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ILLUMINATED PUSH BUTTON SWITCH

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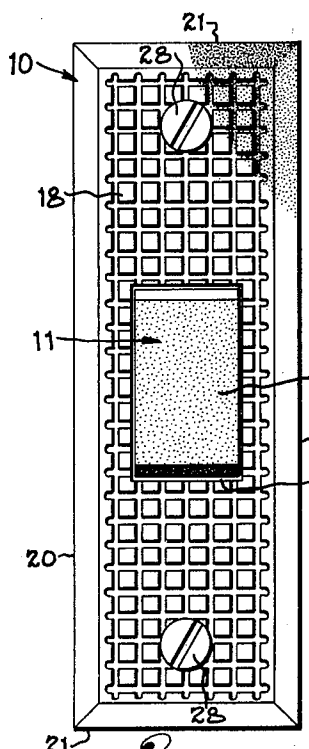


Fig. 1

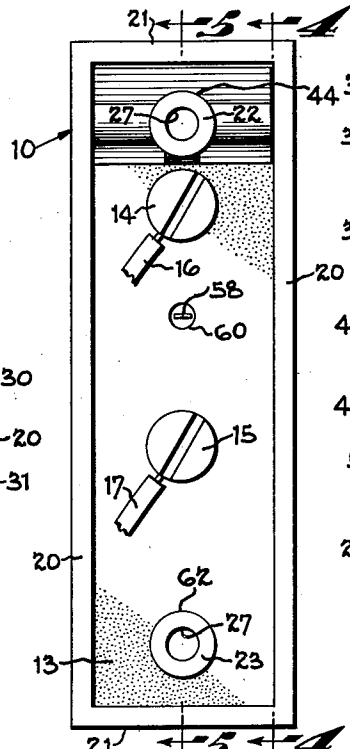


Fig. 2

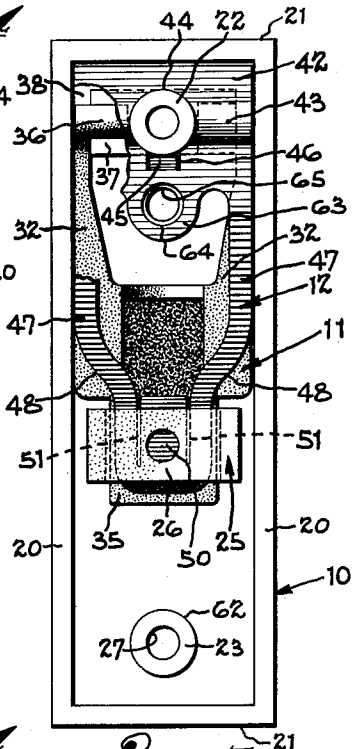


Fig. 3

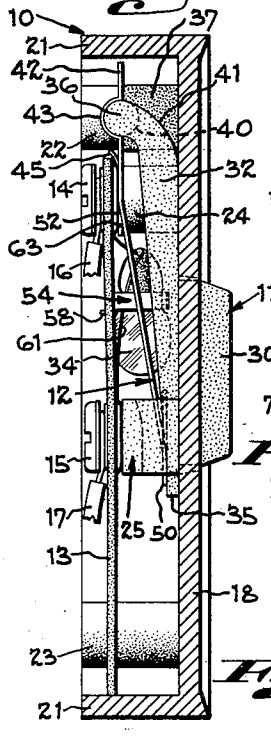


Fig. 4

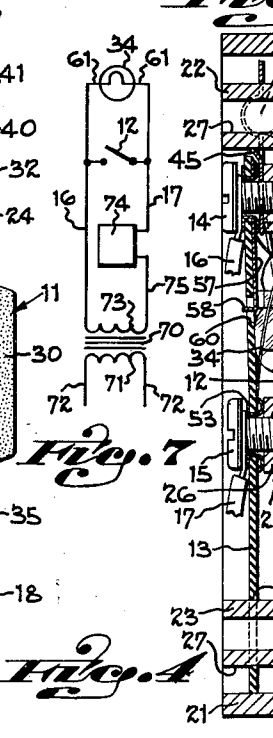


Fig. 7

Fig. 5

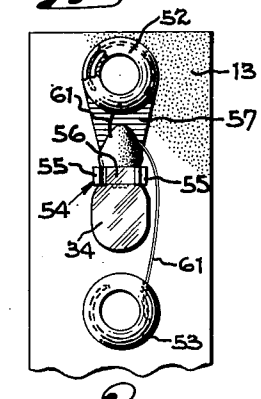


Fig. 6

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ILLUMINATED PUSH BUTTON SWITCH

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7 Claims. (Cl. 200—167)

This invention relates to an illuminated push button switch, particularly for residential use in the signal circuits of door chimes, buzzers and the like, the switch being installed adjacent the door or doors of the building.

An illuminated switch of this general type is disclosed in the copending application of Elmer H. Bladh, Serial No. 245,579, filed September 7, 1951, which is assigned to the present assignee. The switch of the prior application embodies an electrical lamp arranged to illuminate a card which bears the name of the occupant of the building or apartment, so as to make the card visible at night. The lamp, which is of a miniature, low voltage type, is shunted across the terminals of the switch in such a way that the lamp is energized at all times directly from the transformer which operates the door signal. The switch of the present application likewise is provided with a lamp bulb; however, the lamp is arranged to illuminate the push button of the switch, as distinguished from a card, the lamp being located directly behind the push button which is fabricated from a translucent material to allow the light rays to diffuse through it.

One of the primary objects of the invention has been to provide a switch having a push button or actuating key which is in the form of a light chamber partially enclosing the lamp bulb so as to receive the light rays directly from the lamp for clear illumination at night.

For the purpose of providing direct illumination, the push button is a generally yoke-like structure, consisting of a box-like actuating key or button forming a light chamber partially enclosing the light bulb and having a pair of spaced arms rising from the hollow button and straddling the light bulb. The outer ends of the arms include trunnions which are pivotally journalled in the housing, such that the button structure is mounted for pivotal movement. The button is held in its normal extended position by a switch blade in the form of a flat spring which is also generally yoke-shaped, corresponding to the button structure, and having a pair of flexible limbs straddling the light bulb and yieldably urging the button outwardly under light spring pressure. The flat switch blade serves the additional function of completing the electrical circuit of the switch when the button is depressed.

A further object of the invention has been to provide a push button switch of exceptional simplicity in which the pivotally mounted push button is locked permanently in assembly by the switch blade which provides a self-locking wedging engagement relative to the housing. By virtue of this arrangement, the assembly procedure consists simply in placing the push button structure within the switch housing from its open rearward side, then forcing the switch blade upon it in operating position.

Another feature of the invention resides in the arrangement of a backing plate upon which the lamp bulb is permanently mounted, the backing plate being removably mounted upon the open rearward side of the switch housing such that it may be replaced readily in the event the lamp burns out after prolonged service. The backing plate is also utilized to complete the electrical circuit from one lead wire of the signal circuit through the switch blade to the other lead wire of the circuit. For this purpose, the switch terminals are mounted directly upon the backing plate in position to complete the circuit through the switch blade when it is sprung inwardly by depressing the push button.

The miniature lamp bulb which is utilized for the switch is devoid of a base, its lead wires being sealed in the glass envelope and protruding from one end of the lamp. By mounting the lamp permanently upon the backing plate, the plate forms a protective mounting with the leads connected permanently to the terminals of the backing plate and protected from strains. The backing plate is attached to the switch housing by the means of two screws, one of which provides a contact which is engaged by the switch blade when the button is depressed. By virtue of the self-locking engagement of the switch blade, the backing plate may be removed for replacement of the lamp without disturbing the other components of the switch. The simple structure of the switch therefore adapts the several components to be assembled in a highly efficient manner to provide a low cost unit and also provides the convenient replacement of the light bulb.

Various other features and advantages of the invention will be apparent to those skilled in the art from the following description taken in conjunction with the drawings.

In the drawings:

Figure 1 is a front elevational of the illuminated switch in mounted position.

Figure 2 is a rear view of the switch removed from its mounting surface showing the lead wires connected to the terminal screws.

Figure 3 is a rear view of the switch with the backing plate removed to illustrate the internal switch components.

Figure 4 is a sectional view of the switch taken on line 4—4 of Figure 2.

Figure 5 is a sectional view taken on line 5—5 of Figure 2, further detailing the internal switch structure.

Figure 6 is a fragmentary view of the backing plate, showing the mounting structure and electrical connections of the lamp bulb.

Figure 7 is a diagram showing the electrical circuit of the switch and its connections with a transformer and door signal.

Described generally with reference to the drawings, the illuminated switch comprises a rectangular housing indicated at **10**, which is formed preferably of a thermoplastic material such as polystyrene having a suitable opaque surface finish; for example, it may be given an external metallized film which is protected by a lacquer coating. As best shown in Figure 4, the switch is of simplified construction, comprising a pivotally mounted push button or actuating key indicated generally at **11**, a switch blade **12**, and a backing plate **13** which overlies the push button and switch blade. The backing plate is attached to the switch housing by the terminal screws **14** and **15** which also complete the circuit of the lead wires **16** and **17** through the switch blade when the push button is depressed. As described later in detail, the switch blade is fabricated to provide a self-locking engagement wihtin the housing at assembly to retain the push button in operating position before the backing plate **13** is attached and also to urge the push button outwardly. This facilitates assembly and allows the backing plate to be removed, if necessary, and replaced with a new plate and light bulb assembly.

Described in detail, the switch housing, which is preferably of molded construction, is generally rectangular in shape, comprising a decorative front wall **18**, side walls

20—20 and end walls 21—21, the back of the housing being open. The interior of the housing is provided with a pair of cylindrical bosses 22 and 23 at opposite end portions rising from the front wall and an intermediate threaded boss 24 adjacent the boss 22. In addition, the casing includes a bridge structure 25 including a cross member 26. The cylindrical bosses and bridge provide the means for mounting the components of the switch and backing plate as described later. The bosses 22 and 23 are bored as at 27 to receive the mounting screws 28 (Figure 1); the ends of the bosses 22 and 23 seat against the mounting surface and thus absorb the pressure imposed by the mounting screws 28.

The push button structure is generally yoke-shaped as viewed in Figure 3 with its arms straddling the light bulb, such that the light rays pass directly to the interior of the button or actuating key. The switch blade as described later, is also generally yoke-shaped so as to straddle the light bulb. The bulb is mounted upon its backing plate in such position that the bulb resides centrally of the open face of the chamber and partially within it; thus there is no interference with the light rays by any parts of the switch assembly.

The button or key 11 of the switch consists of a swinging yoke having an actuating head 30 at one end which projects outwardly through an opening 31 formed in the front wall of the casing. The head is pivotally mounted within the casing by a pair of arms 32—32, the ends of the arms being pivotally mounted within the upper portion of the casing as described later. The head is generally rectangular as viewed from the front and is in the form of a hollow, box-like chamber indicated at 33, forming a light chamber partially enclosing the lamp bulb 34.

The push button, which is also preferably molded, is formed of translucent material, such as polystyrene and is attractively illuminated at night by the bulb so that its head 30 is plainly visible to the user. The opaque surface finish of the switch housing prevents the emission of light rays through the housing to accenuate the glowing head of the switch. It will be noted in Figure 5 that the edge of the head 30 is provided with a peripheral flange 35 which, in the normal position of the push button, resides against the front wall of the housing around the opening 31. As shown in Figure 4, the arms of the push button also reside in contact with the surface of the front wall. The flange 35 and lower portions of the arms 32 thus prevent direct light rays from passing through the crevice of the opening surrounding the switch head.

Referring to Figure 3, it will be seen that the arms 32 straddle the light bulb and fit closely but with running clearance between the side walls 20 of the switch housing. The upper end of each arm is provided with a trunnion or pivot pin 36, the two pivot pins projecting inwardly toward one another from opposite sides of the cylindrical boss 22. The trunnion pins are pivotally confined in respective bearing blocks 37 which project inwardly from the front wall 18 of the housing as best shown in Figure 4. The inner sides of the bearing blocks merge with and form an integral part of the cylindrical boss 22 while their outer sides are spaced from the side walls as at 38 (Figure 3) to provide clearance at the upper portion of the arms 32. The projected ends of the bearing blocks are provided with semicylindrical recesses indicated at 40 (Figure 4), the pivot pins interfitting the recesses. It will be noted that the end portions of the arms which carry the trunnion pins, are curved outwardly as at 41 and that the curved portions reside in the clearance spaces 38 between the side walls and bearing blocks.

The trunnion pins are confined in their recesses by the switch blade as explained below. The switch blade is in the form of a leaf spring which urges the head of the push button normally to its extended position and also completes the electrical circuit when the push button is depressed. It is formed from thin springy sheet metal, such as phosphor bronze, and is fabricated as a one-piece stamping. Referring to Figure 3, it will be noted that the switch blade includes a mounting plate portion indicated at 42 which is provided with a pair of transverse, semicylindrical corrugations 43—43 which form bearing caps overlying the pivot pins 36. The bearing caps and recesses which they overlie thus provide cylindrical bearings rotatably confining the pins 36.

The switch blade has a width to fit loosely between the side walls 20—20 of the switch housing. The mounting plate portion 42 is provided with a mounting hole 44 which fits snugly over the cylindrical boss 22. The plate portion is locked securely to the boss by a retainer tang 45 which is delineated by the slits 46—46 extending outwardly from the mounting hole 44. The tang projects at an angle outwardly from the plane of the plate portion 42 (Figure 4) and its outer end establishes a wedging engagement against the periphery of the cylindrical boss 22.

Upon assembly, the push button is first placed in position from the open side of the housing with its trunnion pins interfitting the recesses of the bearing blocks; thereafter, the plate portion 42 of the switch blade is slipped over the cylindrical boss and pressed down until it seats firmly against the outer ends of the bearing blocks to confine the pivot pins. Upon release of the plate portion, the retainer tang locks the switch blade firmly to the boss and thus holds the push button and switch blade permanently in assembly with the push button sprung outwardly.

The spring portion of the switch blade is in the form of flexible limbs 47—47 extending downwardly from the plate portion 42. The lower portions of the limbs are curved inwardly as at 48, the curved portions converging toward one another and joined to a contact plate 50. The contact plate is delineated by slits 51—51 which separate it from the limbs and allow the contact plate to flex with respect to the limbs.

As viewed from the side in Figures 4 and 5, the flexible limbs 47 extend at an angle from the plate portion 42 downwardly toward the front wall of the housing, with the contact plate 50 seated against the flange 35 of the push button head 30. The limbs are bent at an angle greater than that shown in the drawing, such that they are sprung to a decreased angle when the mounting plate portion is forced upon the boss. The limbs are thus preloaded to urge the head of the push button outwardly under constant light pressure with the flange 35 of the head and the arms 32 engaged against the surface of the front wall.

After the push button and switch blade are assembled in the housing, the backing plate 13 is placed in position and attached by the screws 14 and 15. When the switch is to be mounted for operation, the screws 14 and 15 are loosened and the lead wires 16 and 17 are hooked under the heads of the screws; thereafter, the screws are tightened. The backing plate consists of a sheet of electrical insulating material such as pressed fiber board. It is provided with a pair of contact rivets 52 and 53 to receive the terminal screws 14 and 15, the rivets serving to complete the electrical circuit through the switch as described later.

As shown in Figure 6, the lamp bulb 34 is permanently mounted upon the backing plate by means of a clip 54 consisting of a pair of curved spring limbs 55—55 embracing the neck portion 56 of the lamp. The spring clip includes a shank 57 seated against the surface of the backing plate and attached thereto by the rivet 52 which passes through a hole in the shank. When the rivet is rolled, its head clamps the shank and spring clip permanently to the backing plate. To lock the spring clamp and bulb permanently in position, the spring clip shank is provided with a tang 58 (Figure 5) projecting through a hole 60 formed in the backing plate.

The lamp bulb is of the minature type which is devoid of the conventional base, being provided instead with lead wires 61—61 which are sealed in the glass envelope.

These wires are connected directly to the rivets **52** and **53**, the ends of the lead wires being curled around the shanks of the rivets and engaged by the rivet heads as indicated in broken lines. The lamp is capable of being energized at the low transformer voltages upon which the various signal circuits operate and has a sufficient voltage range to provide satisfactory service in practically any signal circuit even though the voltages of the various circuits vary considerably from one residence to another.

According to the present arrangement, the lamp is in shunt across the contact rivets of the switch, such that the transformer voltage is impressed constantly across the lamp filament. When the push button is depressed, however, the circuit is completed through the switch blade, causing the lamp to go out. When the push button is released, current again flows through the filament to provide constant illumination of the head of the push button.

It will be understood that the present lamp bulb is the type which gives years of service while consuming only a small amount of electrical energy. In the event that the lamp does burn out after years of service, a new backing plate assembly, with the lamp mounted upon it, is installed upon the switch. It will be apparent that this mode of permanent assembly provides convenient replacement of the lamp and also utilizes the backing plate as a protective mounting for the delicate lead wires **61** which are susceptible to injury in handling.

Upon assembly, the lower end of the backing plate slips over upon the lower boss **23**, the plate being provided with a hole **62** interfitting the boss. This hole locates the rivets **52** and **53** in proper position to complete the electrical circuit through the switch blade. As shown in Figure 4, the upper rivet **52** resides in contact with a contact tab **63** forming a part of the mounting plate portion of the switch blade. The contact tab is provided with a hole **64** in registry with the threaded bore **65** of boss **24**, such that the screw **14** passes through the rivet and switch blade into threaded engagement with bore **65**. Since the lead wire **16** is engaged by the head of the screw and rivet, the electrical circuit is completed to the switch blade. When the screw is tightened, it clamps the rivet firmly against the tab, thus forcing the switch plate toward the actuating key. This seats the mounting plate **42** firmly upon the bearing blocks **37** independently of the retaining tang **45**.

The lower screw **15** passes through its rivet **53** and is engaged in a threaded bore **66** formed in the cross member of bridge **25**. It will be noted that the inner end of the screw resides in spaced relationship to the contact plate **50**, the spacing being indicated at **67**. Since the lead wire **17** is engaged between the head of the rivet and screw head, the electrical circuit is completed from terminal screw **14** through the switch blade to terminal screw **15** when the switch blade is depressed. Upon depressing the head of the push button, the contact plate yields slightly relative to the limbs by virtue of its slits **51**; therefore upon contacting the end of screw **15**, the contact plate provides to a limited extent, a wiping action with respect to the end of the screw to insure a good electrical contact.

It will be noted in Figure 5, that the end portion of the push button head **30**, which resides adjacent the lamp, is provided with a semicircular recess **68**. This recess provides adequate clearance between the lamp and wall when the push button is depressed.

The electrical circuit of the push button is illustrated diagrammatically in Figure 7. As shown, the lamp **34** is connected in shunt with the normally open switch blade **12** by way of the lead wires **61** which are connected to the rivets of the backing plate. The circuit is energized by the transformer **70** having a primary winding **71** energized by the service lines **72** and a secondary winding **73** for energizing the chime signal and lamp. The line **16** of Figure 2 is shown connected directly to one side of the secondary winding while the second wire **17** is shown connected to one side of a chime signal **74**. The circuit is completed through the chime signal to the secondary winding by way of the line **75**. The circuit is thus completed constantly from one side of the secondary winding through the lamp **34** and through the chime signal **74** to the opposite side of the winding. Although the circuit is closed at all times through the bulb **34** in series with the chime signal, the resistance of the lamp prevents operation of the chime signal except when the switch blade is depressed to close the circuit through the push button switch.

From the foregoing, it will be noted that the switch structure, while providing efficient operation and long life, is exceptionally simple. The two actuating elements, that is, the switch key and switch blade are ruggedly constructed and are assembled simply by inserting them into the housing by virtue of the self-locking arrangement of the switch blade. The arrangement of the switch blade and contact screws eliminates the use of springs since the switch blade serves both as a contactor and as a spring, while the attaching screws and rivets of the backing plate complete the circuit. It also will be noted that the backing plate arrangement with the lamp bulb mounted directly upon it simplifies the assembly operation and allows the lamp to be replaced quickly and conveniently.

Having described our invention we claim:

1. A switch having an illuminated switch button comprising a switch housing having a front wall and an open rearward side, said front wall having an opening therein, a depressible push button extending through said opening, the push button comprising a hollow light chamber formed of translucent material having an open side disposed within the housing, a pair of spaced mounting arms extending from the push button behind said front wall and generally parallel therewith, a respective pivot pin on the outer end of each of said arms, said pivot pins disposed upon a common axis parallel with said front wall, the front wall having a pair of spaced recesses partially embracing said pivot pins, a switch blade formed of resilient sheet metal, the switch blade having a mounting plate overlying said pivot pins, the mounting plate being anchored to the housing and rotatably confining the pivot pins in said recesses, the switch blade having a pair of spaced flexible limbs extending from said mounting plate and contacting said arms and urging the arms and push button toward the front wall of the housing, and a light bulb mounted within the switch housing between said spaced mounting arms of the push button and spaced limbs of the switch blade and residing adjacent the open side of said light chamber in position to project light rays directly into said chamber.

2. A switch having an illuminated push button comprising a switch housing having a front wall and an open rearward side, said front wall having an opening therein, a depressible push button extending through said opening and projecting outwardly beyond the plane of said front wall, said push button comprising a hollow light chamber formed of translucent material, the chamber having an open side disposed within the housing, a pair of spaced mounting arms extending from the push button behind said front wall, pivot means connecting the outer ends of said arms to the switch housing, said arms mounting the push button for movement relative to said front wall, a switch blade formed of resilient sheet metal, said switch blade having a mounting plate disposed within the housing behind the pivot means of said arms, a boss projecting from said front wall rearwardly through said mounting plate, a retainer tang projecting at an angle rearwardly from said mounting plate toward said boss and having an outer edge in wedging engagement against said boss and anchoring said mounting plate in the housing, the switch blade having a pair of spaced flexible limbs extending from the mounting plate

and contacting said arms, said limbs extending generally in parallelism with the arms and urging the arms and push button toward the front wall of the housing, and a light bulb mounted within the switch housing between said arms and limbs and adjacent the open side of the light chamber in position to project light rays directly into the light chamber.

3. In a switch having an illuminated push button, a switch housing having a front wall and an open rearward side, said front wall having an opening therein, a depressible push button extending through said opening, the push button comprising a hollow light chamber formed of translucent material having an open side disposed within the housing, a pair of spaced mounting arms extending from the push button behind said front wall and generally parallel therewith, a respective pivot pin on the outer end of each of said arms, said pivot pins disposed upon a common axis parallel with said front wall, said front wall having a pair of spaced partially cylindrical recesses embracing said pivot pins, a switch blade formed of resilient material, the switch blade having a mounting plate including a pair of partially cylindrical corrugations overlying said pivot pins, means securing the mounting plate to said housing, thereby confining the pivot pins in said partially cylindrical recesses and supporting said arms and switch button for pivotal movement relative to the housing, said mounting plate having a pair of spaced flexible limbs extending generally parallel with said arms and contacting the same, said flexible limbs urging the arms and push button toward the front wall of the housing.

4. In a switch having an illuminated push button, a switch housing having a front wall and an open rearward side, said front wall having an opening therein, a depressible push button extending through said opening, the push button comprising a hollow light chamber formed of translucent material having an open side disposed within the housing, a pair of spaced mounting arms extending from the push button behind said front wall and generally parallel therewith, a respective pivot pin on the outer end of each of said arms, said pivot pins disposed upon a common axis parallel with said front wall, the front wall having a pair of spaced open recesses partially embracing the pivot pins, a switch blade formed of resilient sheet metal, the switch blade having a mounting plate including a mounting hole, a boss projecting rearwardly from the front wall of the housing between said recesses, said boss projecting through said mounting hole, said mounting plate having a retaining tang adjacent the said mounting hole, said tang projecting angularly and rearwardly from the plane of the mounting plate toward said boss, said tang having an outer end in wedging engagement against said boss, the mounting plate including a pair of corrugations extending from opposite sides of said mounting hole, said corrugations overlying said pivot pins, said tang thereby locking the mounting plate and said corrugations against the pivot pins and confining the pivot pins in said recesses, the mounting plate having a pair of spaced flexible limbs generally parallel to said mounting arms and urging the arms and push button toward the front wall of the housing, the tang of the mounting plate providing a self-locking engagement relative to said boss when the mounting plate is forced thereon from the open rearward side of the switch housing.

5. A switch having an illuminated push button comprising a switch housing having a front wall and an open rearward side, said front wall having an opening therein, a push button projecting outwardly through the said opening, the push button having a peripheral side wall, a front wall, and an open rearward side disposed within the housing, a yoke extending outwardly from the side wall of the push button and residing in a plane generally parallel with the front wall of the switch housing, said yoke having an opposite end pivotally connected to the switch housing internally thereof, said yoke supporting the push button and guiding the same in an arcuate path of motion upon being depressed, spring means in said switch housing connected to the push button and urging the same outwardly of the front wall of the switch housing, and a light bulb mounted within the housing, said light bulb residing adjacent the open rearward side of the push button in position to project light rays into the push button, the front wall of the push button being formed of translucent material and being illuminated externally by the light bulb.

6. A switch having an illuminated push button comprising a switch housing having a front wall and an open-rearward side, said front wall having an opening therein, a push button projecting outwardly through the said opening, the push button having a peripheral side wall, a front wall, and an open rearward side disposed within the housing, a yoke extending outwardly from the side wall of the push button and residing in a plane generally parallel with the front wall of the switch housing, said yoke having an opposite end pivotally connected to the switch housing internally thereof, said yoke supporting the push button and guiding the same in an arcuate path of movement, spring means in said switch housing connected to the push button and urging the same outwardly of the front wall of the switch housing, a backing plate detachably mounted upon the open rearward side of the switch housing, and a light bulb carried by the backing plate and disposed within the housing, said light bulb residing adjacent the open rearward side of the push button in position to project light rays into the push button, the front wall of the push button being formed of translucent material and being illuminated externally by the light bulb.

7. A switch having an illuminated push button comprising a switch housing having a front wall and an open rearward side, said front wall having an opening therein, a push button projecting outwardly through the said opening, the push button having a side wall, a front wall, and an open rearward side disposed within the housing, a yoke extending outwardly from the side wall of the push button and residing in a plane generally parallel with the front wall of the switch housing, said yoke having an outer end pivotally connected to the housing internally thereof, said yoke supporting and guiding the push button in an arcuate path of movement, a switch blade comprising a pair of spaced spring limbs residing within the switch housing behind the said yoke and generally parallel therewith, said limbs having endwise portions anchored to the switch housing and opposite ends contacting the switch button and urging the same outwardly of the housing, and a light bulb mounted within the housing, said light bulb residing between the spaced spring limbs and adjacent the open rearward side of the push button in position to project light rays into the push button, the front wall of the push button being formed of translucent material and being illuminated externally by the light bulb.

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