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SWITCH CONTROL

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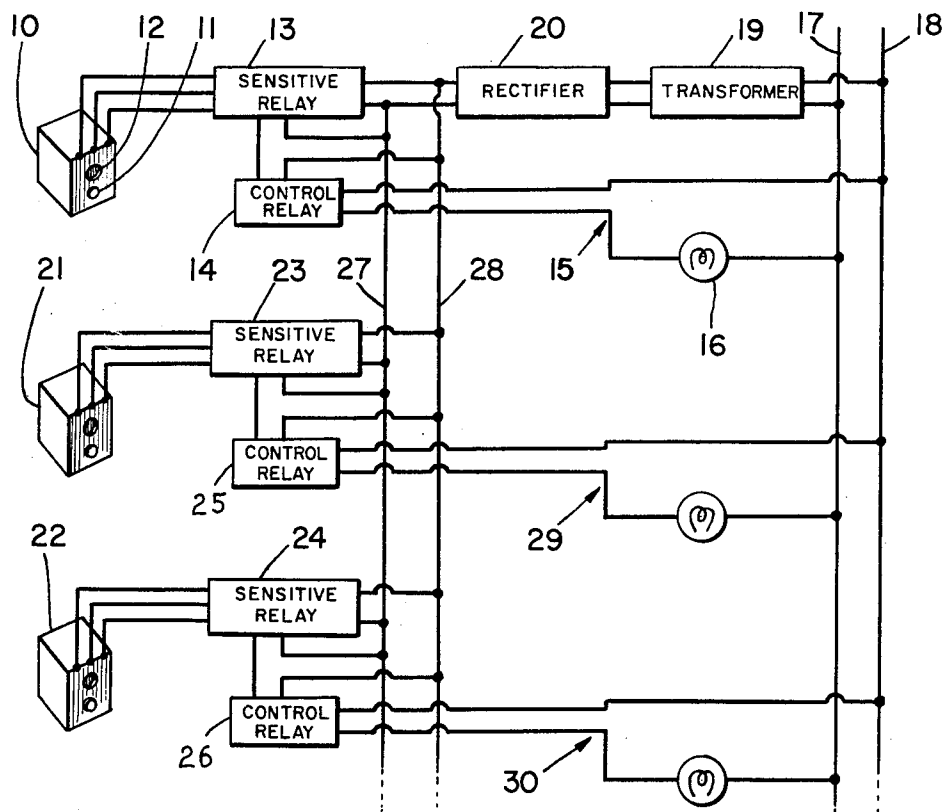


FIG. 1.

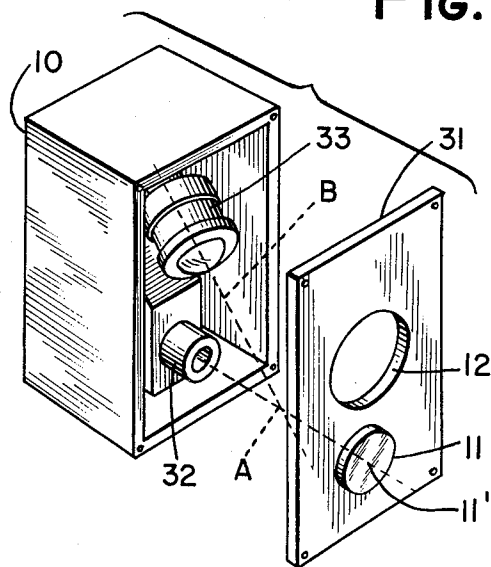


FIG. 2.

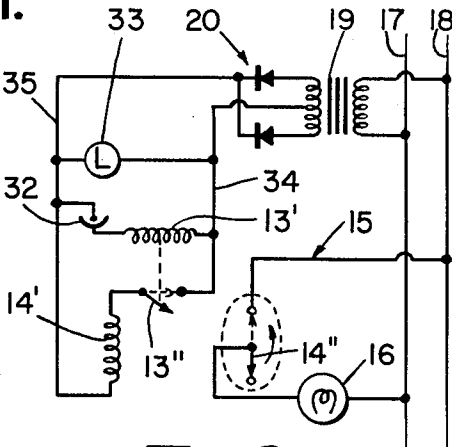


FIG. 3.

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SWITCH CONTROL

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This invention relates generally to a switch control for opening and closing an electrical circuit to operate an appliance, and more particularly, to an improved wall switch.

In both residential and business establishments, the room lights are normally operated by wall switches. Such switches are for the most part satisfactory but, after prolonged use, the wall area about the switch tends to become soiled as a result of constant contact by the user's hands particularly when attempting to find the switch in the dark. Further, in certain types of switches there is generally an audible click or noise which can become annoying when the lights or other appliances associated with the switch are operated at night. In other types, the design has been such as to eliminate any audible sound when the switch is operated. On the other hand, manual pressing or movement of the switch operating component itself is still necessary so that the disadvantage of physical contact with the adjacent area in attempting to locate the switch is still present.

In connection with the above, the required manual operation of the switch itself can become awkward particularly when a person is carrying a tray or glasses from one room to another and wishes to turn the lights off or on.

With all of the foregoing in mind, an important object of this invention is to provide a greatly improved wall switch which may be easily located and operated without the necessity of physically touching any portion of the switch to the end that the switch and adjacent wall area will remain clean.

Another important object is to provide an improved switch which is silent in operation.

Still another object is to provide an improved switch which may be actuated without any physical contact or special manipulation by the user, but rather by merely passing his hand, arm or other object across the face of the switch so that appliances or lights may be easily operated by the user while carrying various objects or when his hands are otherwise occupied.

Briefly these and many other objects and advantages of this invention are attained by providing a housing structure including first and second openings in its front face. The housing includes a photoelectric cell and a light source adjacent to the first and second openings to receive and transmit light respectively. Light passing out the second opening will normally not energize the photoelectric cell in the absence of any object close to the front openings. On the other hand, when a user's hand or other object is disposed near the openings, it will serve as a reflecting surface for the light from the second opening to reflect a portion of the light into the first opening and thereby energize the photo-electric cell to generate a signal.

The resulting signal is employed to trip a very sensitive relay which in turn will close a circuit to a step or ratchet type control relay. This latter relay is in turn connected into the electrical circuit for the lights or other appliance to be operated.

A better understanding of the invention will be had by referring to a preferred embodiment thereof as illustrated in the accompanying drawings, in which:

FIGURE 1 is a schematic block diagram illustrating the basic components making up the present control circuit and illustrating how a plurality of such circuits may be employed;

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FIGURE 2 is an exploded perspective view of certain elements of the circuit; and,

FIGURE 3 is a more detailed circuit diagram of further elements disposed within the blocks of FIGURE 1.

Referring first to FIGURE 1, there is shown in the upper left hand corner a housing structure 10 provided with first and second front openings 11 and 12. The opening 11 is arranged to pass light to the lower interior portion of the housing 10 to energize a suitable light sensitive means disposed therein. The second opening 12 in turn is arranged to pass light from a light source within the housing to the exterior of the housing. The arrangement is such that disposition of an object close to the front of the housing 10 will serve as a reflector for light from the opening 12 to pass a portion of the light into the opening 11 and thus energize the light sensitive means therein.

Energization of the light sensitive means within the housing 10 is arranged to operate a sensitive relay 13 which in turn will operate a control relay 14 to open or close an electrical circuit indicated generally by the numeral 15. In FIGURE 1, the circuit 15 constitutes a lighting circuit as schematically indicated by the light bulb 16.

Power for the components described is supplied from conventional 110 volt, 60 cycle power lines 17 and 18 at the right of the drawing. As shown, a transformer 19 is connected across the power lines 17 and 18 to provide a reduced voltage in turn rectified by a rectifying circuit 20 for providing rectified current to operate the elements within the housing 10 and the various relays. The electrical circuit 15 is also energized by the power lines 17 and 18 as shown.

Additional housing structures 21 and 22, associated sensitive relays 23 and 24, and control relays 25 and 26, may also be powered from the output of the single rectifier 20 by leads 27 and 28. These additional controls may be used to open and close further electrical circuits such as indicated at 29 and 30.

Referring now to FIGURE 2, the details of the structure within the housing 10 will become clearer. As shown, one side or door 31 of the housing 10, shown removed includes the first and second openings 11 and 12. A light collecting lens 11' is preferably disposed in the first opening 11. The light sensitive means or photocell itself is indicated at 32 within the lower portion of the housing and the light source for energizing the cell 32 when an object is disposed adjacent to the front of the door 31 is indicated at 33.

It will be noted that the sensitive axis A of the photocell 32 passes directly into the housing through the opening 11 whereas the light source 33 projects a beam of light from the interior of the housing out the opening 12 along a beam axis B. The axis B is in a direction other than the axis A so that in the absence of some object in front of the door which could reflect part of the light in the beam, the photocell 32 will normally be un-energized. The sensitivity of the cell to ambient light may be adjusted to render the cell active only when a given illumination is provided or exceeded as is well known to those skilled in the art.

Referring now to FIGURE 3, there is shown a simplified schematic circuit diagram for the elements in the housing 10 and the various components making up the sensitive and control relays. Elements in the circuit of FIGURE 3 corresponding to the blocks in FIGURE 1 have been identified by the same numerals. The transformer 19 reduces the conventional 110 volt source on the lines 17 and 18 to 24 volts. This 24 volts is rectified by the full wave rectifier 20 and will appear on the output leads 34 and 35 as a direct current. The light source 33 for the photoelectric cell is connected across these

output leads so that it will always be energized. The photocell itself as shown at 32 is connected in series with the sensitive relay coil, designated 13' in FIGURE 3, to provide a series circuit. This circuit in turn is connected across the output leads 34 and 35 of the rectifier.

The control relay coil is designated 14' in FIGURE 3 and is connected in series with a switch 13'' constituting part of the relay 13. Upon closing of the switch 13'' the relay coil 14' will be connected across the output leads 34 and 35 of the rectifier 20.

Control relay coil 14' is arranged to operate a ratchet or step type relay switch 14' which will move between make and break positions illustrated in FIGURE 3 upon each actuation or energization of the coil 14'. In other words, the circuit 15 will be alternately connected and disconnected in response to successive energizations of the coil 14', the switch arm 14'' stepping through 180 degrees in a constant direction.

In operation, the side or door 31 is normally secured to the front of the housing structure 10 and this side may be made flush with a wall surface so that the only structure visible is that defining the first and second openings 11 and 12. With reference to FIGURE 3, it will be noted that with the various switches in the positions as shown in solid lines, the electrical circuit 13 is de-energized. Also, the switch 13'' is open and the co-operating relay coil 13'' is de-energized. The light beam passing from the second opening 12 from the light 33 described in connection with FIGURE 2 will in no way appreciably affect the photocell 32 until some object passes relatively close to the first and second openings. However, this light will provide a certain amount of illumination to enable the switch control to be readily located in a darkened room.

When a user passes his hand, arm, or another object close to the openings 11 and 12, the light passing from the opening 12 will be reflected and collected by the lens 11' to impinge upon the photocell 32. The photocell 32 may be of a type which, when illuminated by light, exhibits a decrease in its resistance. Thus, upon illumination of the cell 32 the resistance in the series circuit constituting the cell 32 and sensitive relay coil 13' will decrease permitting sufficient current to flow between the output leads 34 and 35 of the rectifier 20 to energize the coil 13' thereby closing the sensitive relay contacts 13''. Closure of the contacts 13'' as shown in FIGURE 3 will then place the control relay 14' across the output of the rectifier 20 thereby applying full voltage across this coil. The full voltage across coil 14' is sufficient to step the corresponding relay switch arm 14'' from the solid line position shown around to the upper contact so that the circuit 15 is closed across the power leads 17 and 18. The light bulb 16 will then light.

When the user's hand or other object is removed, the absence of light will result in an increase in the resistance of the cell 32 and the sensitive relay coil 13' will become sufficiently de-energized to permit its contacts 13'' to open and thereby de-energize the coil 14'. Because of the ratchet mechanism in the relay, however, the contacts 14'' will remain in their up position.

If now the hand is passed in front of the openings to actuate the photocell a second time, the switch 13'' will again be closed to apply power across the relay coil 14' and switch the switch arm 14'' through another 180 degrees to turn the light bulb 16 off. The circuit is thus in the position illustrated in solid lines in FIGURE 3. It is evident therefore that the light will be alternately turned on and off for each successive pass of the hand in front of the openings 11 and 12.

For most efficient operation, it is desirable to use the reduced voltage, rectified as described. However, it is only necessary to provide one transformer and one rectifier, any subsequent units being simply connected in parallel as described in connection with FIGURE 1.

From the foregoing description, it will be evident that

the present invention has provided a greatly improved control for opening and closing electrical circuits to operate appliances. Not only is physical touching of the switch unnecessary which enables its ready operation even when the user's hands are otherwise occupied, but this feature also eliminates shock hazards in the event a user's hands should be wet.

While the turning on and off of lights has been particularly described, it should be understood that any type of electrical appliance could be operated by the control provided by this invention. Further, while the light source for the photocell has been described as visible to facilitate location of the switch at night, the light could as easily be non-visible or semi-visible radiation as in the ultra-violet range.

Thus, various modifications and changes which fall clearly within the scope of the invention will readily occur to those skilled in the art. For example, relay type transistors could be substituted for the relays shown. The control apparatus is therefore not to be thought of as limited to the particular embodiment set forth merely for illustrative purposes.

What is claimed is:

1. A control apparatus for opening and closing an electrical circuit to operate an appliance, comprising in combination: a housing; a light sensitive means mounted in said housing and responsive to illumination directed into the front of said housing to provide an electrical signal; a light source mounted in said housing for projecting a light beam out the front of said housing so that in the absence of any intercepting object close to the front of said housing, said light sensitive means is not energized; a control relay connected to said electrical circuit and including means responsive to successive actuations thereof to alternately close and open said circuit; and a sensitive relay connected between said control relay and said said responsive means and responsive to said electrical signal to actuate said control relay whereby interception of said light beam with an object to reflect a portion thereof onto said light sensitive means, closes said electrical circuit, and the next interception of said light beam to reflect a portion thereof onto said light sensitive means opens said electrical circuit.

2. A control apparatus for opening and closing an electrical circuit to operate an appliance, comprising in combination: a housing; a light sensitive means mounted in said housing and responsive to illumination directed along a sensitive axis thereof passing into the front of said housing to provide an electrical signal; a light source mounted in said housing for projecting a light beam out the front of said housing in a direction other than the direction of said sensitive axis so that in the absence of any intercepting object close to the front of said housing, said light sensitive means is not energized; a control relay connected to said electrical circuit and including means responsive to successive actuations thereof to alternately close and open said circuit; and a sensitive relay connected between said control relay and said responsive means and responsive to said electrical signal to actuate said control relay whereby interception of said light beam with an object to reflect a portion thereof onto said light sensitive means, closes said electrical circuit, and the next interception of said light beam to reflect a portion thereof onto said light sensitive means opens said electrical circuit.

3. A control apparatus adapted to be energized from a given source of alternating current for closing and opening an electrical circuit to operate and de-energize an appliance, comprising, in combination: a transformer adapted for connection to said source to provide a reduced voltage; a rectifier connected to said transformer for rectifying said reduced voltage; a housing structure; a light sensitive means mounted in said housing structure and responsive to illumination along a sensitive axis thereof passing from the front of said housing structure; a sensitive relay coil in series with said light sensitive means to

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provide a series circuit, said series circuit being connected across the output of said rectifier; a light source mounted in said housing and connected across the output of said rectifier for projecting a light beam out the front of said housing in a direction other than the direction of said sensitive axis so that in the absence of any intercepting object close to the front of said housing, said light sensitive means is un-energized; a control relay coil a switch operated in response to energization of said sensitive relay coil, said control relay coil and switch being connected together in series across the output of said rectifier; and a control switch including means operated in response to successive energizations of said control relay coil to successively close and open said electrical circuit whereby interception of said light beam with an object to reflect a portion thereof onto said light sensitive means will close said circuit to operate said appliance, and the next successive interception of said light beam with an object to reflect a portion thereof onto said light sensitive means will open said circuit to de-energize said appliance.

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4. The subject matter of claim 3, including a plurality of additional light sensitive means, sensitive relay coils, light sources, control relay coils, switches, and control switches connected together and to said rectifier in an identical manner to said first-mentioned light sensitive means, sensitive relay coil, light source, control relay coil, switch, and control switch, to close and open additional electrical circuits, respectively, whereby said transformer and rectifier serve as a single power source therefor.

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