Oct. 7, 1947. H. F. WATERS 2,428,441

LAMP FAILURE SWITCH

Filed May 12, 1945

FIG.1.

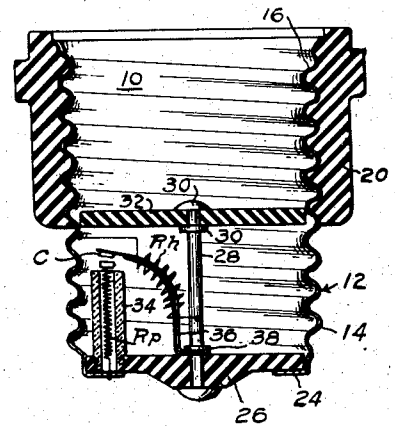


FIG.2.

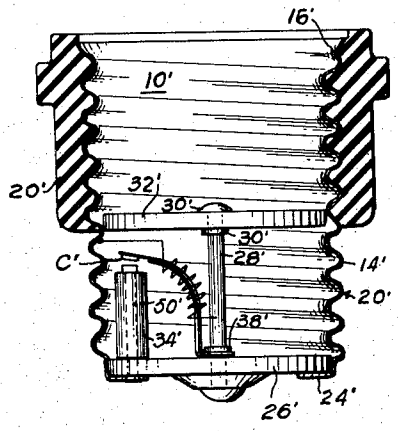
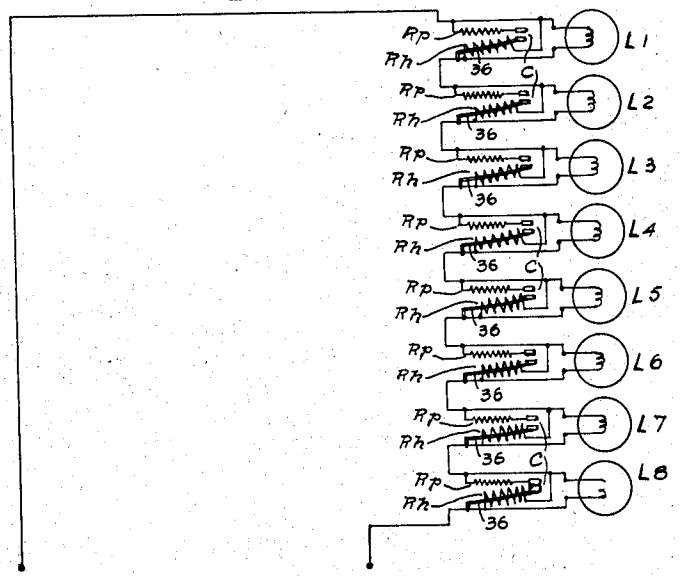


FIG.3.



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LAMP FAILURE SWITCH

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1 Claim. (Cl. 200—118)

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The improved lamp failure system and indicator adapter comprising the present invention is primarily adapted for use in connection with Christmas tree lighting circuits wherein the incandescent electric lamps associated therewith are operated in series from the usual 110–120 volt household lighting system. The invention however is capable of other uses and the same may, if desired, with or without modification, be employed in connection with all manner of illuminating equipment wherever the circuit involved employs two or more indicating devices arranged in series. Irrespective however of the particular use to which the invention may be put, the essential features thereof are at all times preserved.

The invention has accordingly been illustrated in connection with a conventional illuminating circuit of the type employed for Christmas tree lighting effects. The most commonly employed circuit of this type operates from the usual 110–120 volt household lighting system and consists of eight so-called miniature incandescent lamps arranged in series. Since the combined voltage of these eight miniature type lamps equals the line voltage, each lamp is adapted to operate at a maximum of fifteen volts when the source of current is at its maximum of 120 volts. The lamps are designed for a normal current flow of 5 amperes and consequently, according to Ohm's law, the resistance of each lamp is approximately 3 ohms with a total of 24 ohms existing in the entire series circuit. The present invention has been illustrated and described on the basis of the above mentioned considerations of line voltage, filament resistance and current flow which is more or less standard for most of these Christmas tree lighting circuits. It will be distinctly understood however that where the lamps are of different electrical characteristics and where a greater or lesser number of them are employed in series, suitable modification of the electrical elements which cooperate to make up the present invention will be resorted to.

In lighting systems of the type set forth above, considerable inconvenience occurs when one lamp in the series burns out in that the continuity of the circuit through the remaining lamps is broken and it becomes necessary to resort to a trial and error method to determine which lamp has become defective. Various methods and devices have been proposed to avoid the above noted limitations, principal among which are (1) the use of cut-out or short circuiting devices which are so arranged as to carry the load of the burned

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out filament to permit the remaining lamps to function, and (2) the use of glow discharge devices which may consist of additional filaments arranged in parallel with the filaments of the incandescent lamps or of electronic devices which go into operation when the lamp burns out. The first of these methods has proven unsatisfactory in that it involves a temporary expedient wherein a higher voltage drop occurs across the remaining lamps in the series, thus hastening their ultimate destruction. Furthermore the effect of successive lamp failures is cumulative in that when a second lamp burns out a still higher voltage is placed across the remaining lamps. Usually, unless the defect is noticed and remedied within a reasonable length of time after the initial burnout, the lamps will all become defective with the last few lamps in the series receiving quarter, third, half and full line voltage in rapid succession resulting in their almost immediate destruction when their turn arrives.

Where glow discharge devices are employed, the cost of these devices is prohibitive to extensive use thereof and usually this procedure involves the use of specially constructed lamps that cannot be manufactured except by special operations involving the use of skilled labor.

The present invention is designed to overcome the above noted limitations that are attendant upon present day lamp failure indicators and toward this end contemplates the use of ordinary miniature incandescent lamp bulbs of the usual Christmas tree variety which may be inserted in special adapters and the adapters in turn inserted in the conventional sockets of a series arrangement. Alternatively, the series wired sockets themselves may be modified according to the present invention to attain the desired result and, under some conditions, it is contemplated that the lamp bulb bases may be modified according to the exigencies of the present invention.

According to the present invention, whether the use of adapters, special sockets or special incandescent units be resorted to, it is contemplated that the filament of each incandescent unit be bridged by a heat-giving resistance unit of relatively high ohmic value. This element is so proportioned that it does not assume heat-giving qualities until it is subjected to the increased potential incident to the rupture of a filament. A thermostatically controlled and normally open pair of contacts also bridges the filament and is designed upon closing thereof to bypass current across the filament terminals and

also across the terminals of the high resistance element. The contacts are under the control of the heat generated by the high resistance element and as a consequence, when a filament burns out, the heat generated by the high resistance element causes closing of the former whereupon the filament is bypassed and the remaining incandescent elements in the circuit are illuminated briefly. However, as soon as the contacts become closed the rush of current to the remaining lamps in the series deprives the high resistance element of its capacity load thus causing the latter to lose its heat giving qualities whereupon the contacts become open and the lamps to which current has been bypassed become extinguished. As soon as this occurs the high resistance element again conducts current and assumes its heat giving qualities and the entire process is repeated indefinitely with the net result that all of the lamps in the series other than the defective lamp will continue to flash intermittently until such time as the defective lamp is replaced.

In one contemplated form of the invention each pair of shorting contacts has associated therewith a series-arranged resistance unit which preferably is of an ohmic value identical with the ohmic value of the lamp filament. This latter resistance unit is employed to prevent over heating of the remaining lamps in the series as well as to safeguard against direct shorting of the current source when the system is plugged into the source with no lamps existent in the adapters or sockets as the case may be.

The provision of an indicating system of the character outlined above being the principal object of the present invention, it is a further object of the invention to provide an adapter or socket unit for miniature and other lamp bulbs which is assembled and held together as a unitary structure in a novel manner which is conducive toward extreme rigidity and strength.

Another object is to provide such an adapter or socket which may be manufactured at a low cost, yet which at the same time is rugged and durable and unlikely to get out of order.

Numerous other objects and advantages of the invention, not at this time enumerated, will become more readily apparent as the following description ensues.

In the accompanying single sheet of drawings two embodiments of the invention have been illustrated.

In these drawings:

Fig. 1 is a sectional view taken substantially longitudinally and centrally through one form of adapter constructed in accordance with the present invention.

Fig. 2 is a sectional view similar to Fig. 1 showing a modified form of adapter, and

Fig. 3 is a diagrammatic view of an illuminating assembly embodying the principles of the present invention.

In all of the above described views, like characters of reference are employed to designate like parts throughout.

Referring now to Fig. 1, an adapter or socket member is designated in its entirety at **10** and includes a metal shell **12** of generally cylindrical design and which is corrugated throughout its entire length to provide external threads **14** in its lower regions and internal threads **16** in its upper regions. The internal threads **16** are designed to receive therein the external threads provided on the base of a conventional miniature

incandescent lamp such as is shown diagrammatically in Fig. 3. The external threads **14** are adapted to be received in the socket of a conventional miniature lamp socket or holder of the type associated with Christmas tree lighting systems wherein there are usually eight incandescent lamps arranged in a series circuit and designed for energization from a conventional 110–120 volt household lighting system.

If desired, the upper regions of the cylindrical shell **12** may be slightly larger in overall diameter than the overall diameter of the lower regions thereof, but in general, ordinary manufacturing tolerances will permit insertion of a lamp in the socket portion of the shell and the insertion of the lower portion of the shell in a lamp socket or holder even when the overall diameter of the shell is uniform.

A sleeve **20** of insulating material is threadedly received on the upper portion of the shell **12** and fits tightly thereagainst in such a manner as to prevent ready dislodgment.

The lower end or rim of the shell **10** is turned inwardly as at **24** and forms a seat for a bottom disc **26** which may be formed of any suitable insulating material. A binding post **28** which may be in the form of an elongated rivet extends through the disc **26** and is provided with clamping flanges **30** at its upper end between which there is held in fixed position an upper disc **32** which also is formed of insulating material. The binding post or rivet **28** serves in the usual manner to conduct electric current from the socket into which the adapter is screwed to the central filament terminal of the illuminating lamp when the latter is received within the adapter. The shell **12** itself serves to conduct current to the base shell of the illuminating lamp and consequently to the outer filament terminal of this unit.

The lower disc **24** has extending upwardly from the peripheral regions thereof a tubular insulating sleeve **34** through which there extends a resistance unit R_p which is preferably of low ohmic value and which is substantially of the same ohmic value as that of the filament of the lamp with which the adapter is associated. The upper end of the resistance unit R_p carries one element of a pair of contacts C and the other element thereof is carried at the upper end of a bi-metallic thermostatic element or strip **36**. The lower end of the thermostatic unit or strip **36** is anchored to the binding post **28** by means of a clamping flange **38** formed on the latter. A resistance unit of the wire wound type is designated at R_h and is of an ohmic value which is relatively high with respect to the ohmic value of the individual lamp filaments. This latter resistance unit R_h is placed close to and preferably surrounds the thermostatic strip **36** and has one end electrically connected to the binding post **28** and the other end thereof electrically connected to the shell **12**.

From the above description it will be seen that, by virtue of the specific electrical connection for the resistance unit R_h, this unit serves to effectively short the terminals of the filament of the lamp disposed within the adapter. In other words, this resistance unit R_h is disposed in parallel relationship across the filament terminals. The specific resistance of the member R_h may vary within fairly wide limits but it is essential that the member be proportioned electrically so that it will not assume heat giving qualities during normal current flow through the filament. If however the filament should be-

come ruptured the resistance element R_h must be proportioned to assume heat giving qualities incident to the increased potential occasioned by its constituting the sole path for current across the burned out filament terminals. In such an instance the amount of heat generated by the resistance element R_h and the character of the bi-metallic thermostatic unit **36** must be such that this latter unit will be deflected in such a manner that the contacts C will become closed.

The ohmic resistance of the element R_h will of course be dependent upon the character of the bi-metallic strip **36** as well as upon the resistance of the individual filaments of the lamps employed. Inasmuch as in conventional Christmas tree lighting systems of the type illustrated the lamp filaments are of an ohmic value in the neighborhood of 3 ohms, it has been found that a responsive thermostatic element may be constructed when the ohmic value of the resistance element R_h ranges upwards from 50 ohms. Generally speaking, the higher the ohmic value of the resistance unit R_h, the less will be the bleeder current flow across the filament terminals of the lamps. Also, the higher the ohmic value of this resistance, the more delicate will the construction of the thermostatic element **36** have to be. In carrying out the principles of the present invention, ordinary electrical engineering exigencies are followed and the invention is not to be limited to any specific electrical value or ranges of value for the ohmic resistance of any of the various resistances employed.

Referring now to Fig. 3, a conventional series arrangement of illuminating lamps is shown. The lamps are eight in number and are designated at L_1 to L_8 inclusive. The filaments *f* of lamps L_1 to L_7 are shown intact but the eighth lamp L_8 is shown as having a ruptered filament. According to the invention the increased potential across the heater or bleeder resistance R_h causes the generation of sufficient heat to affect the thermostatic element **36** and thus the contacts C associated with the lamp L_8 are shown as being closed. The lamps L_1 to L_7 are thus illuminated. The circuit as shown however is such that the resistance element R_h is directly shorted and the loss of current flow through the latter will cause cooling thereof after which the contacts C will become opened and the lamps L_1 to L_7 extinguished. This process is repetitive and the lamps L_1 to L_7 will thus exhibit flashing characteristics until such time as the defective lamp L_8 is replaced.

The resistances R_p may be termed protective resistances since their function is to make up for the loss of total resistance (which in this case is 3 ohms) when one of the lamps becomes defective. Otherwise a somewhat higher voltage drop will occur across the remaining lamps in the series when the latter are illuminated during the flashing operation. The presence of the resistance R_p in any one single adapter **10** is not of material importance but these resistances become significant when two or more lamp filaments are defective. With the arrangement just described, any number of the lamps L_1 to L_8 inclusive may become defective and the remaining lamps will continue to flash intermittently and at the proper voltage rating.

In Fig. 2 the resistance element R_p has been omitted and in its stead there has been substituted a metallic pin or rivet **50** at the upper end of which there is carried one element of the

pair of contacts C. Otherwise the adapter **10'** remains substantially the same as in the form of the invention shown in Fig. 1 and for convenience of illustration similar characters of reference have been employed to designate the corresponding parts in the two figures of the drawing.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawing or described in this specification as various changes may be resorted to without departing from the spirit of the invention. For example, while in both Figs. 1 and 2 the invention has been illustrated in connection with an adapter adapted to receive in one end thereof the base of a lamp bulb and to be in turn received at its other end in a conventional lamp-receiving socket, it will be understood that the principles of the invention may be applied to a lamp socket directly or to a lamp base if desired. Only insofar as the invention has particularly been pointed out in this regard in the accompanying claim is the same to be limited.

Having thus described the invention, what I claim and desire to secure by Letters Patent is:

An adapter for threaded lamp bases comprising in combination an outer ring-like body portion formed of insulating material, a tubular threaded metal base-receiving member disposed in said body portion, concentric therewith, and projecting beyond the confines of the latter, said tubular member constituting the outer or socket contact element for a lamp base, a centrally disposed contact element in the form of a stud positioned within said tubular member and having a major portion thereof disposed in the projecting portion of said tubular member, upper and lower insulating supporting discs connecting said central and outer contact elements and forming with the latter a closed chamber, a pair of thermostatically controlled contacts disposed within said chamber, a heat giving resistance of relatively high ohmic value connecting said central and outer contact elements, thermostatic means under the control of said resistance for actuating said contacts, said contacts being normally open and adapted to become closed under the influence of heat generated by said resistance element, a tubular sleeve of insulating material disposed in said chamber and supported on said lower disc, a protective resistance disposed in said latter sleeve, and means electrically connecting said contacts and protective resistance in a series circuit across said central and outer contact elements, said central contact element projecting completely through said discs and being accessible interiorly of the tubular member and exteriorly thereof for contact purposes.

HARRY F. WATERS.

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