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W. E. ANDERSON
LAMP FAILURE INDICATOR

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Fig. 1.

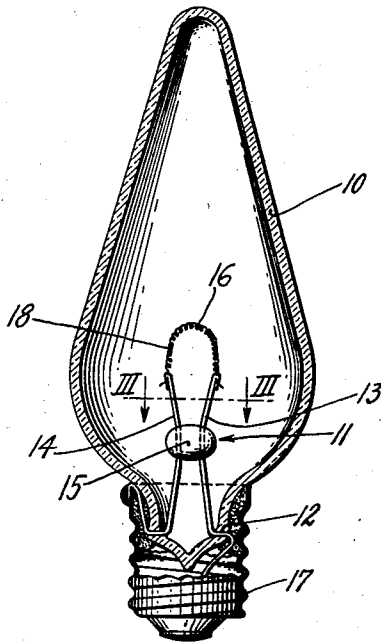


Fig. 2.

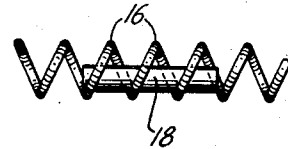


Fig. 5.



Fig. 3.

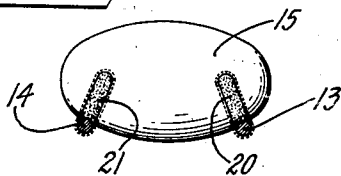
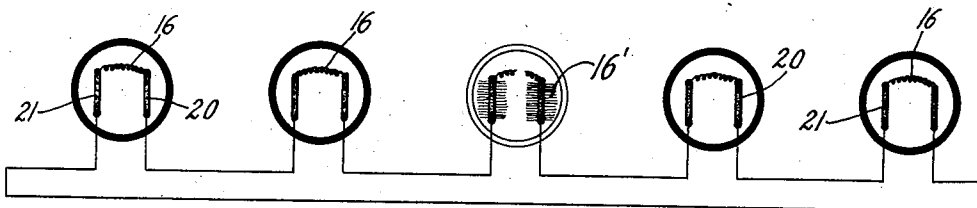


Fig. 4.



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LAMP FAILURE INDICATOR

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13 Claims. (Cl. 176—24)

This invention relates to incandescent electric lamps which are operated in series and relates more particularly to a lamp having means incorporated therewith for indicating a breakage or failure of the filament within the lamp.

Certain types of incandescent electric lamps, such for example, as those employed for Christmas tree lighting and which may be termed miniature lamps, are operated when a given number are connected in series so that the combined voltage of the lamps equals the line voltage supplying the electrical energy.

It has been found that when using a plurality of lamps connected in series considerable inconvenience occurs upon a failure of one of the lamps, as for instance, when a filament breaks or burns out, such failure interrupts the continuity of the circuit and the rest of the lamps are extinguished.

When a string or plurality of series connected lamps become extinguished, owing to a failure of one of the lamps, it is difficult to determine by inspection which lamp is defective and it becomes necessary in order to discover the lamp which has failed, to test by trial until the defective lamp is found. This procedure involves considerable time and inconvenience and has heretofore caused considerable annoyance in connection with series burning lamps.

Various methods have been proposed for avoiding the above disadvantages and lamps have been provided with cut-out materials so arranged that the cut-out material will carry the load when the lamp has failed, permitting the remaining lamps to burn, thus indicating the defective lamp.

The present invention provides a lamp in which the use of cut out materials is avoided and in which visible indication is given upon the breakage of a filament in the lamp.

This is accomplished by so constructing the lamp that when the filament fails, a glow discharge will occur, which, by reason of its color, will clearly indicate the defective lamp.

It is an object of the present invention therefore to provide an incandescent electric lamp operable to give a visible indication of a failure in the filament of the lamp.

Another object of the invention is to provide an incandescent electric lamp having a filament and operable to produce a glow discharge upon a failure in the filament circuit.

Another object of the invention is to provide an incandescent electric lamp having electrodes capable of producing a glow discharge upon a break in the filament of the lamp.

Other objects and advantages of the invention

will be more clearly understood from the following specification together with the accompanying drawing in which,

Fig. 1 is a vertical sectional view of a lamp of the type to which the present invention may be applied;

Fig. 2 is an enlarged view of a section of the filament of the lamp shown in Fig. 1 and illustrates the deposit of a vaporizable material disposed in the core of the filament.

Fig. 3 is a view taken on line III—III enlarged and showing a deposit of vaporizable material on the lead wires which serve as the electrodes;

Fig. 4 is a diagrammatic view showing a number of lamps in series and indicating a glow discharge in one of the lamps in which the filament is broken;

Fig. 5 is an enlarged view of a section of a filament showing a portion thereof coated with a vaporizable material.

Although the present invention may be applied to various types of electrical devices where it is desirable to produce glow discharge by failure of a current carrying element, the selected embodiment of the invention may comprise a bulb having a mount secured therein by butt sealing at 12 in the usual manner. The mount 11 may comprise conductive support members or lead wires 13 and 14 held in given space relation by a glass bead 15. The upper ends of the lead wires are secured to the terminals of a coiled filament 16. The usual base 17 may be secured to the bulb.

The lamp shown is of the type commonly used for Christmas tree lighting and in this type of lamp it is desirable to have some means for indicating the failure of the filament.

For the purpose of converting the incandescent electric lamp, as shown, into a glow lamp upon a break or failure in the filament, it is desirable to provide electrodes of a metal such as, magnesium, aluminum or the like to reduce the voltage drop whereby the glow discharge will occur on the ordinary commercial voltages and to provide the bulb with a gaseous filling consisting of either neon or argon or a mixture of both at from 10 to 40 mm. pressure.

It has been found desirable to introduce vaporizable material by inserting a minute slug 18 into the coil of the filament as shown in Fig. 2, or by mixing the vaporizable material with a suitable binder and spraying a layer 19 on the filament as shown in Fig. 5.

If desirable, however, the filament may be dipped in dry powdered material and a sufficient

amount will adhere to the filament. When the filament is lighted the material thereon will become activated or vaporized and serve to clean up the residual impurities and become deposited in a thin layer on the leads 13 and 14 to act as electrodes 20 and 21. The amount of material introduced into the bulb may be insufficient to cause a noticeable deposit upon the bulb. If desirable each conductive support may have a bead or deposit of material such as magnesium, in solid form thereon to constitute a pair of electrodes of low break down voltage.

When a lamp constructed as above described is lighted and the leads receive the deposits or are otherwise prepared to constitute the electrodes 20 and 21, the lamp may be burned in the usual manner with the electrodes ineffective to produce a glow at the normal voltage of the lamp until the filament breaks, or fails in such manner as to open the filament circuit. At the instant the filament fails the full line voltage becomes impressed across the ends of the break in the filament and therefore between the provided electrodes resulting in the glow discharge in a manner similar to that in well known discharge devices.

It will be evident that full line voltage is momentarily applied to the ends of the filament where a break occurs until the glow discharge current begins to flow. Since this is so small in comparison with the full load filament current, line voltage is virtually maintained after glow forms. Likewise since having established the glow discharge, voltage may drop somewhat without extinguishing the glow.

The glow discharge causes the passage of a flow of current, which flow of current is however insufficient to heat the filaments of the remaining lamps in the series to incandescence. Thus, when current fails to flow in the filament of a lamp and the glow occurs, the remaining lamps will be dark; the lamp which glows may, therefore, be easily detected and removed for the substitution of a good lamp. The remaining lamps of the series serve as a ballast resistance for the regulation of the glow discharge in the lamp in which the failure has occurred.

A number of lamps may, as shown in Fig. 4, be connected in series and if a break occurs in a filament 16 the circuit will be broken and by reason of the glow discharge 16' which occurs the lamp having the broken filament will be indicated.

Obviously if the lamps are connected to an A. C. source both electrodes will glow alternately and if on D. C. one of the electrodes will have a substantially continuous glow.

A string of lamps provided with auxiliary electrodes for conversion into a discharge device may be employed in the same manner as the ordinary series burning lamp since the operation of the glow discharge occurs only upon a break in the internal circuit within the bulb.

The present invention has been found specially advantageous when employed in connection with strings of Christmas tree lamps in which it is usually desirable to provide a string of eight lamps and wherein it has heretofore been difficult to determine the failure of a particular lamp which causes the other lamps of the series to be extinguished.

With the present invention a break in the filament of a lamp causes the remaining lamps to become extinguished but the glow discharge within the defective lamp gives a quick and convenient indication of which lamp to remove for the re-

placement of a new lamp to complete the series.

Although a preferred embodiment of the invention is shown and described herein it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A series incandescent electric lamp comprising a sealed envelope, a filament operable at a voltage equal to a multiple of line voltage, an electrode connected to each filament terminal, means for reducing the electrode drop between said electrodes, an ionizable gas medium in said envelope, the electrode drop between said electrodes and the pressure of said gas being such that a glow discharge of low current density occurs when current fails to flow through said filament and line voltage is impressed across said electrodes.

2. A series incandescent electric lamp comprising a sealed envelope, a filament operable at a voltage equal to a multiple of line voltage, an electrode connected to each filament terminal, a material on said electrodes for lowering the electrode drop therebetween, an ionizable gas medium in said envelope, the electrode drop between said electrodes and the pressure of said gas being such that a glow discharge of low current density occurs when current fails to flow through said filament and line voltage is impressed across said electrodes and means for stabilizing said discharge.

3. An incandescent electric lamp comprising a bulb, an ionizable medium within said bulb, a filament, lead wires for said filament, a material disposed on said wires for lowering the electrode drop therebetween to produce a visible glow discharge when full line voltage is applied between said wires upon a failure of said filament.

4. A series incandescent electric lamp comprising a sealed envelope, a filament operable at a voltage equal to a multiple of line voltage, an electrode connected to each filament terminal, means for reducing the electrode drop between said electrodes, an ionizable gas medium in said envelope, the electrode drop between said electrodes and the pressure of said gas being such that a glow discharge of low current density occurs when current fails to flow through said filament and line voltage is impressed across said electrodes.

5. A series incandescent electric lamp comprising a sealed envelope, a filament operable at a voltage equal to a multiple of line voltage, an electrode connected to each filament terminal, a material on said electrodes for lowering the electrode drop therebetween, an ionizable gas medium in said envelope, the electrode drop between said electrodes and the pressure of said gas being such that a glow discharge of low current density occurs when current fails to flow through said filament and line voltage is impressed across said electrodes and means for stabilizing said discharge.

6. An incandescent electric lamp comprising a sealed envelope, a filament operable to be heated to incandescence at a given voltage, conducting members for said filament, an electrode connected to each of said conductors, an ionizable gas medium, the electrode drop between said electrodes and the pressure of said medium being such that a glow discharge of low current density occurs when the voltage for operating the filament is impressed across the electrodes upon a failure of current flow in the filament.

7. A filament failure indicator lamp comprising a bulb, an ionizable gas medium in said bulb,

- a filament in said bulb, a pair of electrical conductive members in circuit with said filament, portions of said conductors having electron emissive surfaces to provide electrodes of low electrode drop to ionize said medium and produce a glow discharge when current flow between said electrodes upon a failure of current to flow through said filament.
8. An incandescent electric lamp comprising a bulb, an ionizable gas medium in said bulb, a filament in said bulb, a pair of electrical conductive members in circuit with said filament, portions of said conductors being electron emissive to provide electrodes of low electrode drop to ionize said medium and produce a glow discharge when current flows between said electrodes when a rupture of said filament prevents the flow of current therethrough.
9. An incandescent electric lamp operable on a given voltage comprising a bulb, a filament in said bulb, an ionizable gas medium, a conductor connected to each end of said filament an electrode connected to each conductor, a material on said electrodes for lowering their voltage drop to ionize said medium and produce a glow discharge of low current density when said voltage is impressed between said electrodes in the absence of current flow in said filament, and means for stabilizing said discharge.
10. An incandescent electric lamp comprising a bulb, a filament in said bulb to furnish illumination during normal operation of the lamp, conductors in circuit with said filament, an ionizable gas medium within said bulb providing an environment for said filament, a thermionically active electrode connected to each conductor for ionizing said medium to produce a discharge of low current density when current fails to flow through said filament and acts upon said means giving a glow indication of the failure of current flow in said filament.
11. An electric incandescent lamp comprising a sealed envelope, an incandescent filament for furnishing illumination during the normal operation of the lamp, conductors connected to the terminals of said filament, an ionizable medium in said envelope normally inoperable to furnish illumination during the operation of the filament as a light source, a pair of electrodes and means electrically connecting one electrode to each of said conductors, said electrodes and ionizable medium operating to furnish gaseous illumination upon the failure of current to flow through said filament.
12. A series incandescent electric lamp comprising a sealed envelope, an ionizable gas in said envelope, a filament, a pair of electrodes, one electrode being connected to each filament terminal, a common conductor for each filament terminal and its respective electrode, the electrode drop and the pressure of gas being such that when current fails to flow through said filament the voltage impressed across said electrodes will ionize said gas and give visible indication of the failure of current flow through said filament.
13. A plurality of incandescent electric lamps having sealed envelopes, said lamps having their filaments connected in series and operable at a voltage equal to a multiple of the line voltage, a pair of thermionically active electrodes in each envelope, an ionizable gas in each envelope operable to produce a glow discharge between said electrodes when line voltage is applied, upon the failure of current flow in the filament within the envelope containing the electrodes, the filaments of the remaining lamps serving as a ballast resistance for the glow discharge.

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