Nov. 24, 1970 B. C. GARRETT 3,543,088

VARIABLE LIGHT DIMMING ADAPTORS FOR INCANDESCENT BULBS

Filed May 7, 1968

FIG. 1

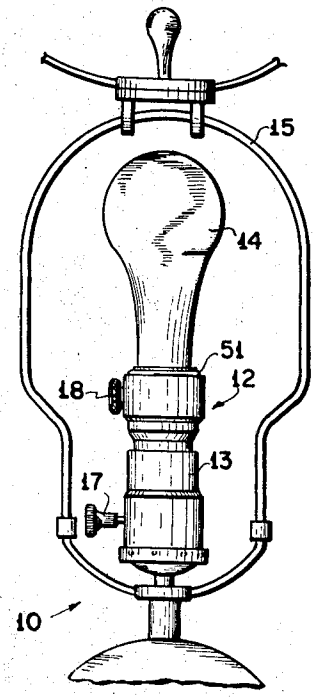


FIG. 2

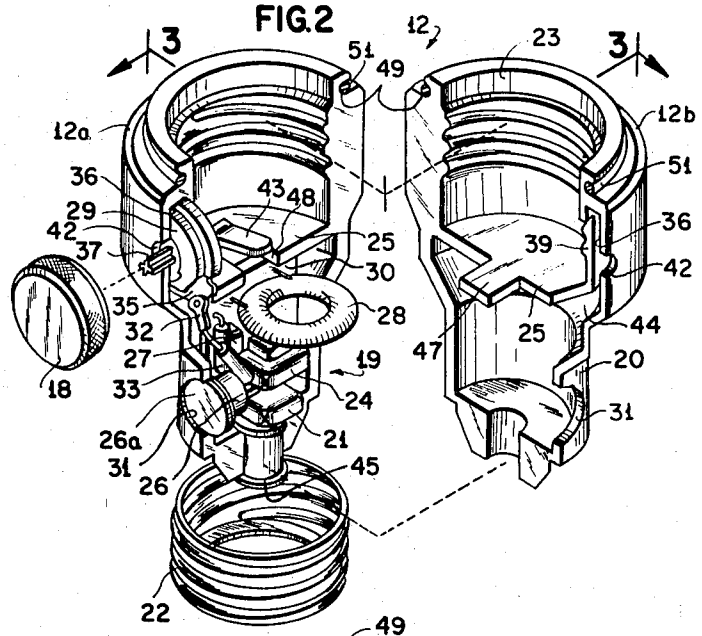


FIG. 3

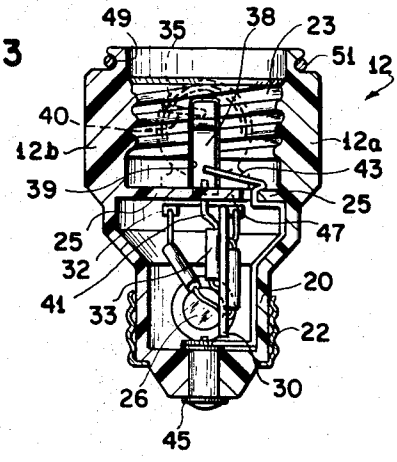
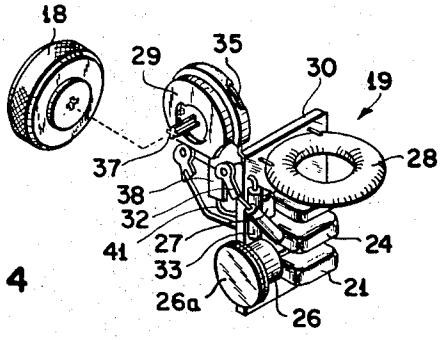


FIG. 4



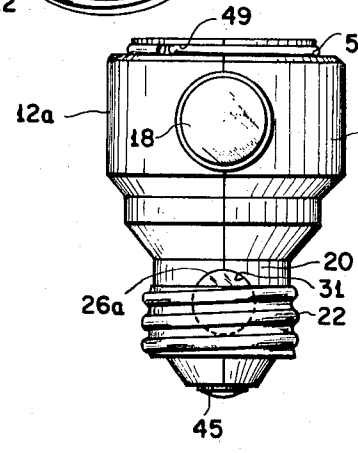


FIG. 6

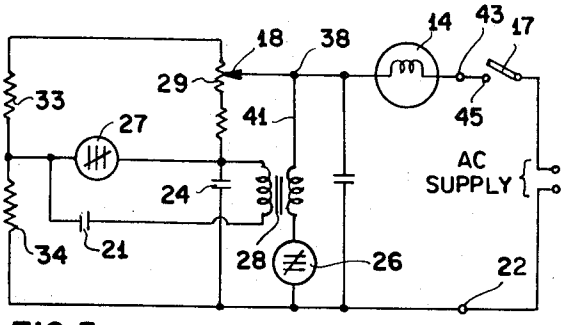


FIG. 5

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United States Patent Office 3,543,088 Patented Nov. 24, 1970

3,543,088

VARIABLE LIGHT DIMMING ADAPTORS FOR INCANDESCENT BULBS

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Filed May 7, 1968, Ser. No. 727,172
Int. Cl. G05f 3/04; H05b 37/02
U.S. Cl. 315—272 3 Claims

ABSTRACT OF THE DISCLOSURE

A light dimming adaptor for adapting a lamp fixture to variably illuminate an incandescent bulb from a dim-off condition to a full illumination condition. A body structure for the adaptor having a base portion and a socket portion houses the elements of a dimming circuit including a load semiconductor device and a potentiometer. The semiconductor device is positioned in the base portion in contact with a conductive screw sleeve provided on the outer surface thereof for dissipating heat generated by the semiconductor device, and the potentiometer is positioned in a cavity provided in the socket portion with a knob on the wall thereof for adjusting its setting to thereby control the intensity of illumination of the bulb.

This invention relates to light dimming adaptors for incandescent bulbs and more particularly to such an adaptor which houses an electronic circuit that enables the illumination of a bulb to be selectively varied from a full-off condition to a full-on condition.

It is highly desirable on many occasions to vary the illumination of floor or table lamps by switch controls provided on the lamp. This is usually provided for in residential environments by the use of three-way lamps. These lamps are constructed to utilize a type of incandescent bulb having two filaments. The switching mechanism of the lamp fixture selects either one or both of the filaments to be energied to thus provide three different illumination levels. In order to avoid the necessity of utilizing two-filament incandescent bulbs which are more expensive and have a tendency to burn out more quickly than single-filament bulbs, adaptors have been provided in the prior art which make it possible for a conventional lamp socket to accommodate a single-filament bulb to provide dual levels of illumination. The adaptor makes this possible by including within the structure thereof a diode rectifier connected to one of the terminals of the light bulb. A switch means included in the adaptor is used to open or close a circuit path bypassing the diode rectifier for thus establishing the dual levels of illumination in the light bulb mounted in the adaptor.

The present invention provides an improved adaptor over the prior art in that it includes within the body structure thereof an electronic circuit which provides for variably controlling the illumination of a lamp as desired, from a dim-off condition to a full brilliance condition. Although the use of such variable, full range, control in light dimming circuits is known in the prior art for residential lighting systems, their use heretofore has been limited to wall-type installations. Examples of typical light dimming circuits useful for incorporation in the adaptor of the present invention are disclosed in U.S. Pat. No. 3,188,490. Such circuits utilize a multilayer semiconductor device which exhibits a thyratron type switching action for controlling the power supplied to the bulb. A firing circuit including a resistance-capacitance phase shift network is provided in the dimming circuit to produce a firing signal of different phase angle than the voltage applied to the bulb. The firing signal controls the point in each alternating current half cycle at which the load semiconductor device becomes conductive and passes current to the bulb placed in series therewith. The firing circuit is manually adjusted by a potentiometer. In this manner the circuit controls the application of full wave power to the incandescent bulb and thus controls the intensity of illumination of the bulb.

It is thus seen from the above that when it is desired to provide an adaptor which will produce a full range of illumination in a light bulb, the adaptor must house a dimming control circuit comprised of several electronic components. These components must be physically fitted within the structure of the adaptor in a compact manner so as to provide a unit which is sufficiently small in size so that when screwed into a lamp fixture socket it will not interfere with the mounting of an ordinary light bulb in the lamp. Furthermore, in such control circuits, the semiconductor device dissipates a certain amount of heat during its operation, and in order for the electronic dimming circuit to operate properly, the adaptor must house the semiconductor device to enable the transfer of heat from the enclosure of the adaptor to the environment without an excessive temperature buildup in the adaptor. The existence of a high temperature source in an adaptor for a lamp fixture is not only inherently unsafe but additionally the load semiconductor device will only operate reliably within a relatively narrow temperature range and will fail to operate at all if the temperature rises beyond a critical value.

These and other objects and features of the invention are achieved through the physical structure and arrangement of an electronic light dimming circuit which will allow it to be assembled in a novel compact manner within the body structure of the adaptor. More particularly, the load semiconductor device required in such a dimmer circuit is disposed within the adaptor so as to have thermal contact with a conductive screw sleeve provided on the base of the adaptor, thus utilizing the appreciable surface area of the sleeve as a heat radiating surface for controlling the transfer of heat from the semiconductor device.

The specific nature of the invention as well as other objects, advantages and features thereof will become apparent from the following description of the preferred embodiment in conjunction with the following drawings in which:

FIG. 1 shows the adaptor of the present invention positioned on a lamp fixture;

FIG. 2 is a perspective view of the two separate halves of the adaptor, together with the electronic assembly unit mounted therein;

FIG. 3 is a sectional view of the assembled adaptor taken along the lines 3—3 of the halves of the body structure shown in FIG. 2;

FIG. 4 is a perspective view of the electronic assembly unit including the components of the dimming circuit;

FIG. 5 is a schematic diagram of a typical dimming circuit for incorporation in the adaptor of the present invention; and

FIG. 6 shows the two halves of the body structure mated together to form the assembled adaptor.

Reference will first be made to FIG. 1 showing a conventional lamp fixture **10** provided with adaptor **12** which is constructed in accordance with the teachings of the present invention. It should be noted that the adaptor **12** is relatively small in size and does not extend very high above the conventional socket **13** of the lamp fixture **10** so that an incandescent bulb **14** mounted in the adaptor **12** does not hit the lamp shade stirrup **15** or shade holder. The lamp fixture socket **13** is provided with a conventional on-off rotary switch **17**. The adaptor is provided with a knob **18** which can be turned to provide a variable illumination of the bulb **14** from dim-off to full brilli-

ance. As will be made clear in the ensuing description, simply by turning the on-off switch **17** the light bulb **14** may be turned on. Then by turning the knob **18**, the light bulb may be controlled to any desired degree of illumination.

Referring to FIG. 2, a perspective view is shown of the two halves **12***a* and **12***b* forming the main body structure of the adaptor **12**. The two halves are separated in order to show the associated electronic assembly unit **19** mounted therein. The halves of the body structure are preferably molded of a plastic insulation material such as polycarbonate. When the two halves of the body structure are mated, the lower smaller diameter end thereof forms a base portion **20** over which is fitted a one-piece conducting sleeve **22** having standard threads on the outer surface thereof. The base portion **20** is adapted to be screwed into conventional on-off type lamp fixture socket **13** to make electrical contact with the terminals thereof. The upper larger diameter end of the body structure forms a female socket portion **23** having internal standard threads for receiving the base of a conventional single-filament on-off type light bulb **14** and making electrical contact with the light bulb terminals. The socket portion **23** of the body structure is separated from the base portion **20** by a divider **25** formed at the time the body structure is molded.

Reference is next made to FIG. 5 which schematically illustrates a typical light dimming circuit which is incorporated in the adaptor **12** of the present invention. As disclosed in the previously referred to patent, the semiconductor device **26** controls the flow of current through the bulb **14**. The capacitor **24**, potentiometer **29** and resistors **33** and **34** of the circuit comprise the phase shift network utilized to produce a firing signal of different phase angle than the voltage applied across the bulb **14**. The output of the phase shift network is applied across a controller semiconductor device **27** connected in parallel with a series circuit comprising capacitor **21** and the primary winding of transformer **28**. When the controller semiconductor device **27** conducts in response to the firing signal it produces a large voltage pulse on the secondary of the transformer **28** causing the load semiconductor device **26** in series therewith to conduct current to the bulb **14**. The phase angle of the firing circuit is adjusted by manipulating the potentiometer **29** to thereby provide for varying the load current to the bulb and thereby its intensity of illumination.

Referring back to FIG. 2, the hollow base portion **20** of the body structure has positioned therein a rectangular circuit card **30** on which are mounted the electronic components such as the capacitors **21** and **24**, resistors **33** and **34** and semiconductor device **27** required for a typical power regulating circuit as exemplified by the circuit shown in FIG. 5. The load semiconductor device **26** is positioned on the card **30** such that wher the card is fitted into the hollow base portion **20** of the body structure, the end **26***a* of the casing of the load semiconductor device **26** fits into an opening **31** provided on the side of the base portion **20**. Along the upper portion of the card **30** the transformer **28** is secured such that it is enclosed by the expandirg diameter portion of the body structure. Extending upwardly at an angle from the side of the card **30** and positioned in a passageway **44** formed between the base portion **22** and the socket portion **23** are a pair of stiff terminal members **32** which connect to the second circuit card **35** whose plane generally extends rormal to the plane of the first circuit card **30**. The second card **35** fits into a cavity **36** provided on the side wall of the body structure surrounding the socket portion **23**. The potentiometer is mounted on the outer surface of the second card **35** so as to be enclosed within the cavity **36**. A strip terminal **38** is disposed on the inner surface of the second card **35** to fit in a vertical slot **39** provided in the threaded wall of the female socket portion **23** so as to make electrical contact with the threaded portion of the base of light bulb

14 which may be screwed into the socket portion **23**. This strip terminal **38** is electrically connected by wire **40** to the potentiometer **29** and by a wire **41** to the transformer **28** located on the first circuit card **30**.

Above the divider **25** forming the bottom of the socket portion **23** of the body structure is a spring terminal **43** which extends to a central position within the female socket portion **23** for the purpose of maintaining electrical contact with the central base terminal of the conventional single-filament light bulb **14**. The other end of the spring terminal **43** is shaped to conform to the inside contour of the body structure as shown in FIG. 3, and extends down through the hollow base portion **20** of the body structure to central base terminal **45**.

It should now be clearly understood from the above that the inner spring terminal **43** of the socket portion **23** is electrically connected directly to the central base terminal **45** of the base portion **20** of the body structure; and the outer strip terminal **38** of the socket portion **23** is electrically connected to the electronic circuit comprised of the components on the circuit board **30** and through the load semiconductor device **26** to the outer conductive sleeve **22** which corresponds to the outer terminal on the base portion **20** of the body structure. It should be noted that the components and terminals of the dimming circuit shown in FIGS. 2 and 3 are schematically indicated in the diagram of the circuit illustrated in FIG. 5 and designated by corresponding reference numerals.

As shown in FIG. 4, all the electronic components for the dimmer circuit including the potentiometer **29** are assembled to form an integral unit prior to being inserted in the body structure. The cards **30** and **35** are held in position relative to each other by the interconnecting stiff terminal members **32**. The assembly is such that the respective cards with the components secured thereon as previously described can be readily inserted into the opening provided by the hollow base portion **20** and the opening provided by the cavity **36** formed in the wall of the socket portion **23** of one of the halves of the body structure. When the two halves of the body structure are aligned and mated, the tongue **47** located on the divider **25** on one of the halves is fitted into a groove **48** provided on the divider **25** of the other one of the halves. When so assembled, the potentiometer **29** is properly positioned in the cavity **36** with its shaft **37** extend-through an opening **42** on the outer wall of the socket portion **23** of the body structure, and the end **26***a* of the casing of the semiconductor device **26** is positioned in the opening **31** provided on the outer wall of the base portion **20** of the body structure. The conductive sleeve **22** is fitted over the base portion **20** and a solder junction is formed so as to make electrical and thermal contact with the end **26***a* of the casing of the load semiconductor positioned in the opening **31**. In addition to being held by the conductive sleeve **22**, the two halves of the body structure are provided with a groove **49** on the upper end of the socket portion which groove is formed to provide a seat for a split circular spring **51** which holds the halves together.

It should now clearly be understood that the present invention provides a small adaptor **12**, which is simple in its construction, and relatively inexpensive, for use in a lamp fixture **10** to adapt a lamp to variably control the illumination of a conventional single-element light bulb **14** inserted into the socket portion **23** of the adaptor. The adaptor **12** can be used without requiring any rewiring or the use of any other than conventional lamp fixtures and light bulbs. The conductive screw sleeve **22** and the load semiconductor device **26** which is in series with the lamp load and which conducts the load current are in direct thermal and electrical contact with each other. In a typical dimming control circuit for use in the present invention, the multilayer semiconductor device **26** has a maximum junction temperature rating of

approximately 100 degrees centigrade and the power dissipated in the load semiconductor device is approximately 1.5 watts when the load is at 1.25 amps. Under such operating conditions, the maximum junction temperature would be quickly exceeded, destroying the semiconductor device if the heat generated by the device were not dissipated in the appreciable surface area of the conductive sleeve **22** and in the ambient air surrounding the female sleeve of the lamp socket and other parts in the socket of the lamp fixture **10**.

It should be further noted that the socket portion **23** including the internal threads thereof is formed of a plastic insulating material. The only conductive surface is the strip terminal **38** recessed in the internal threads thereof. This arrangement aids in isolating the semiconductor device **26** from the heat generated in the light bulb **14**. Furthermore the potentiometer **29** is completely enclosed within the cavity **36** provided in the side wall of the socket portion **23**, thus assuring that no metallic surface of the adaptor is normally contacted during insertion of the adaptor **12** into a lamp fixture **10**. Furthermore, using the conductive sleeve **22** located on the lower base portion of the adaptor for a heat dissipating structure avoids exposing to operator touch any conductive surface which is electrically alive. It is only when the base portion **20** is screwed into the lamp fixture socket **13** and the corresponding terminals of these members make contact, that the electronic circuit incorporated in the adaptor becomes energized such as to heat up the semiconductor device **26** and the conductive sleeve **22**.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before described as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

It is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise the preferred form of several modes of putting the invention into effect.

What is claimed is:

1. A lamp fixture adaptor for providing variable illumination for a light bulb, comprising: a body structure having a hollow base portion and a socket portion, said base portion having a first and second terminal for making contact with corresponding terminals in an on-off socket of the lamp fixture, said second terminal on said base portion being in the form of a conductive screw sleeve substantially covering the base portion, and said socket portion having a first and second terminal for making contact with corresponding terminals of the light bulb, means for electrically connecting the first terminals of the socket and base portions of the body structure, a dimming circuit enclosed within said body structure including a load semiconductor device and a potentiometer, said circuit connected across the second terminals of the socket and base portions of the body structure with said semiconductor device enclosed within said hollow base portion and extending through an opening in the side wall thereof to contact said screw sleeve second terminal for providing an electrical and thermal conductivity path between said semiconductor device and said screw sleeve whereby heat produced in said load semiconductor device is dissipated in said screw sleeve making contact with a corresponding terminal in the on-off socket of the lamp fixture, and external means on said body structure for manually adjusting the setting of said potentiometer to control the application of power to the light bulb and thereby control the intensity of illumination of the bulb.

2. An adaptor for lamp fixtures comprising: a body structure formed of insulating material, said body structure having a hollow base portion for engagement in mating relation with a conventional on-off type light socket and having an inner terminal and a screw sleeve outer terminal arranged to make contact with corresponding terminals of the light socket, said body structure having a socket portion provided with internal threads for engagement in mating relattion with a base of an incandescent light bulb and having an inner terminal and a strip outer terminal arranged to make contact with corresponding terminals of the light bulb, said socket portion provided with a cavity on the side wall thereof, means for electrically connecting the inner terminals of the socket and base portions of the body structure, a dimming circuit within said body structure including a potentiometer and a load semiconductor device, said circuit connected across the strip outer terminal of the socket portion and the screw sleeve outer terminal of the base portion with said potentiometer disposed in the cavity provided in the side wall of said socket portion and connected to said strip outer terminal and with said load semiconductor device extending through an opening in the side wall of the base portion to contact said screw sleeve outer terminal for providing an electrical and high thermal conductivity path between said load semiconductor device and said screw sleeve outer terminal, and external means on the socket portion of said body structure for manually adjusting the setting of said potentiometer to control the application of power to the light bulb and thereby control the intensity of illumination of the bulb.

3. The combination as claimed in claim **2** wherein said body structure is formed in two separate halves mated along the vertical central plane of the body structure, wherein the interior of the body structure is formed with the hollow base portion having a passageway connecting to the cavity provided in the side wall of said socket portion for enclosing said dimming circuit, wherein the elements of said dimming circuit form a separate assembly comprising a first circuit card on which said load semiconductor device is mounted, a second circuit card on which said potentiometer and said strip outer terminal is mounted, and electrical interconnecting means for rigidly holding said cards in position relative to each other, and wherein said separate assembly is insertable between the respective halves of the body structure such that the first card is positioned in the hollow base portion with the semiconductor device thereon contacting the screw sleeve outer terminal through the opening provided in the side wall of said hollow base portion, and such that the second card is positioned in the cavity provided in the socket portion with the strip outer terminal thereon positioned in a slot formed in the internal threads thereof and with the potentiometer thereon accessible from the outside of the body structure.

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U.S. Cl. X.R.

315—200;323—19, 22, 36;339—154