PHOTOELECTRIC LAMP CONTROL

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5 Claims

ABSTRACT OF THE DISCLOSURE

The present invention utilizes a lamp adapter of the screw-in type as one element, and a control photosresistor located in a housing connected to the lamp socket only by wire leads; as another element the lamp socket including, internally thereof, a bi-metallic switch and a heater resistor for the bi-metal of the switch cemented thereto by flexible, heat transmissive cement. The switch and heater are enclosed in a heat insulating enclosure, so that the bi-metal will be unaffected by heat from the lamp and will be responsive only to heat developed by the heater.

The present invention relates generally to photo-electric control systems, and more particularly to a system for selectively connecting and disconnecting a lamp to a power source as a function of ambient light intensity. The present invention, in one specific embodiment thereof, utilizes a lamp adapter of the screw-in type as one element, and a control photosresistor located in a housing connected to the lamp socket only by wire leads; as another element the lamp socket including, internally thereof, a bi-metallic switch and a heater for the bi-metal of the switch. The switch and heater are enclosed in a heat insulating enclosure, so that the bi-metal will be unaffected by heat from the lamp and will be responsive only to heat developed by the heater.

As a feature of the invention the heater is a resistor of the rigid cylindrical ceramic type, which is cemented over its entire length to the bi-metal by heat conductive flexible epoxy resin. The layer of epoxy resin is sufficiently resilient and sufficiently thick that (1) an appreciable area of the heater is embedded in the cement, (2) the rigidity of the heater does not significantly impede flexing of the bi-metal by virtue of the interposition of the flexible cement; and (3) adequate heat transfer to operate the bi-metal can occur from a 1/4 or 1/2 watt heater resistor.

The photosresistor control is enclosed in an opaque cup-shaped housing, which is quite small and unobtrusive, the photosresistor itself facing externally of the open end of the cup, and the rim of the cup (about 1/8") being coated with cement, so that the photocell housing may be secured to a transparent wall, e.g. glass. By suitable selection of locations of lamp socket and photosresistor no direct light path may exist between the lamp and the photosresistor, yet these may be located in close proximity.

A system in accordance with the invention may be installed by screwing a lamp adapter, having internally thereof a heater and bi-metallic switch, into a socket of a lighting fixture, and a lamp into the adapter. The photosresistor enclosure, above referred to, may then be cemented to a surface of a window of the lighting fixture. The system is, accordingly, capable of installation by the housewife, or other unskilled person, with minimum instruction and virtually no possibility of error.

The photosresistor controls the bi-metallic switch by means of any conventional circuitry, for example, by connecting the photosresistor in series with the heating resistor across a voltage source. When unilluminated the photosresistor is essentially an open circuit, and the heater receives no power. The bi-metallic switch is normally closed and maintains the lamp lighted. When the photosresistor is illuminated its resistance drops to a low value, causing appreciable current flow in the resistor, heating the bi-metal and causing its switch contacts to open, thereby de-energizing the lamp.

An important feature of this invention resides in the utilization of the flexible thermally conductive epoxy resin for securing a heating resistor to a bi-metal, the epoxy being sufficiently flexible that it does not inhibit the snap action of the bi-metal nor thermally insulate the bi-metal from the heating resistor.

It is another object of this invention to provide a photoelectric control system in part housed within an electrical lamp adapter, a photo-sensitive element of the system being remotely located with respect to the adapter.

It is another object of this invention to provide a photoelectric control device for an electric lamp wherein the control device is partially housed in a socket adapter for the lamp and wherein the photosensitive element of the device is provided with adhesive surfaces adapted to adhere to a wall of a lamp fixture.

It is another object of this invention to provide a photoelectric control device for an electric lamp wherein a portion of the device is housed in an electrical lamp adapter, that portion containing elements which are not detrimentally affected by heat generated within the adapter, and having a photosensitive element located remotely from the adapter, the element being adapted to adhere to the wall of a lamp fixture in such orientation that exposure of the photosensitive element to light from the lamp is avoided.

It is a further object of this invention to provide a photoelectric control device for controlling an electrical appliance, wherein the appliance is turned on and off by a thermal switch which responds to heat generated by a resistor secured to the thermal switch by a flexible, thermally conductive epoxy resin.

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is an exploded view in perspective illustrating component parts of the photoelectric control device of the invention;

FIGURE 2 illustrates a thermal switch according to the invention;

FIGURE 3 is a view in partial section of the complete system of the invention;

FIGURE 4 is a view in perspective of a lamp fixture in which the photoelectric control device of this invention is installed; and

FIGURE 5 is a schematic circuit diagram of the photoelectric control of this invention.

Referring now to the accompanying drawings, and particularly to FIGURE 5, power leads 11 proceed to a heater resistor 12, in series with a photosresistor 13. It follows that if the photosresistor 13 is illuminated, and its resistance therefore small, a major part of the voltage available at leads 10 and 11 is available across resistance 12, but that if photoresistor 13 is not illuminated, substantially no current will flow in resistance 12.

Resistance 12 provides its heat to bi-metal 26 coupled to a movable contact 15, normally bridging contacts 15a, 15b. On supplying heat to bi-metal 26 from heating resistance 12, bi-metal 26 flexes and separates the contacts. The switch consisting of contacts 15, 15a, 15b.
is connected in series with a lamp load 16, across power leads 10, 11. The broad objective of the invention is to de-energize lamp load 16 when photo-resistor 13 is illuminated, but not otherwise.

The heater 12 and the bi-metal 26 and associated contacts 15, 15a, 15b, of FIGURE 1, are illustrated in respect to their physical form in FIGURE 2. These elements are enclosed in a casing 20 made of a heat and electrically insulating material, generally cylindrical and including upper cover disc 21 and under cover disc 22. A bolt 23 extends outwardly from cover disc 22, its head being internal of the casing and securing an L-shaped bracket 24 to the inner surface of cover disc 22. On the bracket 24 is mounted a bi-metallic switch casing 25, which takes the form of a cylindrical enclosure having disc shaped bi-metal 26 as a cover. Secured to the under side of switch casing 25 is a lug 27. The latter is secured to a stationary electrode 15b within the switch casing 25 and the bi-metal 26 is electrically isolated from the bracket 24 and the contact electrodes. The switch is normally closed and opens when the bi-metal 26 is heated, by means of an insulated linkage between the bi-metal and the contact of the switch.

To heat the bi-metal 26 a small ½ or ½ watt resistor 30 is cemented to the bi-metal 26 by heat conducting, resilient epoxy resin cement 31, of which several are commercially available.

Sufficient cement is employed to couple a considerable area of the resistor 30 to the disc via the cement, to provide effective and adequate heat transfer to operate the bi-metal, and also to provide a resilient cushion between the resistor 30 and the bi-metal 26 so that the latter can flex readily, despite the presence of a rigid resistor 30 cemented thereto. The resistor 30 is a commercial ceramic and therefore is quite rigid, and if forcibly flexed might well crack. Use of the cement, in adequate amount and thickness, prevents cracking of the resistor 30, yet permits the bi-metal 26 to flex and to acquire adequate heat in a short time from the resistor 30, to effect the flexing.

The casing 20 is enclosed within an adapter, so-called, identified generally by reference numeral 50. Adapter 50 is essentially an insulating cylinder, usually made of Bakelite, within which is secured a thin walled metal cylinder 52 having its walls deformed to provide both internal and external threads. The threaded cylinder 52 extends partly into the insulating cylinder 51 and partly externally thereof. A screw-in lamp bulb can be threadedly inserted into the internal portion of the cylinder 52, and the protruding portion 54 can be threadedly inserted into a lamp socket 55. The enclosure 20 is placed internally of protruding portion 54 and is held therein by placing a washer 56 over the end of protruding portion 54, with bolt 23 protruding beyond the washer 56, and tightening a nut 57 over the end of bolt 23. The end of bolt 57 presses on a spring contact 58, in the base of the socket 55, which is in turn connected to power lead 10.

A photo-unit 60 is illustrated in detail in FIGURE 1. Essentially it consists of a metallic cup 61 having an open end. Located in the open end is photo-resistor 13, facing externally and coated on a supporting disc 62. Leads 63 extend from an opening in the back of cup 61. To the rear of cup 61 is secured an annulus 65 of soft rubber and on the outer surface of the latter is coated a pressure sensitive adhesive, so that the cup 61 can be caused to adhere to any glass surface, whether flat or rounded, such as the transparent surface 66 of a lighting fixture 67, FIGURE 4. To this end, annulus 65 may be inserted into both depressions 14a, 14b, of the base of cup 61.

Since the cement 31 does load the bi-metal 26, i.e., is not perfectly resilient, and is not perfectly heat conducting, the presence of the cement damps or delays the operation of the bi-metal. This is an advantage, in that short light flashes, such as might occur due to passing automobiles, during the night, cannot cause false operation, but the photo-resistor 13 must be illuminated for a predetermined period before change of state of the bi-metal can occur.

Tracing the circuitry of the system by reference to FIGURES 2 and 3, electrical current enters from lead 10 via contact 58, bolt 23, bracket 24, lead 24b, resistance 30, one of leads 63 to photo-resistor 13, back via the other of the leads 63 to common at the tube 54, which is connected to lead 11. Another circuit exists in the path from lead 10, contact 58, bolt 23, bracket 24, electrodes 15a, 15, 15b, lug 27, lead 27a, lug 27b, light bulb LB, and back through the light bulb LB to common at the tube 54, which is connected to lead 11.

While I have described and illustrated one specific embodiment of my invention, it will be clear that variations of the details of construction which are specifically illustrated and described may be resorted to without departing from the strict spirit and scope of the invention.

1. A control device, operative from a voltage source and arranged to supply current to a load, comprising:
   a. a normally-closed thermal switch of the type having two contacts and an actuating bi-metal,
   b. means connecting said contacts in series between said source and load,
   c. control means, including a cylindrical heating resistor extending in one straight line,
   d. means cementing said heating resistor to one side only of said bi-metal and comprising a flexible heat conductive cement coating located between said resistor and said bi-metal and having sufficient flexibility that deformation of said bi-metal is not inhibited by said heating resistor, said cement having sufficient heat conductivity to transmit a major part of the heat generated by said heating resistor to said bi-metal.

2. The control device of claim 1 wherein is further provided:
   a. a photo-resistor providing a variable electrical resistance between its terminals as an inverse function of ambient light, and
   b. means for connecting said heating resistor in series with said photo-resistor and with said voltage source.

3. The device of claim 2 wherein said heating resistor and said bi-metal are located in a first housing and said photoresistance is located in a second housing, said second housing being remote from said first housing and being connected thereto only by two wire leads.

4. A thermal switch, comprising:
   a. a cup-shaped container,
   b. a cover plate for said cup-shaped container,
   c. electrodes located internally of said cover plate,
   d. means for connecting said heating resistor to one side only of said cover plate externally of said cup,
   e. said last means being a flexible heat transmissive cement,
   f. the flexibility of said cement being sufficient that flexure of said cover plate is appreciably uninhibited by the presence of said heating resistor and said cement, and
   g. a photo-resistor connected in series with said heating resistor and located externally of said cup-shaped container.

5. A thermal switch, including:
   a. an annular bi-metal capable of flexing in response to application of heat, and
   b. a ceramic heating resistor in the form of a solid cylinder, said means securing said heating resistor to one side only of said bi-metal, and
   c. said last named means being a coating of flexible heat
transmissive epoxy resin located only between said resistor and said bi-metal and having sufficiently great flexibility that flexure of said bi-metal is not appreciably inhibited by the presence of said heating resistor and said epoxy resin, the heat transmissibility of said epoxy resin being sufficiently great that a substantial part of the heat generated by said heating resistor is transmitted to said bi-metal via said epoxy resin, and

a photo-resistor connected in series with said heating resistor and connected by elongated insulated flexible leads to said heating resistor.