

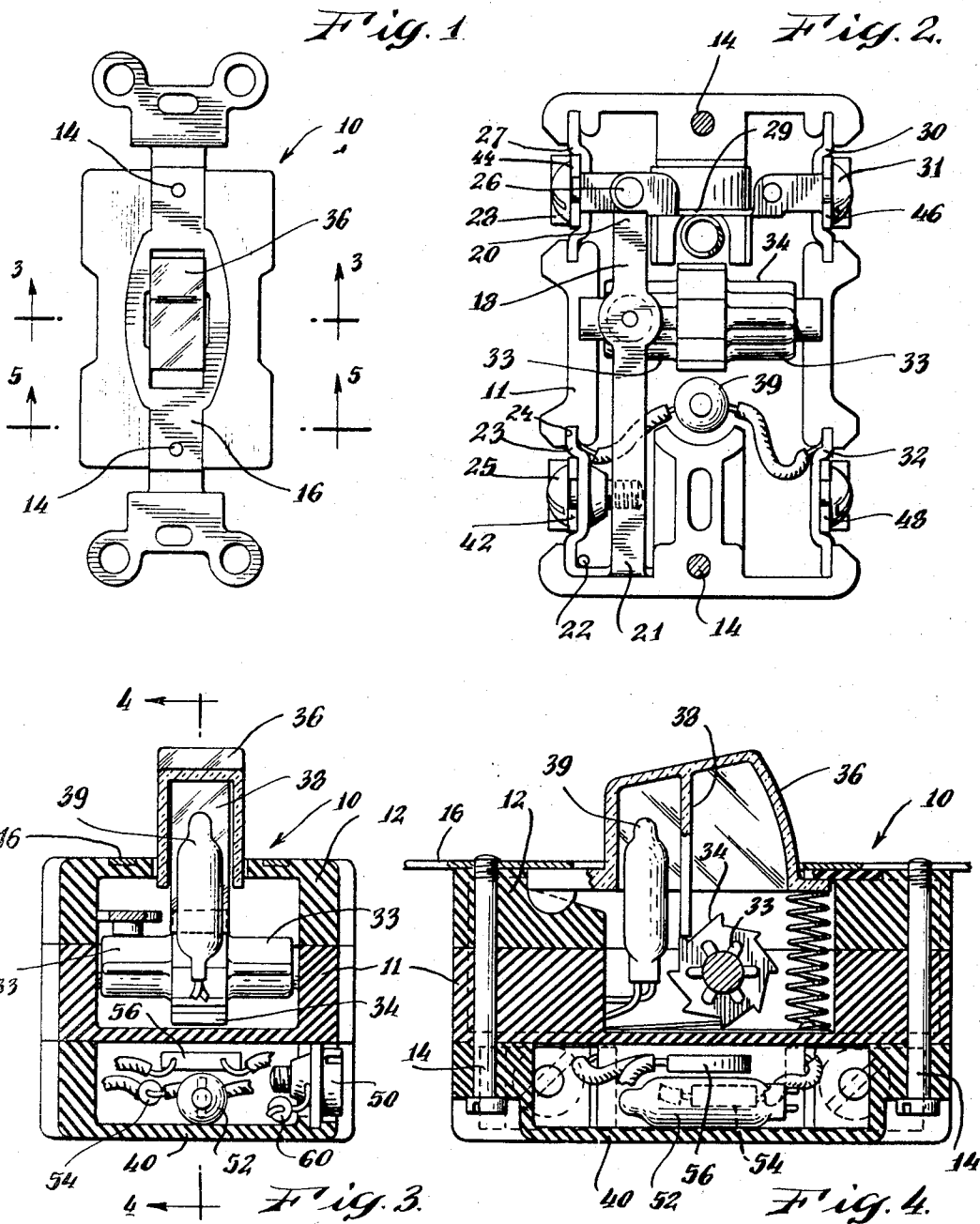
April 22, 1969

R. M. MURPHY ET AL
THREE-WAY SWITCH WITH PILOT LIGHT CONTROLLED
BY A PHOTOCELL CIRCUIT

3,440,429

Filed March 17, 1967

Sheet 1 of 3



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Fig. 5.

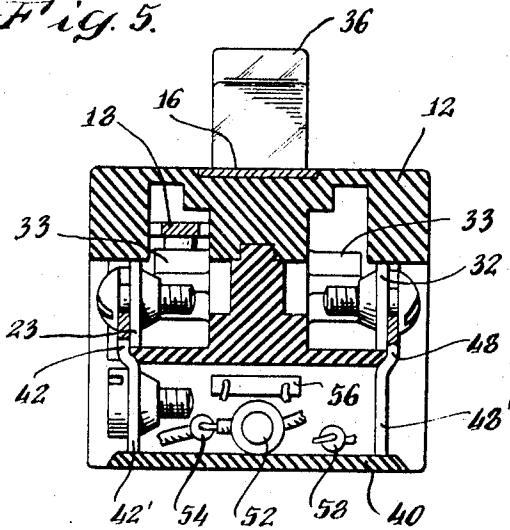


Fig. 6.

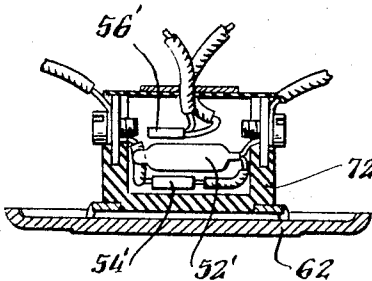
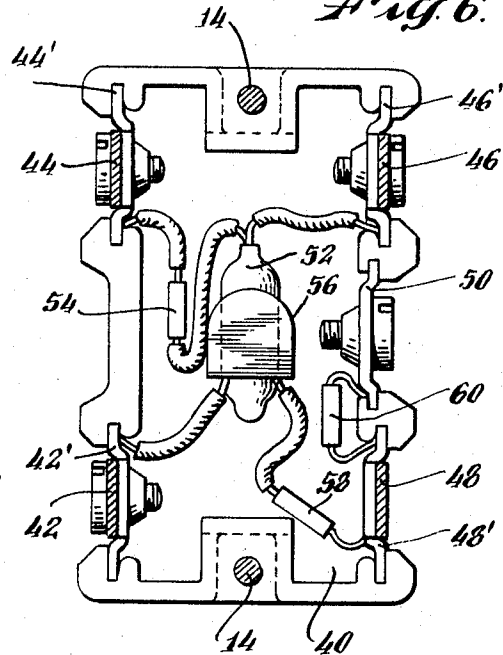


Fig. 9.

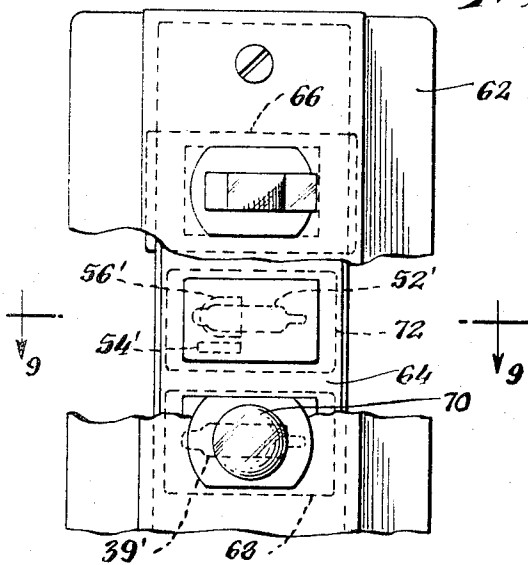
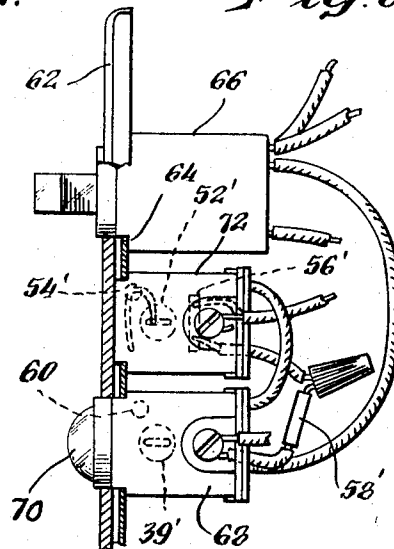


Fig. 7.

Fig. 8.



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Fig. 10.

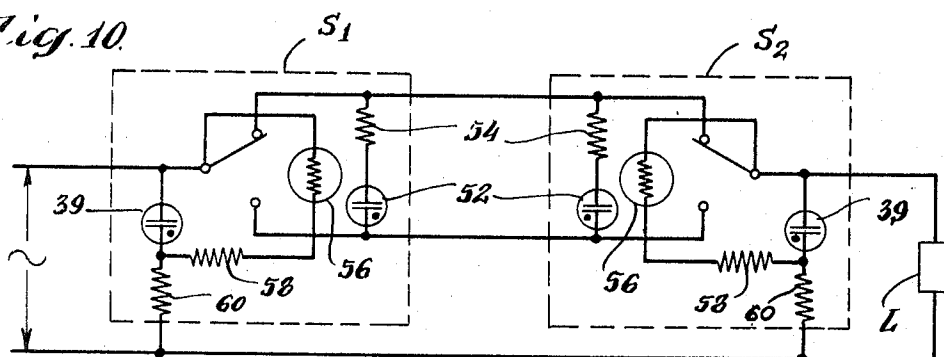


Fig. 11.

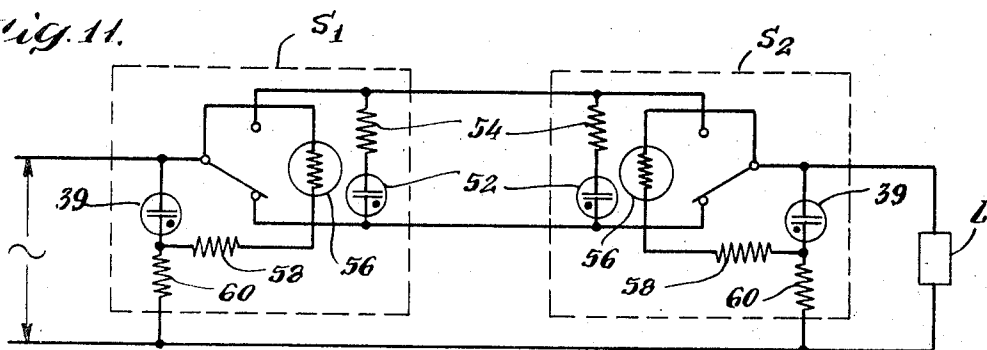


Fig. 12.

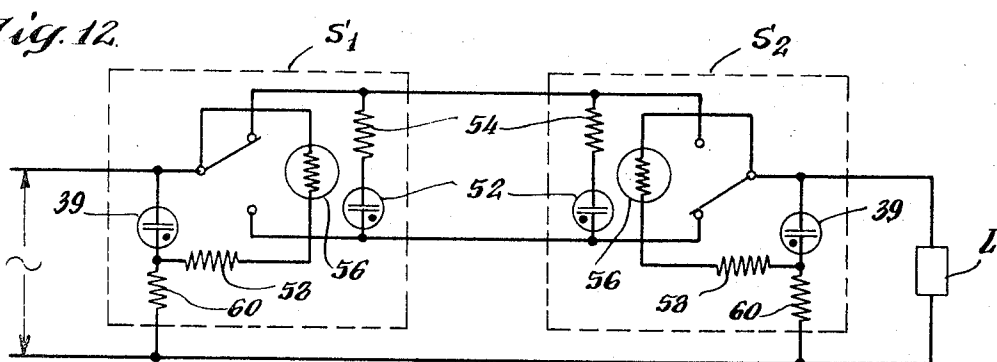
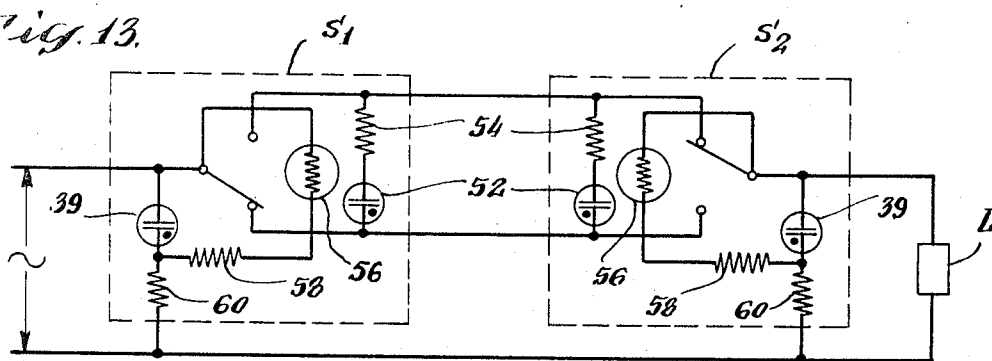


Fig. 13.



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THREE-WAY SWITCH WITH PILOT LIGHT CONTROLLED BY A PHOTOCELL CIRCUIT

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U.S. Cl. 250—215

7 Claims

ABSTRACT OF THE DISCLOSURE

An illuminated three-way switch having a pilot light controlled by a shunting light dependent resistor connected in parallel therewith which in turn is controlled by an optically coupled trigger neon lamp responsive to the state of the load.

This invention relates to an illuminated three-way switch and, more particularly, to an improved switch including means for controlling a pilot light to indicate the state of energization of an electrical load.

In U.S. Patent No. 3,238,343 which issued Mar. 1, 1966 to Ernest R. Carlson there is disclosed an illuminated three-way switch in which the illuminating means is energized in response to the energization of an external electrical load and acts as a pilot light. The switch is designed to fit a standard switch body having four electrical terminals with binding screws but employing only three terminals as does the usual three-way switch. The remaining terminal location is utilized to position a panel through which two auxiliary wires are passed for completing a circuit through the illuminating neon lamp and across the load.

The switch of the above construction, while performing admirably, requires that the neon lamp of each switch be connected across the load. It is obvious that the use of this type of switch for controlling a load from two remote locations would require a considerable length of wire between the load and the two controlling switches. This is because the neon lamp must respond to the state of the load rather than to that of either switch. This makes the device difficult to replace and complicates new installation.

Accordingly, it is a primary object of our invention to provide an improved illuminated three-way switch having a pilot light and including an integral control circuit for eliminating the necessity of running extra conductors from a load to each of the switches.

A further object is to provide an improved illuminated three-way switch having a unique control circuitry housing which may easily be added on to the usual three-way switch, containing standard parts and being economical to construct.

To accomplish these objects, in one form, we have provided an illuminated three-way electric switch for controlling the state of a remote external load including a housing within which is disposed a switch mechanism, a pilot light electrically connected to the switch mechanism and control means connected to the pilot light for allowing the pilot light to be energized in response to the energization of the remote external load.

Other objects and further details of that which we believe to be novel and our invention will be clear from the following description and claims taken with the accompanying drawing wherein:

FIG. 1 is a front view of a three-way switch constructed in accordance with out invention;

FIG. 2 is an enlarged front view of the switch of FIG. 1

with the cover removed showing the interior of the three-way switch;

FIG. 3 is an enlarged cross section taken substantially along line 3—3 of FIG. 1 showing the control circuitry housing secured to the three-way switch;

FIG. 4 is an enlarged cross section taken substantially along the line 4—4 of FIG. 3;

FIG. 5 is an enlarged cross section taken substantially along the line 5—5 of FIG. 1;

FIG. 6 is an enlarged plan view of the switch of FIG. 1 with the usual switch body removed, showing the control circuit;

FIG. 7 is a front view of a three-way toggle switch with a pilot light and a control circuit package with a portion of the cover plate broken away to show the circuit package;

FIG. 8 is a side view of the switch of FIG. 7;

FIG. 9 is a cross section taken substantially along line 9—9 of FIG. 7;

FIG. 10 is a circuit diagram showing two three-way switches and a load, when the load circuit is energized and the pilot lights are on;

FIG. 11 is a circuit diagram similar to that of FIG. 10 showing the two three-way switches in opposite positions;

FIG. 12 is a circuit diagram showing the two three-way switches when the load circuit is deenergized and the pilot light is off; and

FIG. 13 is a circuit diagram similar to FIG. 12 showing the two three-way switches in opposite positions.

There is illustrated in FIGS. 1 through 6 one form of the switch having a housing 10 comprising a base 11, and a cover 12 which are formed of a suitable dielectric material. The base 11 and cover 12 are provided with apertures at their ends for passage of elongated screws 14 which pass through these members and are threadably received in the usual metal mounting yoke 16. The switch includes a movable switch member 18 in the form of an elongated electrically conducting spring strip which carries suitable electrical contacts at its free end 20 and is mounted at its fixed end 21 in the base 11. The mounting of member 18 is effected by bending it at its end 21 and seating it in a recess formed between the side of base 11 and an upright stud 22 molded in the base 11. A laterally extending portion of the bent end 21 forms a terminal plate 23 which is captured in a recess 24 formed in the side of base 11. The terminal plate portion 23 is provided with a tapped opening to receive the usual binding screw 25. The free end 20 of switch member 18 is designed to contact either a lower fixed contact (not shown) or an upper fixed contact 26. The lower fixed contact which cannot be seen is carried by a laterally extending portion of a terminal plate 27 which receives a binding screw 28 and is captured in suitable recesses formed in the base 11. The upper fixed contact 26 is mounted upon a cross-over extension arm 29 which terminates in a terminal plate 30 for receiving a binding screw 31 and is similarly captured in recesses formed in the base 11. A fourth terminal plate 32 is provided opposite the terminal plate 23.

The switch mechanism includes a ribbed wheel 33 and ratchet 34 coaxial therewith which are mounted for rotation in the base 11. A push button 36 including a depending finger 38 rotates the ratchet wheel 34 an incremented angular amount each time it is depressed. Rotation of the ratchet 34 causes the ribbed wheel 32 either to move switch member 18 into contact with the upper fixed contact 26 or to release it to contact the lower fixed contact.

A neon pilot lamp 39 electrically connected across the terminal plates 23 and 32 is located within the housing 10 and extends into the hollow push button 36. Since the push button 36 is formed of a translucent material it is

readily understood that the button will "glow" when the pilot lamp 39 is illuminated. It will become apparent that the lamp 39 will be energized in response to the energization of the remote external load. As the switch mechanism is substantially identical with that described in the Patents No. 2,933,578, issued Apr. 19, 1960 jointly to Harvey Hubbell and Ernest R. Carlson, and No. 3,084,239, issued Apr. 2, 1963 jointly to Ernest R. Carlson and John C. Horvath, it will not be discussed in further detail herein.

The housing 10 further comprises a second base 40 secured to the base 11 of the usual switch which serves as a light-tight housing for the control package and is made of a suitable opaque dielectric material. The base 40 includes apertures at its ends for receiving the elongated binding screws 14 so that it may readily be secured to the switch 10. The elements housed within the second base 40 are electrically connected to the elements of the usual switch by means of binding straps 42, 44, 46 and 48 each having a bifurcated end for insertion between the head of the usual terminal screw and the usual terminal plate of the switch 10. These straps serve the dual function of (1) forming an electrical connection and (2) aiding in the securing of the second base 40 to the base 11. The straps 42, 44, 46 and 48 are formed integral with terminal plates 42', 44', 46' and 48' which are captured in recesses formed in the second base 40. Three of the terminal plates 42', 44' and 46' are provided with binding screws for receiving electrically conductive lead-in wires. The second base 40 further includes a fifth terminal plate 50 which also receives a fourth binding screw for receiving an electrically conductive lead-in wire.

The control circuit package located within the light-tight second base 40 comprises a neon trigger lamp 52 and a current limiting resistor 54 which are electrically connected in series across the stationary contact switch terminals between the terminal plates 44' and 46' for causing illumination of the trigger lamp 52 when the remote, external load is deenergized. A light sensitive resistor 56 is also located within the second base 40 and is optically coupled with the neon trigger lamp 52. A biasing resistor 58 may be connected in series with the light sensitive resistor 56 between the terminal plates 42' and 48' and in parallel with the neon pilot lamp 39. A current limiting resistor 60 is connected in series with the neon pilot lamp 39 and also in series with the biasing resistor 58 by being mounted within the second base 40 and connected between the terminal plates 48' and 50. A lead-in wire from the neutral side of the line may be secured to the terminal plate 50.

With particular reference to FIGS. 7-9 there is illustrated a modified form of the three-way switch incorporating an improved pilot light control circuit which may be mounted behind the usual face plate 62 of a known toggle switch assembly. A mounting strap 64 has three openings in which are secured a three-way toggle switch 66, a pilot light housing 68 with a jewel lens 70, and a control circuit housing 72. The face plate 62, however, is only provided with two openings for receiving the toggle switch 66 and the pilot light lens 70. The control circuitry housing 72 is a light-tight enclosure molded of an opaque plastic material, preferably a phenolic resin, and contains control components similar to those of the preferred embodiment which components will be given the same numbers with a prime (') added.

Within the light-tight housing 72 there are disposed a light sensitive resistor 56' optically coupled with a neon trigger lamp 52' and a current limiting resistor 54' connected in series with the lamp 52'. Within the pilot light housing 68 there is disposed a pilot neon lamp 39' in series with a current limiting resistor 60' and with a biasing resistor 58' outside the housing which, in turn, is electrically connected in series with the light dependent resistor 56'.

Turning now to FIGS. 10-13 there are schematically

represented two three-way switches S_1 and S_2 each constructed in accordance with either modification of our invention, the switches being represented by the dotted-line boxes surrounding the components of the circuit. Switches S_1 and S_2 are connected in the conventional three-way switch arrangement to control a load L. Referring specifically to the state of the circuit in FIGS. 10 and 11 it is readily observable that the load L is energized by being connected directly across the power supply. When the circuit is in this state, the neon trigger lamps 52 are cut out of the circuit and are not illuminated. Accordingly, no light impinges on light sensitive resistor 56 and its resistance remains very high. Accordingly, each of neon pilot lamps 39 is effectively across the load L and is therefore energized and lighted, indicating energization of the load.

Conversely, as schematically represented in FIGS. 12 and 13, when the load L is deenergized, a series electrical path through the neon trigger lamps 52, their respective current limiting desistors 54, and the load L is completed across the power supply. As the trigger neons 52 light, they illuminate the optically coupled light sensitive resistors 56, causing their resistances to fall and, in effect, shunting the pilot neons 39 causing much less than the required firing voltage to appear across the lamps 39. Therefore, the pilot neons will be dark, indicating the deenergization of the load L. It should be noted that, in each switch, two resistors 58 and 60 are utilized where ordinarily one resistor of a higher ohmic value would suffice for both limiting the current through the pilot neon 39 and limiting the current through the light sensitive resistor 56. The substitution of two smaller value resistors allows a higher illumination of the pilot neon 39 and a shorter response time needed to cause ignition voltage to appear across the pilot neon 39 while the combined value of resistance still limits the current through the light dependent resistor 56.

Typical values of the control elements used in the switches are as follows: the neon lamps 39 and 52 may be of the type sold commercially as "G.E. N.E.-2H"; the current-limiting resistors 54 in series with the trigger neon lamps are rated at 100,000 ohms; the light-sensitive resistors 56 are rated at 125 milliwatt dissipation; the biasing resistors 58 are rated at 33,000 ohms, and the current-limiting resistors 60 in series with the neon pilot lamp 39 is rated at 47,000 ohms.

It is apparent that this novel three-way switch with pilot light including an integral electronic control package is an improvement over the three-way switch shown in Patent No. 3,238,343. Our invention precludes the necessity of the running of extra conductors between the remote switches, making our device easy and inexpensive to install as well as to replace. Of course, a simple pilot light in parallel with the load L would suffice instead of the switch S_2 at the load end of switch hook-up (shown in the circuit diagrams). In actual practice, however, it is not always practical to tell which point is to be toward the line and which is toward the load, so the proposed scheme and improved switch allows the use of a common switch for both locations.

It is to be understood that the present disclosure has been made only by way of example and that numerous changes in details of construction and the combination and arrangement of parts may be resorted to without departing from the true spirit and scope of the invention as hereinafter claimed.

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

1. An illuminated three-way switch system for controlling and indicating the state of energization of a remote electrical load which comprises: a housing, a three-way electrical switch mechanism disposed within said housing including first and second relatively fixed contact means and third contact means relatively movable therebetween; means for selectively operating said

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switch mechanism; pilot light means associated with said switch mechanism and connectable across a power supply; and control circuit means responsive to voltage across said fixed contact means to inactivate said pilot light means upon the occurrence of such voltage.

2. The illuminated three-way switch defined in claim 1 wherein said control circuit means is disposed within a light-tight enclosure connected to said housing.

3. The illuminated three-way switch defined in claim 1 wherein said control circuit means includes an illuminating means and an optically coupled light sensitive resistor.

4. The illuminated three-way switch defined in claim 3 wherein said light sensitive resistor is electrically connected in parallel with said pilot light means and serves as a shunt means for bypassing and therefore deenergizing said pilot light means, when the resistance of said light sensitive resistor is lowered upon being lit by said illuminating means.

5. The illuminated electric switch defined in claim 3 wherein said pilot light means and said illuminating means are neon lamps.

6. The illuminated three-way switch defined in claim 1 wherein: said housing is made of a dielectric material and includes a base and a cover which are secured together; said selectively operated means includes a push button extending through the front wall of said cover, said push button being formed of a translucent material and defining a cavity therein; said pilot light means comprises a neon lamp mounted within said chamber and extending into said cavity for illuminating said push button; a second base is secured to said base and defines a chamber therebetween, being a light-tight enclosure for containing said control circuit means; and wherein said control circuit means includes a trigger neon lamp electrically connected for energization when the remote electrical load is deenergized and an optically coupled light

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sensitive resistor electrically connected in parallel with said pilot neon lamp for serving as a shunt for bypassing and therefore deenergizing said pilot neon lamp when the resistance of said light sensitive resistor is lowered upon being lit by said trigger neon lamp.

7. The illuminated three-way switch defined in claim 1 wherein: said housing comprises a first body made of a dielectric material; said selectively operated means includes a trigger lever extending through one face of said body; further including a second body having a translucent face and defining a chamber therein for housing said pilot light means which comprises a neon lamp; further including a third body defining a light-tight enclosure for housing said control circuit means; said control circuit means including a trigger neon lamp electrically connected for energization when the remote electrical load is deenergized and an optically coupled light sensitive resistor electrically connected in parallel with said pilot neon lamp for serving as a shunt for bypassing and therefore deenergizing said pilot neon lamp when the resistance of said light dependent resistor is lowered upon being lit by said trigger neon lamp; and wherein said first, second and third bodies are secured together by being mounted upon a mounting strap.

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3,238,343	3/1966	Carlson	200—156 X

JAMES W. LAWRENCE, *Primary Examiner*.

E. R. LA ROCHE, *Assistant Examiner*.

U.S. Cl. X.R.

200—167; 250—200; 315—226