Sept. 22, 1970 P. J. VAN BENSCHOTEN 3,530,501

PLURAL VISUAL INDICATOR ASSEMBLY ENERGIZABLE THROUGH TWO INPUT TERMINALS

Filed Dec. 11, 1968

Fig. 1

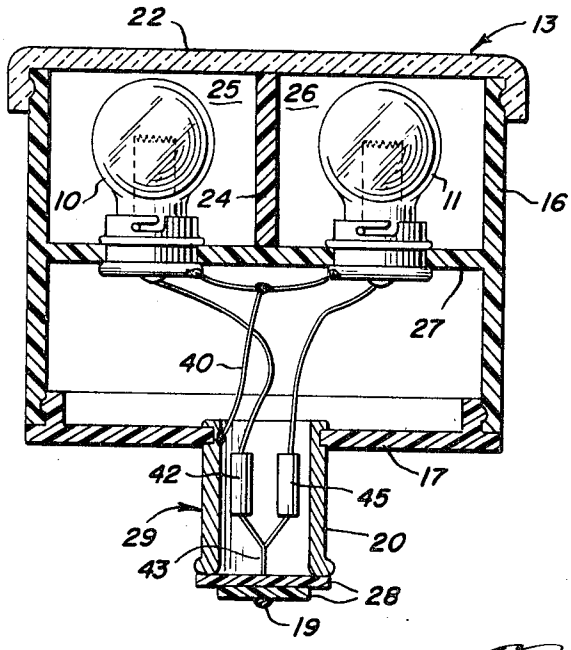


Fig. 2

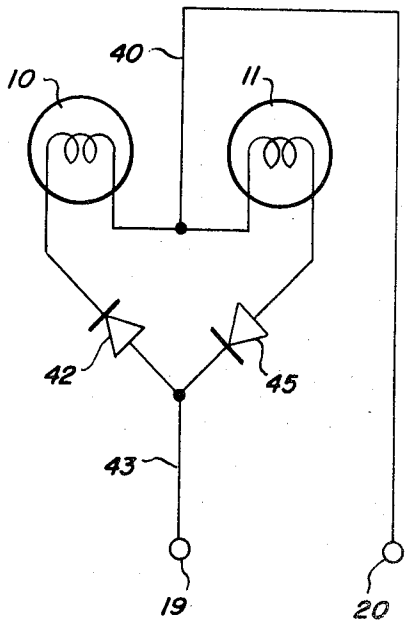


Fig. 4

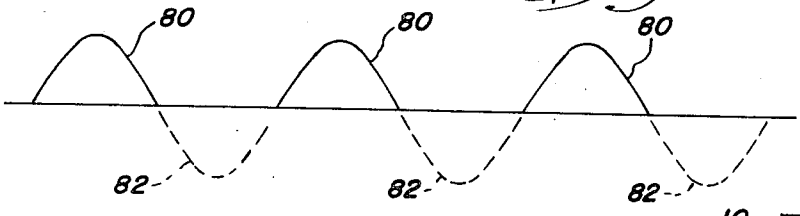
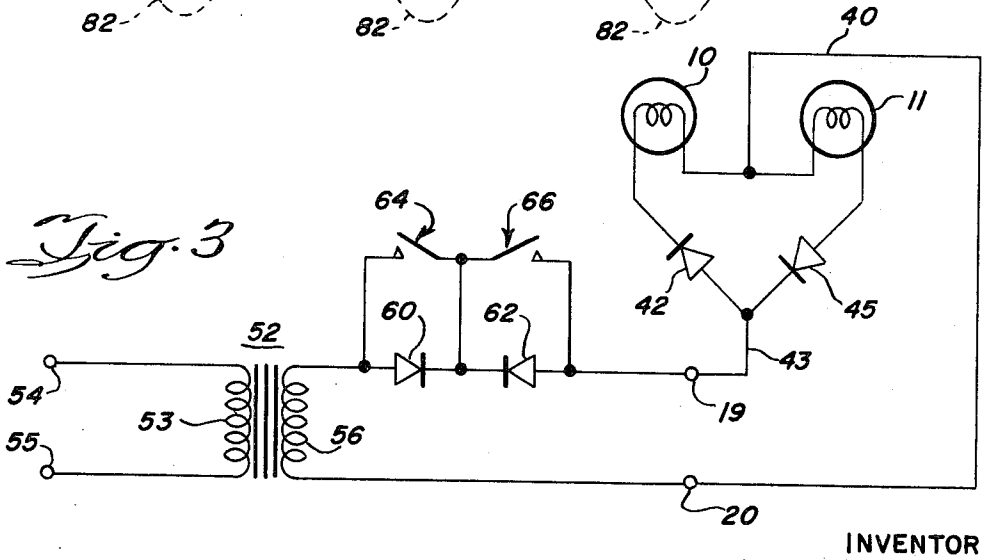


Fig. 3



INVENTOR

Peter J. Van Benschoten

BY Hoffgren, Wegner, Allen, Sheldman & McCord

ATTORNEYS

United States Patent Office 3,530,501
Patented Sept. 22, 1970

3,530,501

PLURAL VISUAL INDICATOR ASSEMBLY ENERGIZABLE THROUGH TWO INPUT TERMINALS

Peter J. Van Benschoten, Rancho Santa Fe, Calif., assignor to Oak Electro/Netics Corp., a corporation of Delaware

Filed Dec. 11, 1968, Ser. No. 782,972
Int. Cl. H01j 1/60
U.S. Cl. 315—129 6 Claims

ABSTRACT OF THE DISCLOSURE

Two lamps are mounted within a lamp socket assembly having a single pair of electrical input terminals. A pair of diodes connected between the terminals and the lamps permit selective energization of the lamps with DC voltage, and simultaneous energization with AC voltage connected to the terminals. A power source selectively supplies DC voltage of either polarity or AC voltage to the terminals.

This invention relates to a circuit and assembly for energizing a plurality of loads, and more particularly to a circuit for selectively energizing one or a combination of loads through a single pair of input terminals.

A pair of visual indicator lamps are typically energized, either individually or simultaneously, through three input terminals, in which one terminal is connected in common to both lamps. By connecting an electrical source across an individual terminal and the common terminal, either one of the lamps can be energized. By connecting the electrical source across both individual terminals, both lamps are energized.

While such a three input terminal circuit is satisfactory in many applications, it is sometimes desirable to be able to individually or simultaneously energize the pair of lamps through a single pair of input terminals. For example, the present invention allows a two lamp assembly to be substituted for a one lamp assembly, without requiring replacement of the two terminal lamp socket receptacle.

In addition, a three terminal lamp assembly is considerably more expensive to tool and manufacture than a two terminal lamp assembly. The cost is further increased when the lamp assembly is to be incorporated with other structure, such as in an illuminated pushbutton switch. Each electrical terminal requires sliding contacts or other structure and an additional terminal significantly increases the cost of the assembly.

One object of the invention is the provision of a circuit for energizing either individually or in combination a plurality of loads through a single pair of input terminals.

One feature of the invention is the provision of a two lamp indicator assembly in which either or both lamps may be energized through a single pair of input terminals.

Another feature is the provision of a two lamp energizing circuit in which diodes are associated with each lamp in order to pass DC currents of different polarity to each lamp. When AC voltage is connected to the circuit, both lamps are energized.

Further features and advantages will be apparent from the following description and from the drawings, in which:

FIG. 1 illustrates a two lamp assembly incorporated in an illuminated pushbutton switch;

FIG. 2 is a schematic diagram of the lamp circuit of FIG. 1;

FIG. 3 is a schematic diagram of the lamp circuit connected to a power supply for energizing the lamps; and

FIG. 4 is a diagram of the voltage waveform available from the power supply of FIG. 3.

While an illustrative embodiment of the invention is shown in the drawings and will be described in detail herein, the invention is susceptible of embodiment in many different forms and it should be understood that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

Turning to FIG. 1, a plurality of energizable loads are illustrated, in the form of a pair of visual indicator lamps **10** and **11**. The lamps are contained within a single socket assembly **13** which is slidably mounted within a receptacle assembly, not illustrated. These assemblies form an illuminated pushbutton switch, in which an operator manually depresses socket assembly **13** in order to engage the receptacle and energize the lamps **10** and/or **11**.

Lamps **10** and **11** are mounted within a cylindrical insulated housing **16** having a base **17**, of insulating material, at one end, with a pair of electrical input terminals **19** and **20** secured thereto. The opposite end of cylindrical housing **16** is covered with a transparent lens **22** which allows light from lamps **10** and **11** to be transmitted therethrough when the lamps are energized. An opaque wall **24** within housing **16** separates the lamps, forming light tight enclosures or chambers **25** and **26** therefor. The lamps are mounted on a wall **27** of insulating material, which forms the bottom portion of the chambers.

Electrical input terminals **19** and **20** may take any desired form, and are illustrated for an illuminated pushbutton switch assembly. Terminal **19** consists of a button extending from insulators **28**, which are mounted at the end of a cylindrical metal housing **29** which forms contact **20**. As assembly **13** is pressed downwardly, it engages a conventional plunger and contact pin of the switch receptacle, thereby connecting contacts **19** and **20** to the circuit of FIG. 3.

In FIG. 2, the lamp circuit contained within socket **13** is illustrated in detail. Either lamp **10** or **11**, or both lamps, may be energized by electrical power from terminals **19** and **20**. For this purpose, one terminal line of each of the lamps **10** and **11** is connected to a common line **40** which directly connects to terminal **20**. The opposite terminal line of lamp **10** is connected through a unidirectional conduction device, in the form of a diode **42**, to a common line **43** which directly connects with terminal **19**. Similarly, the opposite terminal line of lamp **11** is connected through another unidirectional conduction device, in the form of a diode **45**, to line **43**. Diodes **42** and **45** are oppositely poled, so that only diode **42** is conductive when terminal **19** is positive relative to terminal **20**, and conversely only diode **45** is conductive when terminal **19** is negative relative to terminal **20**.

In operation, terminals **19** and **20** are connected to an electrical source which can supply energy of different characteristic, herein positive polarity DC voltage, to either terminals **19** or **20**, or an AC voltage thereacross. When terminal **19** is coupled to a positive DC voltage relative to terminal **20**, a current path is formed through line **43** and diode **42**, lamp **10**, and line **40** to terminal **20**. This causes only lamp **10** to be energized. Lamp **11** cannot be energized because diode **45** is back-biased and blocks current flow through the lamp. When the polarity of the DC voltage is reversed, a current path is formed from terminal **20** and through lamp **11**, diode **45**, and line **43** to terminal **19**. In this case, only lamp **11** is energized.

When both lamps **10** and **11** are to be energized, an AC voltage is connected to terminals **19** and **20**. When the AC voltage goes positive at terminal **19**, lamp **10** is energized, and when the AC voltage goes positive on the opposite half cycle at terminal **20**, lamp **11** is energized. The AC

voltage is chosen to have a frequency in excess of the perception time of the human eye. Thus, although each lamp is alternately energized, the visual perception to the human eye is that of a continuous energized lamp.

Diodes **42** and **45** are mounted within housing **29**, as seen in FIG. 1. As illustrated, the cylindrical housing **29** extends downward from base **17**. Diodes **42** and **45** are placed within the opening defined by housing **29** and insulator **28**, after which an epoxy resin may be poured therein in order to hold the diodes in place.

A power supply suitable for energizing the circuit of FIG. 2 is illustrated in FIG. 3. A transformer **52** has an input winding **53** with a pair of terminals **54**, **55** connectable to a conventional source of 60 cycle AC line current. An output winding **56** of transformer **52** has a turns ratio, relative to input winding **53**, chosen to step down the voltage to a magnitude suitable for lamps **10** and **11**. One side of winding **56** is directly connected to the receptacle structure which engages terminal **20**. The other side of winding **56** is connected to a unidirectional conduction device, as a diode **60**, poled in the same direction as diode **42**. The cathode side of diode **60** is connected to another unidirectional conduction device, as diode **62**, oppositely poled to diode **60** and having an anode directly connected to the receptacle structure which engages terminal **19** when the assembly of FIG. 1 is depressed.

Diodes **60** and **62** are shunted by a pair of normally open, single-pole, single-throw switches **64** and **66**, respectively. When only switch **64** is closed, diode **60** is shorted and has no effect in the circuit. When only switch **66** is closed, diode **62** is shorted and has no effect in the circuit. When both switches **64** and **66** are closed, both diodes **60** and **62** are shunted and effectively disconnected from the circuit.

In operation, when lamp **10** is to be energized, switch **66** is closed, thereby shorting diode **62**. Each time the voltage at the upper side of winding **56** goes positive, shown by the solid line **80** in FIG. 4, current flows through diode **60**, switch **66**, terminal **19** (when the socket is depressed) and diode **42** to lamp **10**, and thence through line **40** and terminal **20** to the lower side of winding **56**.

When only lamp **11** is to be energized, switch **64** is closed, shorting diode **60**. Each time the upper side of winding **56** goes negative, shown by the dashed lines **82** in FIG. 4, current flows through terminal **20** (when the socket is depressed) and line **40** to lamp **11**, and thence through diode **45**, line **43**, terminal **19**, diode **62** and switch **64** to the upper side of winding **56**.

When both lamps are to be energized, both switches **64** and **66** are allowing both half cycles **80** and **82** of alternating current to pass to terminals **19**, **20** and energize lamps **10** and **11**. That is, during the positive half cycle **80**, FIG. 4, lamp **10** is energized, and during the negative half cycle **82**, lamp **11** is energized. Since conventional AC line current has a frequency of 60 cycles per second, each lamp is energized 60 times per second with a 50% duty cycle. Because this repetition rate is above the perception rate of the human eye, lamps **10** and **11** will appear to be continuously energized.

I claim:

1. In an indicator system having a male assembly movable into contact with a female receptacle to allow selective energization of a pair of visual indicators contained within the male assembly, the improvements comprising:

a housing forming said male assembly and having an external surface with only two conductive areas thereon which define two terminals for contacting said female receptacle to conduct electrical energy from said female receptacle to said male assembly, said pair of visual indicators being contained within said housing;

first circuit means within said housing and connecting said two terminals to said pair of indicators for energizing one of said indicators when electrical energy of one characteristic is present across said two terminals and for energizing the other of said indicators when electrical energy of a different characteristic is present across said two terminals; and

source means for connecting electrical energy through said remale receptacle to said two terminals, including second circuit means actuable when one of said indicators is to be energized for supplying electrical energy of said one characteristic and actuable when the other of said indicators is to be energized for supplying electrical energy of said different characteristic.

2. The indicator system of claim **1** wherein said first circuit means includes a pair of unidirectional conduction devices and means connecting each of said devices to a different one of said indicators for energizing the indicator only when a voltage of a polarity corresponding to the direction of conduction of the device is present across said two terminals, wherein said characteristic corresponds to the polarity of voltage from said source means.

3. The indicator system of claim **2** wherein said second circuit means includes means actuable when both of said indicators are to be energized for supplying voltage of alternating polarity through said female receptacle to said two terminals, said first circuit means alternately causing each of said unidirectional conduction devices to pass current and alternately energize the indicator associated therewith.

4. The indicator system of claim **3** wherein said AC voltage has a frequency at least two times greater than the perception rate of the human eye, said first circuit means alternately energizing each visual indicator at a repetition rate greater than the perception rate of the human eye, whereby said pair of visual indicators appear to the human eye to be continuously energized.

5. The indicator system of claim **3** wherein said second circuit means includes a third unidirectional conduction device connected to said AC voltage supplying means for rectifying the AC voltage to produce half cycle voltage of positive polarity, a fourth unidirectional conduction device connected to said AC voltage supplying means for the AC voltage to produce half cycle voltage of negative polarity, and switch means actuable to shunt both said third and fourth unidirectional conduction devices to couple AC voltage of positive and negative polarity through said female receptacle to said two terminals.

6. The indicator system of claim **1** wherein said housing includes lens means transparent to light energy emitted by said pair of visual indicators when energized, opaque means in said housing for forming a pair of separate light chambers, each chamber being adjacent said lens means, and means mounting each of said visual indicators in a different one of said pair of chambers.

References Cited

UNITED STATES PATENTS

3,019,369	1/1962	Zarleng	315—209
3,110,810	11/1963	Fransen	250—100
3,268,742	8/1966	Pinckaers	307—88.5

JOHN HUCKERT, Primary Examiner

R. F. POLISSACK, Assistant Examiner

U.S. Cl. X.R.

315—130, 131, 132, 135, 200, 201, 209, 272; 340—331, 332, 366