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PHOTOELECTRIC WALL SWITCH WITH MEANS TO ILLUMINATE THE OPERATING SURFACE

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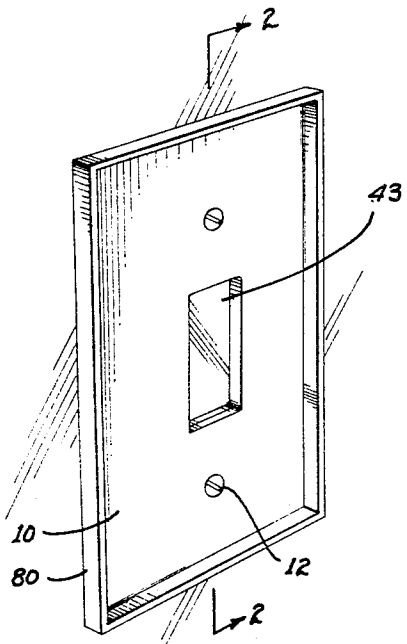


Fig. 1

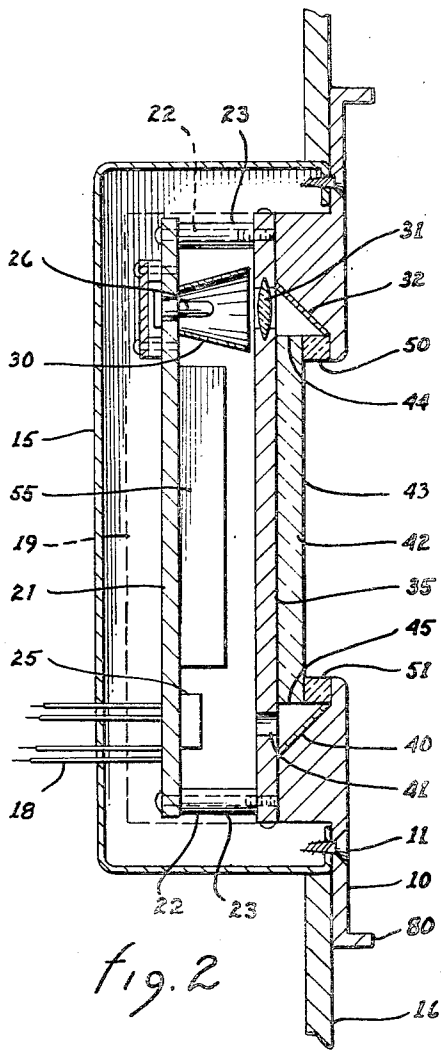


Fig. 2

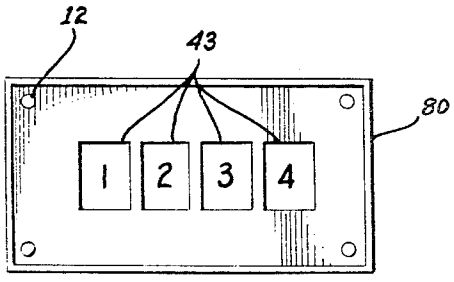


Fig. 4

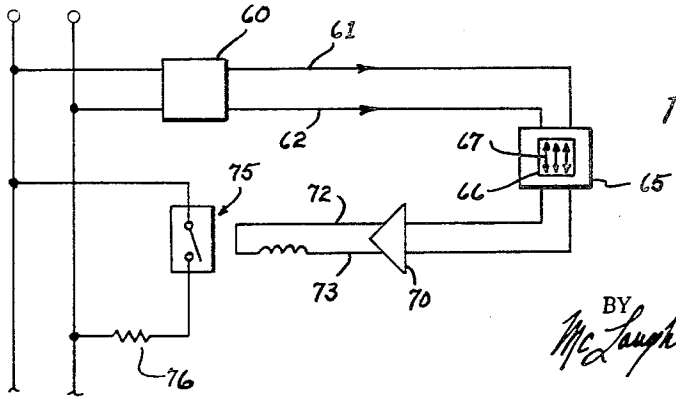


Fig. 3

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PHOTOELECTRIC WALL SWITCH WITH MEANS TO ILLUMINATE THE OPERATING SURFACE

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ABSTRACT OF THE DISCLOSURE

A wall switch utilizing a light source directing light through a prism parallel to an operating surface and subsequently onto a radiation detector. The light is also directed through the edge of a radiation scattering material forming the operating surface; the radiation scattering material therefore provides scattered radiation for identifying the switch in the dark and the parallel-directed radiation may be utilized to operate a circuit when interrupted.

The present invention pertains to wall switches of the type commonly found in households. More particularly, the present invention pertains to a unique type of wall switch wherein the switch contains no moving parts and radiation is utilized as the switching media.

A great variety of wall switches are available to contractors for use in homes and commercial establishments. These wall switches vary from simple over-center spring mechanisms with contacts to the more modern "silent" mercury switches found in most of the newer homes. In addition, certain low voltage types of switches have been found to be advantageous and are presently used in some of the more expensive homes since the low voltage switches have been found to be more convenient to use and also permit the easy design of a control panel centrally located in the house. These low voltage wall switches, however, usually suffer from the fact that they are designed as push-button contacts merely operating at a substantially reduced voltage level.

The present invention contemplates the utilization of a reduced direct current voltage in a switching system wherein central control panels may easily be designed and all of the advantages of the reduced voltage system may be achieved with the added advantages and convenience, including the reliability, of a wall switch operating upon the interruption of a directed source of radiation. It is therefore an object of the present invention to provide a wall switch that operates to actuate an electrical system upon interruption of a beam of radiation.

It is also an object of the present invention to provide a wall switch having an operating surface which, when touched or approached, directs the operator to the proper location for interruption of the beam of radiation.

It is also an object of the present invention to provide a wall switch operating upon the interruption of a beam of radiation and having an illuminated operating surface to assist locating the switch in the dark.

It is also an object of the present invention to provide a radiation-operated wall-type electric switch wherein the wavelength of the radiation used may be varied in accordance with the requirements of a particular application.

These and other objects of the present invention will become more apparent to those skilled in the art as the description thereof proceeds.

Briefly, in accordance with one embodiment of the present invention, the radiation-operated wall-type switch is provided having an operating surface forming one surface of an operating plate. The operating plate comprises a material having light scattering qualities such as certain translucent plastics. A radiation source is mounted beneath the operating plate and is positioned to direct radiation perpendicular to the plate. A pair of prisms, one positioned to receive radiation from the radiation source, and the other positioned to receive radiation from the first prism, are mounted adjacent the edges of the operating plate. A radiation detector is positioned adjacent the second prism and is responsive to radiation reflected by the prism onto the detector. The radiation path between the two prisms is partly through the plastic material which scatters the radiation and thus presents an illuminated background to assist in locating the switch in the dark. The remainder of the radiation travels a path adjacent and parallel to the operating surface of the operating plate. Thus, a person may readily find the switch in the dark and by closely approaching or touching the operating plate will automatically manually interrupt the radiation directed from one prism to the other and will thus present a pulse from the detector which may be amplified and utilized at a remote relay station to energize or de-energize an electrical circuit.

The present invention may more readily be described by reference to the accompanying drawings in which:

FIGURE 1 is a simplified front elevational view of a wall switch incorporating the teachings of the present invention.

FIGURE 2 is a sectional view of the wall switch of FIGURE 1 showing the elements of the present invention.

FIGURE 3 is an elementary block diagram indicating a very general scheme for employing the switch of the present invention.

FIGURE 4 is a schematic illustration of a multiple wall switch of the type using a plurality of switches of the present invention, and also indicating the arrangement of switches for use in a control panel.

Referring to FIGURES 1 and 2, the radiation-operated wall-type switch of the present invention includes a wall plate **10** having openings **11** therein to admit conventional and standard wall mounting screws **12**. An electrical outlet box **15** is positioned within the opening in the wall **16** and includes an opening to admit electrical conductors **18**. The switch of the present invenion is provided in a unitary structure including a cover box **19** used as a means for maintaining the various elements in appropriate physical alignment. A mounting board **21**, which may form a printed circuit board if it is desired to include other electrical elements within the switch, such as a signal processor for amplifying detected signals, is secured to the wall plate **10** through the expediency of screws **22** and spaces **23**. The mounting board supports a radiation detector **25** and a radiation source **26**. The radiation source and radiation detector are matched so that the source emanates radiation of a wave length to which the detector is sensitive. In some instances, the radiation may be in the visible light spectrum; however, many applications may advantageously employ ultraviolet or infrared. The radiation source **26** may conveniently be long-life, low-output device and will usually be inserted into the mounting board to contact a conventional electrical connector of the spring-loaded type. The radiation source will be surrounded by a reflector **30** that will assist in directing the radiation from the source through a lens **31** onto a prism **32**. A second mounting board **35** may be used to mount the lense **31** and also to support the prism **32**. A second prism **40** is positioned above the radiation detector **25** and communicates therewith through an opening **41** provided in the second mounting board **35**. The second mounting board **35** also supports the operating plate **42** which includes an operating surface **43** and edges **44** and **45**, the latter being perpendicular to the operating surface **43**. In the embodiment chosen for ilustration in FIGURES 1 and 2,

a pair of "windows" of transparent optically finished material are shown at **50** and **51** to assist in directing the radiation from one prism to the other and may be selected to provide a filter to pass a selected wavelength.

As previously indicated, the operating plate **42** may comprise a material such as a translucent plastic that, when radiation is received from the prism **32** and directed perpendicularly to the edge **44**, will scatter light and will thus render the plate luminous and visible in the dark. The illuminosity of the plate may be varied to a great extent by the selection of materials used. The surface **43** is the operating surface and is the surface which appears to be illuminated to the person using the switch. In the event that an ultraviolet or infrared source is used, the material of the plate **42** may be so chosen as to be sensitive to the wave length of the radiation source so that the wave length scattered will be chosen in the visible range. For example, the interface between the second mounting board **35** and the operating plate **42** may be coated with a phosphore or radiation-sensitive chemical which, upon illumination by radiation flowing through the plate **42** from the edge **44**, will excite and radiate a visible light.

The radiation being transmitted from the radiation source and being directed by the prism **32** through the window **50** will be transmitted parallel to the surface **43** onto the window **51** and ultimately to the prism **40**. The radiation in this vicinity is that which will be interrupted when the operating plate **42** is touched, or nearly touched, by the person operating the switch. The interruption of the radiation results in a pulse generation by the detector **25**. The detector may be any of several well-known radiation-sensitive devices and may be photovoltaic, photoresistive, or any other photosensitive device yielding an electrical change upon a change in incident radiation. As previously indicated, it may be found to be advantageous to mount upon the mounting board **21** a signal amplifier which, for purposes of illustration, is herein referred to as a signal processor **55**. Since the level of radiation derived from the radiation source **26** will, of necessity, be attenuated by its passage through the prisms **32** and **40**, the signal change derived by the radiation detector **25** may be a very low level electrical pulse. Since the electrical circuit to be controlled will be controlled through the utilization of remotely located relays, it will usually be necessary to amplify the detector signal prior to transmitting the signal to the control circuit. Thus, the detector **25** will produce an electrical signal amplified by the signal processor to a level suitable for transmission. The electrical switch of the present invention will therefore utilize two pairs of electrical conductors, the first of which will provide the necessary low level DC potentials for operating the radiation source and providing the necessary biasing potentials for the signal processor; the second pair of electrical conductors will be used to transmit the amplified signal from the signal processor to a remote relay-operating circuit.

The electrical switch of the present invention may be used as an element in a great variety of electrical systems. As a very simple and general indication of a suitable system in which the present invention may be used, reference will now be had to FIGURE 3. A conventional household electrical power source, usually 110 volts and 60 cycles, is used to supply power to a transformer-rectifier **60** which reduces the voltage to 24 volts and rectifies the voltage to provide DC biasing potentials and radiation source operating voltages through conductors **61** and **62**. An electrical switch of the type shown in FIGURES 1 and 2 may be connected as shown at **65** in FIGURE 3. The operating plate of the switch **65** is shown at **66** and arrows **67** are shown to indicate the direction of radiation across the surface of the operating plate **66**. The radiation continuously energizes the radiation detector. When the switch is to be operated, the radiation plate **66**, which is normally illuminated as previously indicated, is touched. In touching the plate **66**, the radiation **67** is interrupted and the radiation detector senses the reduction in received radiation and presents a pulse. In FIGURE 3, the amplifier or signal processor **70** is shown as remotely positioned relative to the switch **65**. It will be understood, of course, that the signal processor may be included within the switch **65**, as indicated in FIGURE 2. The output of the signal processor is supplied over conductors **72** and **73** to a suitable relay indicated schematically and generally at **75**. Energization of the relay will alternately open and close a switch connected in series with the electrical load **76**.

Referring to FIGURE 4, a typical wall plate assembly is shown using several electrical switches of the present invention arranged in side-by-side fashion to present a control panel. Since the radiation is directed, in the embodiment chosen for illustration, from the top to the bottom of each individual switch, it is unnecessary to shroud each switch from the adjacent switch; however, in many instances, the position of the wall plate may render the switch susceptible to incident radiation from sources other than the switch-mounted radiation source. Thus, as shown in FIGURES 1, 2, and 4, a radiation barrier **80** is provided to insure that light or radiation from sources extraneous to the switch will not fall upon the window **51** at an angle such that the radiation will be reflected upon the radiation detector **25**. The barrier, as shown in the embodiments chosen for illustration, frame the entire wall plate; however, in some instances, it may be found advantageous for the radiation barrier, framing the operating surface **43**, to be positioned closer to the center portion of the wall switch to thereby further decrease the chance of extraneous radiation affecting the switch. The radiation barriers extend perpendicular from the wall plate and may be formed integral with the wall plate.

The present invention thus provides a radiation-operated wall-type switch utilizing a unique combination of operating surface and directed radiation so that the radiation is specifically directed parallel to the operating surface (and thus parallel to the wall upon which the switch is mounted) to provide a convenient, reliable, and completely silent switch with no moving parts and continuous illumination of the switch surface. The switch may be positioned with the radiation directed from top to bottom or from bottom to top depending on the specific environment in which the switch is to be placed. In some instances, such as a skylight area, it may be desirable to insure that the radiation flows from bottom to top so that incident radiation from the skylight will not affect the operation of the switch. The present invention has been described in terms of a specific embodiment with specific elements; however, it will be apparent to those skilled in the art that many modifications may be made without departing from the spirit and scope thereof.

We claim:

1. A radiation-operated wall-type electric switch comprising:

(a) an operating plate having an operating surface and an edge perpendicular to said operating surface, said plate comprising a radiation scattering material,

(b) a radiation source mounted adjacent said operating surface,

(c) means directing radiation from said radiation source parallel to said operating surface and directing radiation from said radiating source onto said edge and into said radiation scattering material,

(d) a radiation detector mounted adjacent said operating surface positioned to receive radiation, from said radiation source, transmitted parallel to said surface, and

(e) means supporting said operating surface in an exposed position to cause the manual interruption of said radiation when said surface is touched.

2. A radiation-operated wall-type electric switch comprising:

(a) an operating plate having an operating surface and

an edge perpendicular to said operating surface, said plate comprising a radiation scattering material,

(b) a radiation source mounted adjacent said operating surface,

(c) means directing radiation from said radiation source parallel to said operating surface and directing radiation from said radiating source onto said edge and into said radiation scattering material,

(d) a radiation detector mounted adjacent said operating surface positioned to receive radiation, from said radiation source, transmitted parallel to said surface,

(e) a wall plate for mounting the switch, and

(f) means securing said operating surface to said wall plate in an exposed position to cause the manual interruption of said radiation when said surface is touched.

3. The combination set forth in claim 2 wherein said means directing radiation comprises a prism secured to the edge of said operating plate.

4. A radiation-operated wall-type electric switch comprising:

(a) an operating plate having an operating surface and an edge perpendicular to said operating surface, said plate comprising a radiation scattering material,

(b) a radiation source mounted adjacent said operating surface,

(c) means directing radiation from said radiation source parallel to said operating surface and directing radiation from said radiating source onto said edge and into said radiation scattering material,

(d) a radiation detector mounted adjacent said operating surface positioned to receive radiation, from said radiation source, transmitted parallel to said surface,

(e) a wall plate for mounting the switch,

(f) means securing said operating surface to said wall plate in an exposed position to cause the manual interruption of said radiation when said surface is touched, and

(g) a radiation barrier framing said operating surface and comprising a flange extending perpendicularly from said wall plate.

5. The combination set forth in claim 4 wherein said means directing radiation comprises a prism secured to the edge of said operating plate.

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