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Rodriguez

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[54] **FULL RANGE LIGHT DIMMER ADAPTOR**

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[52] **U.S. Cl.** **315/58,** 315/71, 315/272

[51] **Int. Cl.** **H01j 7/44**

[58] **Field of Search** 315/58, 71, 291, 315/208, 272

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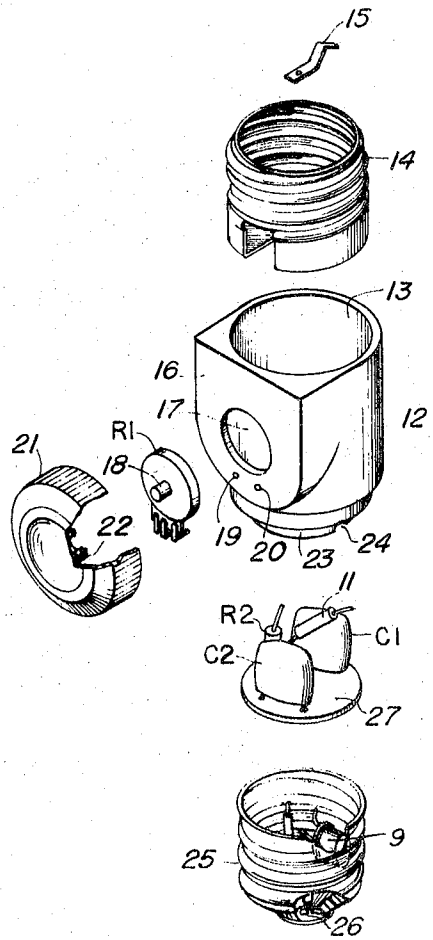
Primary Examiner—Roy Lake

Attorney—Louis Orenbuch

[57] **ABSTRACT**

A lamp dimmer adaptor is disclosed for insertion in a conventional lamp fixture to enable the illumination provided by an incandescent electric lamp to be controlled over a large range from dim to full intensity. The body of the adaptor has a socket for accepting the base of the electric lamp. Secured to the body is a hollow base formed by a metallic shell in which is housed a triac and all the other elements of the lamp dimmer circuitry with the exception of the variable resistor. The case of the triac is soldered to the shell to provide a thermal path for dissipation by the shell of heat generated in the triac. The body has a dependent collar which protrudes into the base and a recess in the collar receives the triac case whereby rotation of the base relative to the body is prevented. Above the base, the body has an external flat face which is substantially covered by a large hollow knob housing the variable resistor which controls the level of illumination.

2 Claims, 5 Drawing Figures



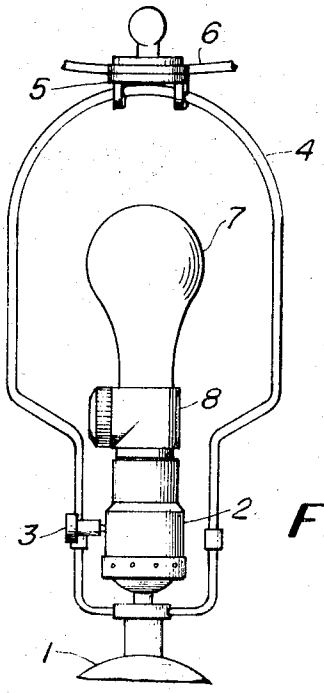


FIG. 1

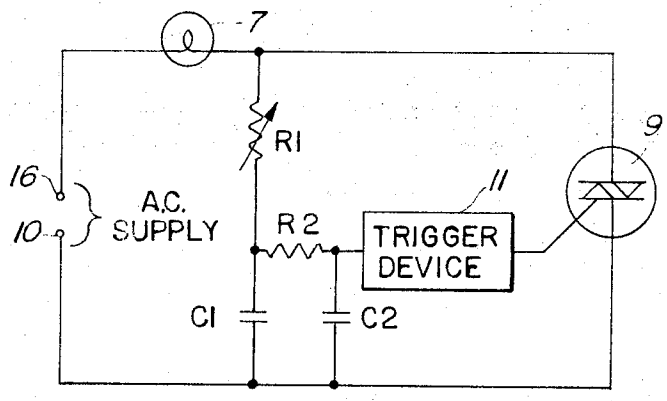


FIG. 2

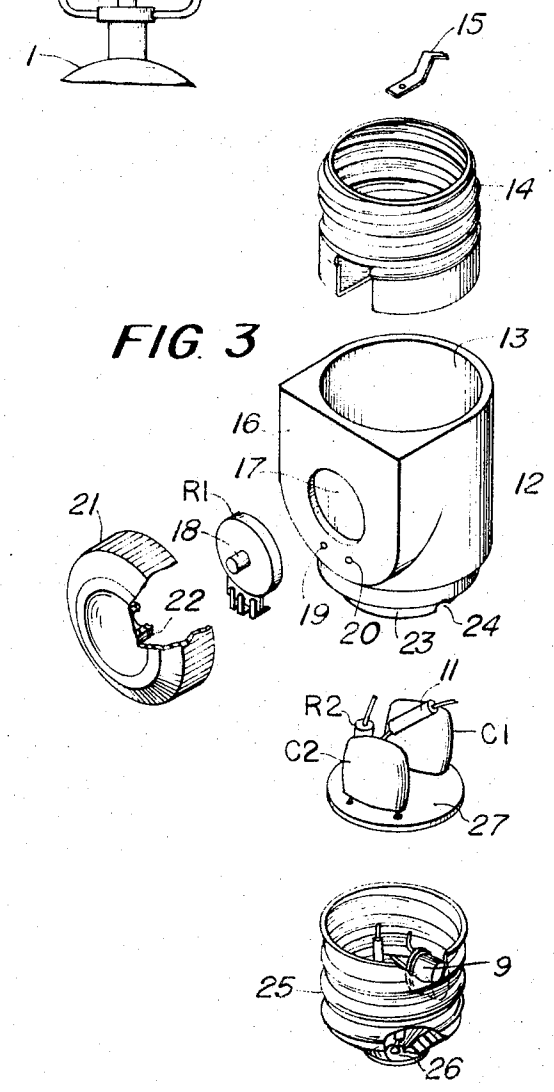


FIG. 3

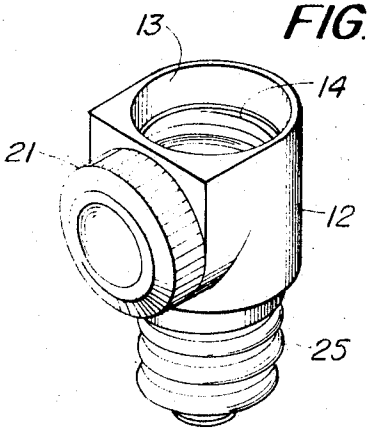


FIG. 4

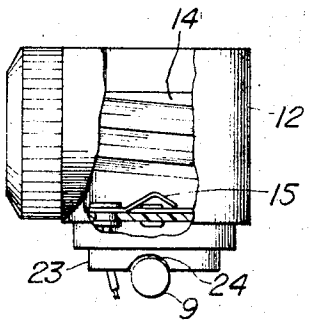


FIG. 5

FULL RANGE LIGHT DIMMER ADAPTOR

This invention relates to controls for electric lamps. More particularly, the invention pertains to a socket insert for varying the intensity of a lamp of the type having a filament heated to incandescence by an electrical current.

It is common in domestic and industrial lighting application to control the intensity of illumination by the use of electronic light dimmers. Such dimmers employ a unilateral controller such as a silicon controlled rectifier or a bilateral controller such as a triac to regulate current flow. Most electrical lamp sockets, however, are constructed with an on-off switch whereby the lamp is either at full intensity or is fully extinguished. The principal objective of the invention is to provide a lamp dimmer which can be inserted in the ordinary lamp socket to convert the on-off arrangement to an arrangement permitting the illumination level to be controlled over a large range.

The invention resides in a light dimmer adaptor containing within itself an electronic circuit that permits the luminous intensity of an incandescent lamp to be controlled over a range from full intensity to very dim or completely off. Although full range variable light dimmers have been employed for residential lighting, the use of such light dimmers have usually been confined to installations, such as wall installations, which afford considerable space for housing the electronic circuitry and where the electronic components are widely removed from the heat produced by the incandescent electric lamp which the dimmer controls. The conventional full range light dimmer employs a triac to regulate the current flow in the filament of the lamp. The triac is triggered by a triggering device controlled by a phase shift network. The phase shift network causes the triac to be triggered into conduction at a phase angle of the A.C. supply voltage which is selected by the setting of a variable resistor in the phase shift network. The trigger determines the point in each half cycle of the A.C. wave at which the triac commences to conduct current to the filament of the lamp. Once triggered into conduction, the triac is conductive for the remainder of the half cycle and reverts to its nonconductive state when the current drops to zero. The triac controls the flow of current to the filament of the lamp and thereby controls the luminous intensity of the incandescent filament.

To be commercially acceptable as an adaptor for use in the conventional floor and table lamp fixtures, the adaptor must contain within itself all the electronic circuitry of a lamp dimmer and must be sufficiently small to permit the adaptor to be mounted in the socket of the conventional lamp fixture without increasing the height to the extent that an electric light bulb cannot be mounted in the adaptor without removing the lamp shade and its supporting stirrup. Further to facilitate mounting in the conventional lamp fixture, the adaptor must be slender enough to rotate within the narrow aperture of the stirrup to permit the adaptor to be screwed into the socket of the fixture without requiring removal of the stirrup. The triac tends to produce heat during the operation of the lamp dimmer and the electric light bulb itself produces heat from the incandescent filament. The heat from these sources must be dissipated before the temperature rises to a level that is damaging to the triac or the other components of the dimmer circuitry. The arrangement of the components of the adaptor to achieve the requisite heat transfer and the requisite small size is the essence of the invention.

The invention, both as to its arrangement and its manner of operation, can be better understood from the exposition which follows when it is considered in conjunction with the accompanying drawings in which:

FIG. 1 shows an embodiment of the invention disposed in a conventional lamp fixture;

FIG. 2 schematically depicts a lamp dimmer circuit suitable for use in the invention;

FIG. 3 is an exploded view of the preferred embodiment of the invention;

FIG. 4 is a view of the assembled preferred embodiment; and

FIG. 5 is a view of the body of the adaptor with a portion of the wall broken away.

A conventional lamp fixture is partially depicted in FIG. 1 to show the body 1 of the fixture having affixed to it a conventional lamp socket 2 containing an on-off switch controlled by a rotary knob 3. To provide support for a lamp shade, a stirrup 4 is provided which is attached to the body 1 and forms a frame around the socket 2. The stirrup has a wide aperture to accommodate the electric light bulb and has a narrower lower portion which is closely spaced from the lamp socket. Atop the stirrup is a bracket 5 to which the frame 6 of the lamp shade is secured in the usual manner. The on-off switch of the conventional lamp socket permits the lamp 7 to be either at full intensity or fully extinguished. To convert the lamp fixture to a device permitting the illumination level to be controlled over a range varying from full intensity to very dim, a variable lamp dimmer adaptor 8, constructed in accordance with the invention, is situated in the lamp socket 2.

To permit the variable lamp dimmer adaptor 8 to be screwed into the conventional socket 2 without requiring removal of the stirrup 4, the contour of the adaptor is such that it can pass through the narrower portion of the stirrup. To maintain the height of the lamp within the aperture of the stirrup and to allow sufficient space to permit the lamp to be unscrewed and removed, the height of the adaptor is kept as low as possible consistent with the need to provide a receptacle for the base of the light bulb.

FIG. 2 is a schematic diagram of the preferred circuitry employed in the invention. The lamp 7 is in series with the main terminals A1, A2 of triac 9 across the A.C. supply voltage impressed at terminals 10. The gate of the triac is connected to a triggering device 11, such as a diac. When the voltage across capacitor C2 reaches the breakover voltage of the triggering device, C2 partially discharges through that device into the triac gate. The discharge pulse triggers the triac into conduction for the remainder of the half cycle of the impressed A.C. The triac turns off during the brief instant when the load current passes through zero.

The variable resistor R1 and capacitor C1 are connected in series to form a charging circuit across the A.C. supply. Inasmuch as resistor R2 and capacitor C2 are in series across capacitor C1, the configuration of R1, R2, C1, and C2 forms a double time constant circuit. The rate at which capacitors C1 and C2 charge is determined by their capacitance, and the resistance in series with those capacitors. Because capacitors C1, C2, and resistor R2 are fixed in value, the rate of charge is controlled by the setting of variable resistor

R1. The double time constant circuit in conjunction with the triggering device effects phase control whereby the triac connects the lamp to the A.C. supply for a controlled fraction of each cycle. Control is accomplished by causing the triac to be triggered into conduction at a phase angle of the A.C. wave which is selected by the setting of the variable resistor. Once the triac is triggered into conduction during a half cycle, it conducts for the remainder of that half cycle. The circuit depicted in FIG. 2 affords full-wave phase control inasmuch as the triac can be triggered to conduct in either direction. To reduce hysteresis and the "snap-on" effect, capacitor C1 is paralled by the series combination of capacitor C2 and resistor R2. The capacitor C2 acts to recharge capacitor C1 after triggering, thus reducing the "snap-on" effect. For a discussion of the "snap-on" effect see the SCR Manual, 4th edition, pp. 187–189, published by the General Electric Company.

From FIG. 2 it is evident that apart from the lamp 7 and the requisite wiring, only six components are employed in the circuit. Those components are so arranged in the adaptor that when the adaptor is screwed into the socket of the lamp fixture, the adaptor is small enough to rotate within the frame of the stirrup and provide sufficient clearance to permit an ordinary light bulb to be mounted in the adaptor.

In the operation of the lamp dimmer, the triac must dissipate heat without encountering a rise in temperature to a level that is unsafe for that semiconductor device. The triac is therefore held in thermal contact with a member of the adaptor which provides a large radiating surface for dissipating the heat transferred to it from the triac.

An exploded view of the preferred embodiment of the lamp dimmer adaptor is shown in FIG. 3, and an assembled view of that embodiment is illustrated in FIG. 4. The body of the adaptor 12 is molded of a synthetic material having the requisite electrical insulative properties. Preferably the body of the adaptor is molded from a thermosetting plastic or from a thermoplastic material having a high melting point. The adaptor body has an internal cylindrical opening 13 in which is disposed a thimble 14 of copper which is threaded to receive the base of a conventional light bulb. As shown in FIG. 5, a resilient spring 15 is secured at the bottom center of the floor of the cylindrical aperture to provide an electrical contact to the center electrode of the conventional light bulb. When a light bulb is inserted in the adaptor, electrical connection to the filament in the bulb is established through the thimble 14 and resilient spring 15.

The upper portion of the adaptor body 12 has a flat face 16 in which a shallow circular depression 17 has been formed. The depression serves to locate the variable resistor R1 which has a flat circular body. Protruding from the variable resistor is a shaft 18 which can be turned to change the resistance of the device. The variable resistor R1 may be a commercially available miniature potentiometer. Preferably the variable resistor is secured in the depression by an adhesive such as an epoxy resin. To permit electrical connections to be made to the variable resistor, the adaptor body 13 has two holes 19, 20 in its front face through which electrical conductors pass. A hollow knob 21 fits over the body of the variable resistor and has a central post 22 which receives the shaft 18 of the variable resistor. The variable resistor is principally situated within the hollow knob 21 inasmuch as the depression 17 in the adaptor body 13 is quite shallow. By housing the variable resistor within the knob, the silhouette of the adaptor is kept to a narrow configuration which permits the adaptor to rotate within the frame of the stirrup 4 (FIG. 1) of the conventional lamp fixture. The hollow knob preferably has a serrated edge to facilitate manual rotation. The knob is of an insulative material to isolate the user from the potential of the variable resistor. The knob completely covers the variable resistor and is closely spaced from the front face 16 whereby the variable resistor is encased between the body of the adaptor and the knob. The external diameter of the knob is equal to the width of the body and the knob covers a large area of the flat front face 16. For esthetic reasons the bottom portion of the flat front face is rounded to conform to the circular contour of the knob. Further conducing to a slender silhouette is the selection of a mechanically strong synthetic material, such as a hard thermosetting urea-formaldehyde resin, which permits the cylindrical wall of the adaptor body to be in the order of one-sixteenth inch thick.

Below the flat face 16 of the body is a cylindrical collar 23 having a semi-circular recess 24 which receives the case of the triac 9, as depicted in FIG. 5. The triac, shown in the exploded view of FIG. 3 has its case soldered to the base 25 of the adaptor. The base 25 is threaded to fit with the threads of the conventional lamp socket. The base, preferably, is a brass shell having an insulated central electrode 26. The rim of the brass shell fits closely around the collar 23 when the adaptor is assembled. The rim of the brass shell is crimped or adhesively bonded to the collar 23 to secure the base to the body. The reception of the triac 9 within the recess 24 of the collar acts to prevent turning of the base 25 relative to the body 12 of the adaptor. Preferably the case of the triac is bonded to the wall of the recess by an adhesive such as an epozy resin to further insure that the base does not separate from the body.

Within the brass shell of the base is situated an insulative disc 27 having electrical conductors formed on one surface in the manner of a printed circuit board. Capacitors C1, C2, resistor R2 and the triggering device 11 are mounted on the disc 27. In the assembled light dimmer adaptor, the triggering device 11 has one terminal connected to the gate of the triac. The triac is of the type having one of its main terminals electrically connected to the case. By soldering the case to the brass shell of base 25, that main terminal of the triac is electrically tied to the brass shell and the solder union provides a thermal bond through which the triac transmits heat to the brass shell where the heat is dissipated by the relatively large surface area of the shell.

The triggering device 11 is a bi-directional device such as a diac which becomes conductive whenever its breakover voltage is exceeded in either voltage polarity. The typical diac has a breakdown voltage in the range from 27 to 37 volts and is intended specifically for triggering diacs. Of course, neon bulbs can be employed as the triggering device but the breakover voltage for such bulbs range from 50 to 100 volts and are consequently less desirable.

Although the circuit of FIG. 2 can be arranged to cause the triac to be cut-off when the variable resistor is set for maximum resistance, it is preferable to select the values of the circuit components so that the filament of the lamp is faint but still visibly aglow at the

maximum resistance of the variable resistor. By insuring that the triac is never completely cut-off when the A.C. supply voltage is present in the circuit, problems arising from hysteresis and quick turn on are partially averted. Further, the faintly glowing filament is a reminder to the user that the on-off switch of the conventional socket is set at "on".

An adaptor constructed in accordance with the invention can be used without requiring disassembly or alteration of the wiring of the conventional lamp fixture. The adaptor is relatively inexpensive because it requires few parts and is easily assembled.

Although the invention has been illustrated and described in the form of a preferred embodiment, it is not intended that the invention be limited to all the specific features of that embodiment. It is apparent to those skilled in the art of light dimmers, that some features of the preferred embodiment can be altered without departing from the essence of the invention. It is therefore intended that the invention not be confined to the specific embodiment here disclosed but rather that the invention be delimited by the appended claims.

I claim:

1. A lamp dimmer adaptor for controlling the illumination provided by an electric lamp of the type having an incandescent filament, the adaptor comprising a body having a cylindrical socket adapted to accept the base of the electric lamp, means in the socket for providing electrical connections to the filament of the lamp, the body having an external flat face, a variable resistor secured to the flat face, the variable resistor having a rotatable shaft for varying the resistance of the resistor, a hollow knob secured to the rotatable shaft and covering the variable resistor, the variable resistor being housed principally within the hollow knob, the body having a dependent cylindrical collar below the cylindrical socket, a hollow conductive shell having its rim engaging the dependent cylindrical collar, the hollow conductive shell forming the base of the adaptor and being threaded to be received by a conventional lamp socket, a semiconductor device for regulating current flow through the filament of the electric lamp, the semiconductor device being disposed within the shell, the semiconductor device having its case bonded to the shell whereby a thermal path is established to the shell for the dissipation of heat generated in the semiconductor device, the dependent cylindrical collar protruding into the shell and having a recess receiving the case of the semiconductor device, a capacitor within the shell, the capacitor being electrically connected to the variable resistor to form a charging circuit therewith, and a triggering device within the shell, the triggering device being controlled by the charging circuit and being adapted to trigger the semiconductor device into conduction.

2. A lamp dimmer adaptor according to claim **1**, wherein the external flat face of the body has a shallow depression therein in which a portion of the variable resistor is situated.

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