# United States Patent

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[54] **ILLUMINATED PUSHBUTTONS USING PIPED LIGHT**
**2 Claims, 7 Drawing Figs.**


[52] **U.S. Cl.** ..... **240/2,** 116/124, 116/129 L, 200/159, 200/167, 240/1 EI, 340/380, 350/96
[51] **Int. Cl.** ..... **F21r 33/00**
[50] **Field of Search** ..... 240/1, 2, 2 S, 2 SP, 2 B, 1 EI; 40/331; 116/124.4, 124, 129 L, 129 E, 135; 200/167, 167 A, 172, 159; 350/96; 340/380



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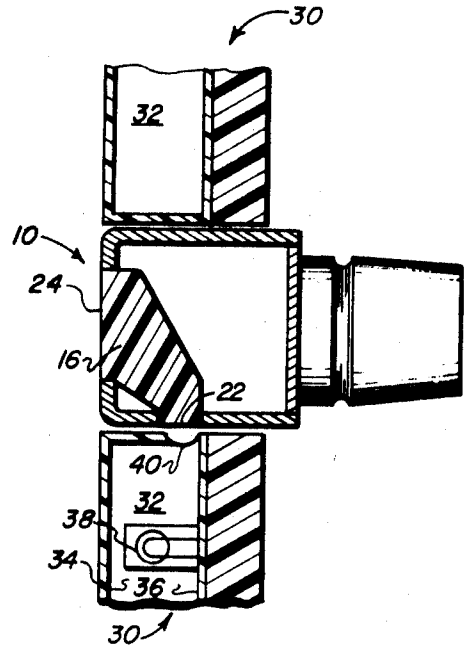
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**ABSTRACT:** A pushbutton-type switch providing illuminated indication of position or mode through utilization of piped light energy the energy being that previously unused excess light which was contained within the opaque coating of a transilluminated unit upon which these pushbuttons are employed. Through controlled escape of this excess light energy and piping of same to the desired pushbutton or surface the switch or pushbutton is self-illuminated, thus obviating any necessity for inclusion of supplemental lighting means.

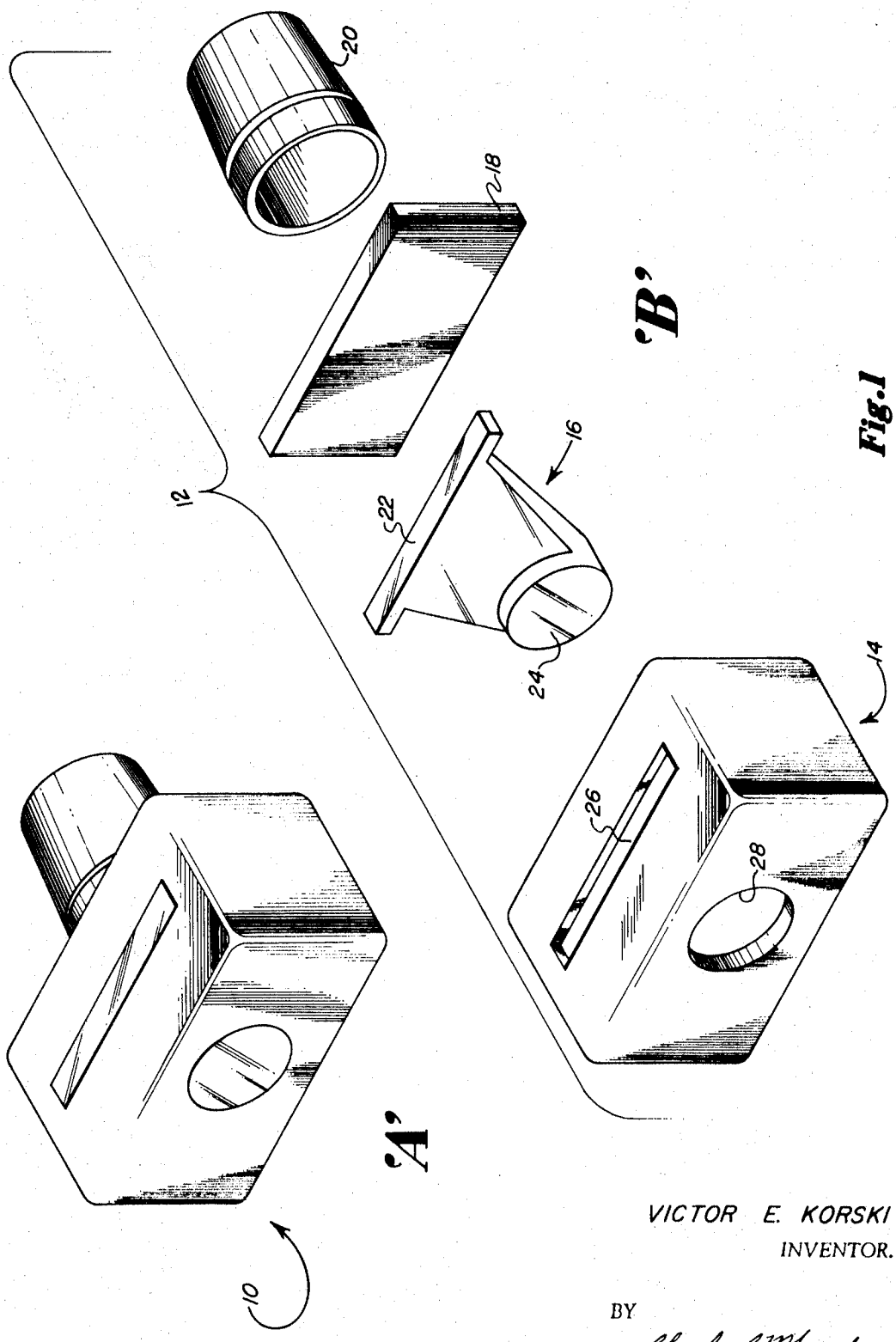



Fig.1

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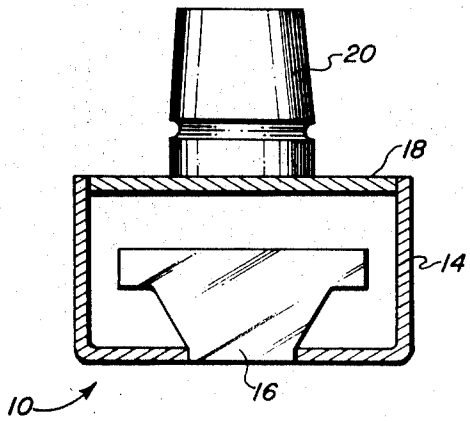



Fig. 2

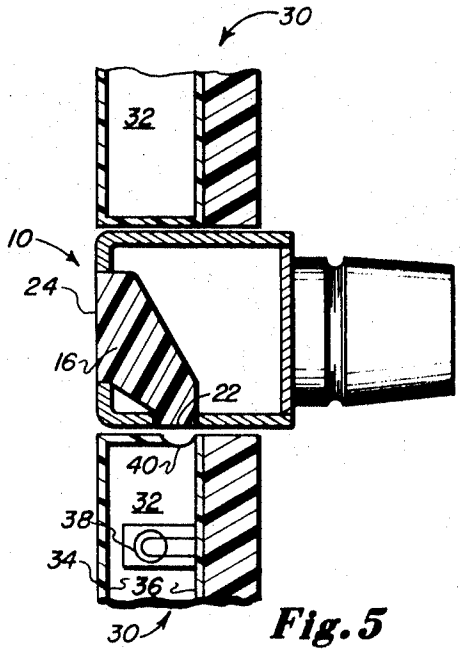



Fig. 5

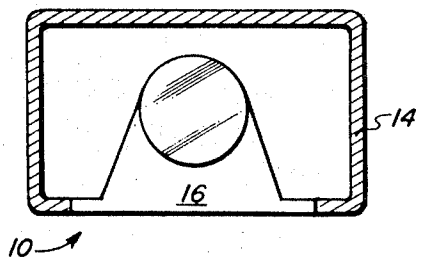



Fig. 3

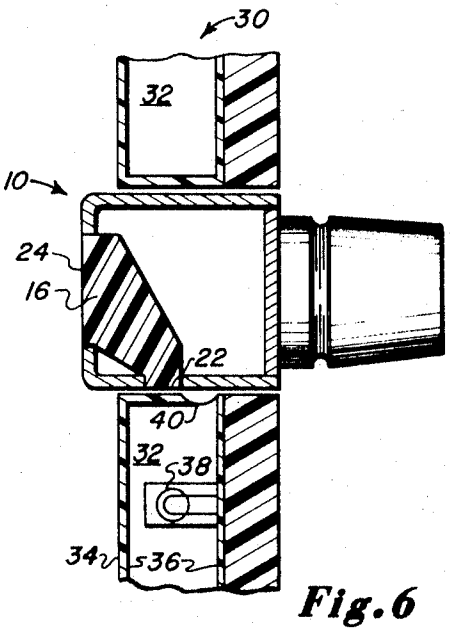



Fig. 6

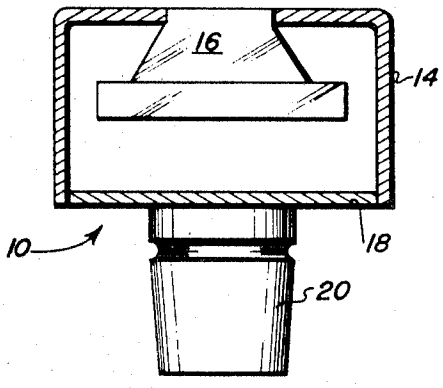



Fig. 4

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# ILLUMINATED PUSHBUTTONS USING PIPED LIGHT

The present invention relates generally to illuminated position indicating pushbutton switches.

More particularly this invention relates to pushbutton switches which are illuminated by piped light methods to provide mode or position indication by using that excess light energy contained within the unit they are employed upon.

## PRIOR ART

Numerous applications have been discovered for illuminated pushbuttons which have resulted in the development of many types of these switches, each designed to fulfill a certain or specific need. One of the most widely used types of illuminated pushbuttons is dependent upon an incandescent lamp embedded or retained in the base of the pushbutton to provide the desired indication. The contained lamp is energized by application of electrical power through the body of the switch upon depression or actuation of the pushbutton. The surface of the switch or pushbutton is in turn transilluminated by the thus energized lamp.

Several disadvantages are inherent in a pushbutton of this self-contained lamp-type. The primary objection is the possible resultant heat concentrated in an area which the switch manipulator, or operator, is required to touch. Any additional heat is also objectionable in many instances in itself; the fact that heat is centered at the required point of physical contact and in close proximity to the means which it actuates renders it especially undesirable.

In addition to the aspect of unwanted heat, there is the necessity for frequent checking or multiple switches and replacement of expended lamps for it is obvious that in the event of a lamp failure there remains no means for acquiring the desired indication of mode or position.

In certain applications, such as for example within aircraft cockpits, there are requirements that the brightness of the indicators be the same level or degree of brightness as the rest of the cockpit lighting. This necessitates dimming controls since power for the lamp must pass through the body of the switch, requiring move complex indicators.

Another frequently utilized method for illuminating pushbuttons consists of an engraved line—etched, masked or otherwise imposed—upon the surface of an adjacent transilluminated panel which line is exposed upon depression or actuation of the pushbutton. This engraved line method presents parallax problems and is limited in its suitability since satisfactory viewing is obtained only from specific angles of view.

The disadvantages referred to above and others which are inherent in pushbuttons presently utilized and known are overcome by the present invention. This invention, as hereinafter completely disclosed, is made operative by piping light from the transilluminated plastic panel to the surface of the selected pushbutton. This method generates no transfer or concentration of heat, thus overcoming some of the more objectional aspects of presently known pushbuttons. In fact, the pushbuttons which are illuminated by Applicant's method remain cooler than the surrounding plastic panel.

A further problem solved by the instant invention is one pertaining to maintenance. The illuminated pushbutton provided by this invention obviates any necessity for periodic lamp replacement thereby saving much time and money previously expended in checking, testing and replacing of faulty lamps and prevents in-use failure. The light energy utilized for purposes of illumination in Applicant's device is that energy which was previously wasted and unutilized. The pushbutton of the present invention requires no additional wiring or electrical power resulting in a system which is more economical as an initial installation and provides continued economy because of the minimum amount of maintenance required for its support. Simplicity is the keynote and many collateral savings are effected by use of the invention.

Parallax presents no problem to the present device since the indicating surface is readily observed from any angle. Brightness control difficulties are likewise vitiated because intensity of the light energy piped to the pushbutton indication means will remain directly proportional to that illumination intensity afforded to the surrounding transilluminated plastic panel.



Devices similar to the pushbuttons hereinafter disclosed are known in the area of the involved art and are perhaps best exemplified in U.S. Pat. No. 3,213,269 issued to C. A. Melvin et al. and U. S. Pat. No. 3,163,739 issued to P. Hutt. The devices described in these patents are similar in that they also use light to provide indication of button selection or depression. The goal of indicative illumination is attained by each in a different manner. Both the Melvin and Hutt patents use a prism to bend the light rays ninety degrees (90°) from an active light source. Melvin's device uses that light to illuminate the total face of the pushbutton; Hutt's uses its light to illuminate a portion of the face of the pushbutton to which pressure has been applied. Both Melvin's and Hutt's pushbuttons require, and were designed to utilize, high levels of source illumination.

On the other hand, Applicant's invention is based on condenser or magnification principles. The shape of the prism, or lens, used in the invention gathers the limited light energy emitted from transilluminated plastic panel construction, condenses, controls and conducts that light energy through a short light pipe. This concentrated light energy is then emitted from the aperture surface of the actuated pushbutton to provide the sought after indication.

A further distinction is that Applicant's invention uses transilluminated plastic panels as a self-contained light source wherein the level of emitted illumination is in most instances no greater than 2.0 foot lamberts in brightness. This is why Applicant's device condenses or concentrates the effective energy to indicate pushbutton actuation.

Therefore, in view of the aforementioned examples, which are exemplary of only a few of the advantages to be obtained by use of the subject invention, it is the salient object of Applicant's invention to provide a simple, effective and inexpensive type of pushbutton indicator which is illuminated by the use of piped light.

It is a further object of this invention to provide easily and readily observable illuminated indications of the mode position of any particular switch or switches.

A further object is to accomplish all of the above by a simple and inherently reliable means, resulting in the effectuation of pecuniary savings in the areas of initial installation and subsequent inspection, replacement and repair.

A still further object of the instant invention is to substitute existing, previously unused light as a source of illumination in lieu of expensive, usually unreliable, additional lighting means, resulting in the furnishing of environmental lighting conditions which are compatible with requirements of such specialized areas as within aircraft cockpits for example.

An additional object of this invention is the provision of pushbuttons which will be illuminated to indicate either "on" or "off" positions, dependent upon the choice of the person installing same. It is conceivable that some conditions would be more suitably indicated by a pushbutton which is extinguished by actuation or depression as opposed to a pushbutton which is illuminated by such manipulation.

The following specifically explained embodiment of the present device is used for purposes of description only and should not be construed as being in any way restrictive of the involved invention.

Other objects and advantages of this invention will become readily apparent from a consideration of the following description, appended claims and accompanying drawings.

The invention will be readily understood by those versed in the art when taken in context of the following specification and related drawings, wherein:

FIG. 1A is an isometric view of the indicator of the invention as embodied in a pushbutton, and FIG. 1B is an exploded isometric view of the indicator indicating the relationship of the basic components contained therein;

FIG. 2 is a partial sectional plan view of the indicator;

FIG. 3 is a front-elevational partially sectional view of the indicator;

FIG. 4 is a bottom partially sectional view of the indicator;

FIG. 5 is an elevational view in cross section of the indicator in operative position in a transilluminated plastic panel; and

FIG. 6 is an elevational view in cross section of the indicator of FIG. 5 showing the position thereof in the undepressed or off position.

Referring first to FIG. 1, A is an isometric view of the pushbutton indicated generally as 10, and B is an exploded isometric view of the component parts comprising pushbutton 10, the relationship of the basic components 12 being shown. As therein shown, component parts 12 of pushbutton 10 comprise a preferably opaque shell 14, lens 16, support block 18 and support adapter 20. Support adapter 20 may be adaptable to any pushbutton switch or mechanical actuator having two relative positions to accomplish a function, and may be made of plastic, metal or any other environmentally acceptable material. Support block 18 should be fabricated or formed of an opaque material chosen so as to be suitable for anticipated operating conditions. Metal is acceptable but plastic is adequate for most uses. This opaque quality of support block 18 assists in preventing escaped light energy and obviously affords an inexpensive, easily workable end piece. Support block 18 may be affixed to support adapter 20 by several means. For instance, joining may be accomplished by riveting, screwing, or it may be spun into position. It is also feasible to form support block 18 and support adapter 20 as one combined piece.

Lens 16 is an optical light-transmitting body, formed in the preferred embodiment of acrylic plastic for example, so shaped as to first absorb light through light intake surface 22 and then redirects the light energy thus received so that it is concentrated and conveyed to provide illumination for light-emitting surface 24.

Light-emitting surface 24 may be frosted if so desired. Frosting would provide diffused illumination. The outer surfaces of the body of lens 16, except for light intake surface 22 and light-emitting surface 24 may be modified by properly selecting a coating material possessing the desired color characteristics.

Light intake surface 22 should be highly polished and may be treated with a proper coating chosen to enhance its light-absorbing qualities.

Opaque shell 14 may be molded or constructed so as to contain properly positioned locating ears and locking flanges (neither of which is shown) internally to assist in maintaining the desired relative positions of shell 14 and lens 16 during bonding or assembly. The ears, flanges, etc. may be so designed as to permanently hold the members in the designed relationship. The method utilized in the preferred construction was to locate lens 16 inside opaque shell 14 so that light intake surface 22 and light-emitting surface 24 were mounted in, and flush with, intake aperture 26 and emitting aperture 28 provided in opaque shell 14. A suitable substance, such as epoxy resin may then be poured or injected into shell 14 and over and around lens 16 which on hardening will retain lens 16 in the desired position within shell 14. Support block 18 and support adapter 20 may then be affixed by several equally acceptable methods, such as gluing for example.

It may be desirable in some instances to provide extensions, ears, flanges, etc. within shell 14 and between shell 14, lens 16 and support block 18 so as to better provide for the transfer of button pressure through pushbutton 10 to support block 18. The preferred construction was not found to require this since it was, in effect, one solid block, the epoxy completely adhering all components together. The necessary structural integrity of the completed button is dependent upon anticipated usage for the switch.

Referring now to FIG. 2, there is shown a partial sectional plan view from above of button 10 as an aid in indicating the relative position of the component parts 12, see FIG. 1, in their assembled relationship, while FIG. 3, which is a front-elevational view partially in section, further illustrates the shape of lens 16 as it is contained within opaque shell 14,

FIG. 4, a bottom view of the same pushbutton 10 partially in section, provides a further indication of the relationship of the component parts 12 of FIG. 1.

Referring now to FIG. 5, there is shown an elevational view in cross section of pushbutton 10 as installed within transilluminated plastic panel 30. Panel 30 is preferably formed of plastic matrix panel 32 having a nonlight-transmitting facing 34 which may be reflectorized on one side 36, matrix panel 32 being integrally lighted as indicated by lamp 38.

Matrix panel 32 has a light source aperture 40 of concave shape therein, the radius of aperture 40 is not critical unless lens 16 is precision engineered to function as a true-lens system. The preferred embodiment of the invention is not predicated upon a true-lens system but rather is a system of piped lighting whereby light energy contained within transilluminated matrix panel 32 is permitted to escape therefrom through source aperture 40, thence into lens 16 through light intake surface 22 where, because of the shape of lens 16, the comparatively large amount of light received through light intake surface 22 is collected, channeled, concentrated, and conveyed to light-emitting surface 24 where the resultant light is emitted, thereby providing the desired illuminated indication. The area of light intake surface 22 is larger than light-emitting surface 24 and this desired disparity in sizes provides the ability to utilize a comparatively weak light source yet still obtain a usable amount of light for indication purposes.

FIG. 6 is similar to FIG. 5 except that it shows the pushbutton 10 in the undepressed, or off position. In this position there will obviously be no light indication upon the face of pushbutton 10 at light-emitting surface 24, since light is not transmitted between matrix panel 32 and light intake surface 22 of lens 16 since surface 22 is not in registry with source aperture 40 of matrix panel 32.

It is to be noted that by changing the relative positions of light intake surface 22 and light source aperture 40, pushbutton 10 may be illuminated in the undepressed position and not be illuminated in the depressed position. There may be situations where this arrangement might be desirable.

It is also noted that light source aperture 40 should be of a width which is equal to the distance which pushbutton 10 must travel in moving from the undepressed to the depressed position. This width should also be of the same width as light intake surface 22, this permits maximum acquisition of light which is to be transmitted through lens 16 to light-emitting surface 24. The length of light source aperture 40 should also be as great as the length of light intake surface 22, and both should be as wide as feasibly possible. Light source aperture 40 is preferably of concave shape, with no paint, and the surface thereof should be polished, in order to achieve maximum light transfer.

In summary, it may be stated that the use of this novel type of pushbutton 10 is not limited to a single button, but rather a multitude of such buttons may be, and preferably are, used. These may be so related as to allow illumination of only one button at a time, or in any number, or such combination as may be deemed desirable or necessary in order to supply the requisite information to the operator or observer.

It may be further said that the illuminated pushbuttons disclosed in the preceding specification and drawings permits visually discernible indication of the switch's position or mode by utilizing previously unused light energy from its normal source by controlling the escape of said light, directing, channeling and concentrating same by use of piped light methods.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A position indicating switch for cooperation with a remote mounted light source comprising:

a. casing means having a first and second portion in angular relationship to one another;

b. light-transmitting means mounted within said casing means and having a first end positioned relative to said first portion of said casing means and the light source so as to permit entry of light energy from the light source to said light-transmitting means on predetermined displacement of said casing means, and a second end positioned relative to said casing means second portion and said light-transmitting means first end operative to effect transmission of the light energy received through said first end to said second portion of said casing means, said second end defining a face to be illuminated on displacement of said casing means.

2. A switch position indicating means comprising, in combination:

a. a panel having attached thereto a light-transmitting plastic matrix unit defining a transilluminated facing panel having a nonlight-transmitting facing on at least the front and sides thereof, a light source mounted within said facing panel, said panel and said facing panel each defining at least one aperture for the reception of a position displaceable switch, said nonlight-transmitting facing defining a source aperture on at least one side of said facing panel defining aperture to permit controlled egress of light from said transilluminated facing panel, said source aperture being positioned so as to be in registry with a light-transmitting means of the position displaceable switch on predetermined displacement thereof;

b. a position displaceable switch means comprising a substantially closed nonlight-transmitting casing means selectively moveably mounted in said panel defining aperture, a light transmitting and directing means positioned within said casing means having a first and second portion angularly displaced from one another, said first portion extending through one wall of said casing means in predetermined relationship to said transilluminated facing panel source aperture so as to be in registry therewith on displacement of said switch, said second portion extending through a second wall of said casing means in angular relationship to said first wall and defining a light-emitting surface, said first portion having an area larger than said second portion operative to utilize a comparatively weak light source.

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