Feb. 10, 1942. G. E. INMAN 2,272,523

ELECTRIC LAMP

Filed Jan. 10, 1941

Fig. 1.

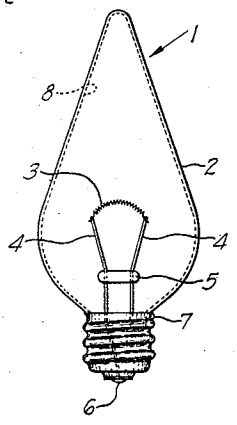
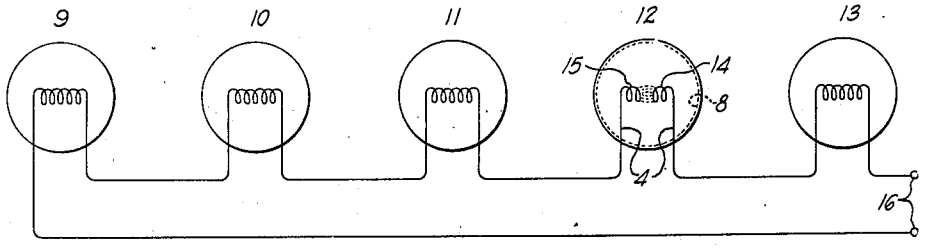


Fig. 2.



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ELECTRIC LAMP

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5 Claims. (Cl. 176—16)

My invention relates to incandescent electric lamps which are operated in series and relates more particularly to a lamp having means associated 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 by connecting a given number in series whereby the combined voltages of the lamps equal 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, since 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, because of such failure, it is difficult to determine which lamp is defective. In order to discover the lamp which has failed, it becomes necessary to test each lamp of the series 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, thus permitting the remaining lamps to burn, and thus indicating the defective lamp. Neon filled lamps which operate as glow lamps when the filament is severed have also been tried, but these have not been entirely satisfactory. Generally, they are unreliable and have a short life because the high ionization of neon gives rise to excessive, positive bombardment of the filament. While other gases may be substituted for the neon, they generally do not provide sufficient light to give a good indication of failure. Now I have found that by using a fluorescent material on the lamp envelope and by using in place of the neon a gas capable of emitting exciting radiation under the influence of an electric discharge between the residual portions of a severed filament, it is possible to obtain a lamp which gives a better indication of filament failure and which has a much longer life.

It is an object of the present invention, therefore, to provide an incandescent electric lamp operable to give an improved, 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 gaseous discharge capable of exciting a fluorescent material upon severance of the filament.

Still another object of the invention is to provide an incandescent electric lamp capable of producing a gaseous discharge upon a break in the filament of the lamp which will have a substantially longer life than lamps of the type hitherto known.

Other objects and advantages of the invention will appear from the following specification taken 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, and Fig. 2 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.

Referring to Fig. 1, the lamp 1 therein illustrated is of the type generally used for Christmas tree lighting and comprises the envelope 2 and the incandescent filament 3 mounted therein. The filament 3 may be supported by the leads 4 held together by the glass bead 5 and connected to any suitable base at points 6 and 7. The inner surface of the envelope 2 may be wholly or partially covered by a layer of fluorescent material 8 which is held in place by any suitable binder in the manner well known in the art of fluorescent lamps. The material may be any of those known in the art, although preferably it is one which will give a color distinct from that of the other lamps associated with the lamp in question. I have found that zinc silicate gives a very satisfactory indication. As is known, the fluorescent layer will not materially absorb the visible radiation normally emitted by the incandescent filament. The envelope is filled with an atmosphere of any gas capable of producing radiation which will excite the fluorescent material when subjected to a discharge. For example, I have found that a drop of mercury within an atmosphere of a starting gas such as argon at about 4 mm. pressure produces very desirable results. Argon, mercury, krypton, xenon, or any mixtures of them may be used. Neon itself may be used but it has the disadvantage already mentioned.

Fig. 2 shows a series of lamps 9 to 13 connected in series with a source of current supply 16 in the manner well known in the art. The lamp 12 of the series is drawn to indicate a failure in that particular lamp. The broken members 14 and 15 are fragmentary portions of the

filament 3. The latter has been broken because of mechanical strain or due to burning.

Upon the failure of any lamp of the series, as for example, lamp 12, the lamps of the series will be extinguished because of the break in the circuit. Immediately, the full line voltage will be applied to the gap between the members 14 and 15 and as a result an arc will be established in the gaseous atmosphere of the lamp 12, the remaining lamps acting as a ballast. The radiation from this discharge will excite the fluorescent coating 8 to give a visible indication of the failure of the lamp. It may be desirable to use an electron emissive coating on the lead wires 4 or on some part of the filament itself in order to facilitate the establishing of the arc when the full line voltage is applied.

While in general, sufficient current will flow in the arc to cause a visible incandescence in the remaining unbroken filaments of the series, nevertheless, the nature of the discharge light in the broken lamp will be generally distinctive so that no difficulty will be experienced in detecting which of the lamps is defective. To further facilitate the detection, however, a fluorescent material may be chosen which will give a distinct color. It will generally be desirable to use a powder or mixture of powders which gives a white fluorescence or else a powder which gives a color which will be transmitted by the normally colored outer bulb coating.

It will be understood that many modifications of the above described example of my invention will occur to those skilled in the art to which it appertains. For example, any number of fluorescent powders which respond to the exciting radiation may be used. These need not necessarily be placed upon the envelope but may be upon any convenient surface within the field of radiation from the discharge. Further, many variations in structural features and in gaseous pressures may be made. All these I aim to include within the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An incandescent lamp for operation in series with one or more series incandescent lamps comprising an envelope, an incandescent filament therein, a filling of ionizable gas capable of supporting a discharge between portions of said filament when severed and capable of emitting exciting radiation when excited by said discharge, and fluorescent means associated with said discharge and responsive to said radiation to give an indication of severance of said filament.

2. An incandescent lamp for operation in series with one or more series incandescent lamps comprising an envelope, an incandescent filament therein for furnishing illumination during normal operation of said lamp, a filling of ionizable gas normally inoperative to furnish illumination but capable of supporting a discharge between portions of said filament when severed and capable of emitting exciting radiation when excited by said discharge, and fluorescent means associated with said discharge and responsive to said radiation to give an indication of severance of said filament, said gaseous filling comprising a metallic vapor and a starting gas.

3. An incandescent lamp for operation in series with one or more series incandescent lamps comprising an envelope, an incandescent filament therein for furnishing illumination during normal operation of said lamp, a filling of ionizable gas normally inoperative to furnish illumination but capable of supporting a discharge between portions of said filament when severed and capable of emitting exciting radiation when excited by said discharge, and fluorescent means associated with said discharge and responsive to said radiation to give an indication of severance of said filament, said gaseous filling comprising mercury vapor and argon.

4. An incandescent lamp for operation in series with one or more series incandescent lamps comprising an envelope, an incandescent filament therein for furnishing illumination during the normal operation of said lamp, supporting leads for said filament, a filling of ionizable gas normally inoperative to furnish illumination but capable of supporting a discharge between portions of said filament when severed and capable of emiting exciting radiation when excited by said discharge, and fluorescent means on said envelope and responsive to said radiation to give an indication of severance of said filament, at least a portion of said leads or said filament being coated with an electron emissive material.

5. In combination, a plurality of incandescent lamps and a power source in series connection, at least one of said lamps comprising an envelope, an incandescent filament therein for furnishing illumination during the normal operation of said lamp, a filling of ionizable gas normally inoperative to furnish illumination but capable of supporting a discharge between portions of said filament when severed and capable of emitting exciting radiation when excited by said discharge, and fluorescent means responsive to said radiation whereby when said filament is severed said lamp furnishes an indication of the severance.

GEORGE E. INMAN.