirable to insert an orange filter in the center so that the colors would then be red, orange and green.

The actuating assembly 12 is normally molded in one piece from a plastic material which is relatively rigid and self-supporting but at the same time sufficiently resilient that the actuating arms 14 and 15 can be spread apart far enough so that the pivot members 33 on opposing sides of the cage 18 can be inserted and snapped into place in opening 34.

Another feature of the escutcheon plate 11 is the provision of downwardly projecting members 54 and 55 which have arcuate surfaces 56 and 57 and are of different widths, the member 55 being wider than the member 54. Thus, it is possible to insert the actuating assembly 12 in the top of housing 37 only in one way. In the embodiment shown, when the escutcheon plate is inserted, the member 54 would fit in the top part 58 of opening 39 and the arcuate surface 56 would then act as an upper bearing surface for member 38 on one side of actuating assembly 12. Similarly, the surface 57 would act as a bearing surface for the opposing member 38 on the opposite side of actuating assembly 12.

After the actuating assembly 12 is in place, the inner surfaces of actuating arms 14 and 15 are superposed and normally rest on or are closely adjacent a flat embossment 59 which is molded into opposite sides of the housing 37. The shape of the ends 60 and 61 of actuating arms 14 and 15 controls the movement of the terminal blades generally indicated at 62 and 63 in FIG. 11. When the ends 60 and 61 have the shape shown in FIGS. 2 and 11 and the opening 39 has the general shape indicated the actuator 2 has three positions, namely, a central position, a lefthand position and a righthand position. The left hand position and the righthand position are momentary because with the particular configuration shown in full lines, the actuator 2 will not lock in either of these positions and the spring pressure of terminal blades 62 and 63 will normally hold actuator 2 in the central position. However,

if the ends 60 and 61 of the actuating assembly 12 have the shape shown in FIG. 9 and shown in dotted lines in FIG. 11, movement of actuator 2 to the lefthand position or the righthand position will automatically lock it in either of said positions. If the ends 14 and 15 of actuating assembly 12 have the shape shown in FIG. 8 and opening 39 has the shape shown in FIG. 11, the actuator 2 will lock in the righthand position but will be momentary in the lefthand position. In case it is desirable to have only two positions, the shape of opening 39 can be changed so that one side is a straight wall as illustrated by the dotted lines 64 in FIG. 2. The actuator 2 can then only move to the right and will normally occupy the center position. It cannot move to the left because the left side of projecting portion 38 will strike against the vertical wall 64 on the left side of opening 39.

The lower portion of housing 37 has a passageway 65 which is rectangular in cross section and is adapted to receive a lamp terminal holder 66. As shown in FIG. 2 the lamp terminal holder 66 on one side has a shallow recessed portion 67 and a deeper recessed portion 68. The shallow recessed portion 67 is adapted to receive the lower portion 69 of the interconnecting contactor 70, the lower end 71 fitting against the upper end of recess 68. The inwardly extending end 72 of wiring terminal 73 is placed against the lower end of recess 68 and coil spring 74 is inserted in recess 68 between the end 71 of contactor 70 and the end 72 of wiring terminal 73, thus holding the two contactors in place when lamp terminal housing 66 is inserted in passageway 65 of housing 37. Lamp terminal holder 66 also has an outwardly extending portion 75, used as a key for orientation, which fits into recess 76 in housing 37. In order to hold lamp terminal holder 66 in place in housing 37 an adhesive can be applied. Before lamp terminal holder 66 is inserted into passageway 65 lamp terminal 77 is placed in a recessed area 78 in the upper part of the other side of lamp terminal holder 66. When the unit is assembled, the upper end 79 of lamp terminal 77 and the upper end 80 of contactor 70 provide a lamp circuit for lamp 17. The wires to said circuit are connected at the opposite ends as indicated at 7 in FIG. 1.

Each of the switch modules 3, 4, 5 and 6 has an embossment as shown at 81, 82, 83 and 84, respectively, which is adapted to be received in openings in retaining clips 8 and 9 so that when retaining clips 8 and 9 are in place as shown in FIG. 1, the embossments seated in said openings hold the switch modules in place. The retaining clips 8 and 9 have opposing sides 85, 86 and 87, 88, respectively, and each of said opposing sides has a pair of pressed-in portions as generally indicated at 89, 90, 91 and 92 which are adapted to be received by recessed areas in opposing sides of housing 37 as generally indicated at 93 and 94.

The switch unit also contains a mounting mechanism which makes it possible to insert it and remove it from the front of a panel. The mounting mechanism generally indicated at 10 in FIG. 1 consists of two T-shaped members 95 and 96 (see FIG. 2) having inwardly directed bent portions 97 and 98 in the leg of the T which are received in recesses 99 on opposing sides of the housing 37. The length of the recesses or grooves 99 limits the movement of T-shaped members

95 and 96. The inwardly bent portions 97 and 98 have screw holes at the top and bottom adapted to receive screws 100 and 101 which are inserted through the top opening 51 of housing 37 into holes 102 and 103 and extend into a aperture in a portion 109 of housing 37 into recesses 110 on opposite sides of the bottom of housing 37. When the screws 100 and 101 are inserted through holes 102 and 103 and then through the screw holes in inwardly bent portions 97 and 98 of T-shaped members 95 and 96, turning the screws 100 and 101 clockwise will cause T-shaped members 95 and 96 to move toward the top of the switch and be cammed outwardly over an outwardly inclined area 104 (see FIG. 1) and upwardly toward the flange portion 105 at the top of the housing. Thus, when a switch unit as shown in FIG. 1 is inserted in a panel opening sized to receive it, the escutcheon plate 11 and the actuating assembly 12 can be removed thereby exposing the heads of screws 100 and 101. The screws 100 and 101 are then turned with a screwdriver so as to cause the T-shaped members 95 and 96 to move upwardly and outwardly until they clamp the panel against the flanged area 105. The actuating assembly 12 and the escutcheon plate 11 are then replaced in the manner previously described.

When it is desired to remove the switch unit from a panel the escutcheon plate 11 is first removed by pulling upwardly on the fingernail holes 52 and 53. Thereafter the actuating assembly 12 is pulled outwardly and the screws 100 and 101 are turned so as to cause the mounting mechanism 10 to be retracted until the T-shaped members 95 and 96 are within a recess 106 in opposite sides of housing 37 thereby permitting the entire unit to be removed through the panel opening. To facilitate the movement of T-shaped members 95 and 96 outwardly, inwardly extending dimples 107 and 108 are provided. Of course, it is unnecessary to remove the unit to re-lamp or to place new color filters in it because this is accomplished by removing the actuating assembly 12 in the manner previously described.

It will be recognized that a switch unit of the type described can be used in many different types of switching operations. FIGS. 3 and 4 illustrate the arrangement of the terminals shown from the rear of the switch in 2-position switches, FIG. 3 being the arrangement in a 2-pole double-throw switch, and FIG. 4 being the arrangement in a 4-pole double-throw switch. FIGS. 5, 6 and 7 illustrate terminal arrangements shown from the rear of the switch in 3-position switches, FIG. 5 being a 2-pole double-throw switch, FIG. 6 being a 4-pole double-throw switch, and FIG. 7 being an 8-pole double-throw switch. The lamp terminals are not shown in these arrangements. Except for the lamp terminals, it will be seen that the terminal arrangement in FIG. 7 corresponds to that in the switch unit shown in FIG. 1.

Referring to FIG. 11 it should be noted that the sides of the flat embossment 59 (also shown in FIG. 2) act as stops for the blades 62 and 63. Thus, when actuator 2 is moved to the right the inner end 60 of side member 14 of actuating assembly 12 will cause terminal blades 62 to move to the left but terminal blades 63 will remain stationary because they are abutted against the right side of embossment 59. When actuator 2 is moved to the left, the end 60 of actuating assembly 12 will cause

terminal blades 63 to move to the right but terminal blades 62 will remain stationary because they are abutted against the left side of embossment 59. Terminal blades 62 and 63 not only rest on but in fact preferably are tensioned against flat embossment 59. This arrangement serves to pre-position blades 62 and 63 so as to permit removal and subsequent re-installing of actuator assembly 2. The pretensioning of 62 and 63 also serves to keep a contact pressure condition between blades 62 and 63 and the two innermost terminal blades.

When the ends of arms 14 and 15 of actuating assembly 12 have the shape indicated at 111 in FIG. 9 and the actuator 2 is pulled to the left, the corner 112 will lock in the angular recess 113 of terminal blades 63 (FIG. 11) and stay in this position until actuator 2 is moved in the opposite direction. When actuator 2 is moved to the right the corner 114 will enter angular recess 115 of terminal blades 62 and lock actuator 2 in the right hand position until manual pressure is applied in the opposite direction. This is usually referred to as 3-position locking action.

When the ends of arms 14 and 15 have the shape generally indicated at 116 in FIG. 8, actuator 2 when moved to the left will lock in the lefthand position due to the fact that corner 117 enters angular recess 113 of terminal blades 63 and will remain in this position until pressure is exerted in the opposite direction. However, when actuator 2 is moved to the right, the surface 118 will merely slide over corner 119 of terminal blades 62 but no locking will occur. Hence, in the righthand position actuator 2 has a momentary function and will return to its central position just as soon as it is released. This is usually called a "lock-non-lock" switch.

As previously indicated, when the inner ends 60 and 61 of actuating arms 14 and 15 have the shape shown in FIG. 2 and the opening 39 has the shape shown in FIG. 2 the switch lever positions are non-locking in three positions and in this case the switch is referred to as a 3-position momentary switch.

The invention provides electrical switch units having unusual versatility and adaptability for all front panel switching applications, for computers, telecommunications systems, industrial control equipment, intercoms, ground support systems, medical electronics, scientific instruments, broadcast consoles and test instrumentation requiring rugged, reliable, economical and ver-

satile illuminated lever switching.

While the invention is particularly important in providing new and improved illuminated switch units, these switch units also afford new and improved electrical switching with or without illumination and the invention is susceptible to substantial modification and variation in the manner of its practical application.

The invention is hereby claimed as follows:

1. An electrical switch unit having an illuminated actuator lever removably mounted in a switch housing, means for illuminating said actuator lever from within the switch housing comprising an actuator assembly having an internal passageway extending inwardly from said actuator, a cage removably mounted in said passageway and a lamp removably mounted in said cage, said cage having an outer and an inner end and sidewalls, the outer end of said cage being disposed toward said actuator and permitting the transmission of light rays to said actuator from said lamp.

2. A switch unit as claimed in claim 1 wherein said actuator is a lever and said actuator assembly is pivotally mounted with respect to said cage.

3. A switch unit as claimed in claim 2 wherein said cage contains one or more color filters disposed between said lamp and said actuator lever in alignment with different positions of said actuator lever.

4. A switch unit as claimed in claim 3 in which said filters are readily removable and replaceable.

5. A switch unit as claimed in claim 1 wherein said lamp is a single lamp centrally mounted in the inner end of said cage with its base extending outward and said cage comprises means for holding said lamp against accidental displacement while permitting removal of said lamp by pulling said base away from said cage.

6. A switch unit as claimed in claim 1 wherein said actuator comprises a manually operable lever movable to different positions and said switch housing comprises means for restraining the movement of said cage during the movement of said lever.

7. A switch unit as claimed in claim 1 wherein said actuator assembly is bifurcated to form two side members and said cage is disposed between said side members.

8. A switch unit as claimed in claim 7 in which said cage comprises outwardly extending pivot members and said side members contain openings adapted to receive said pivot members.

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