May 12, 1936. D. S. GUSTIN 2,040,173

GLOW DISCHARGE DEVICE

Filed July 1, 1932

Fig. 1.

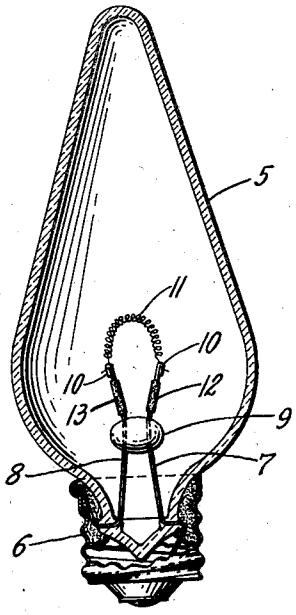


Fig. 2.

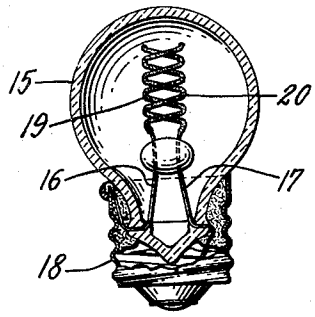
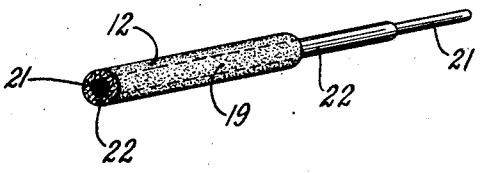


Fig. 3.



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GLOW DISCHARGE DEVICE

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Application July 1, 1932, Serial No. 620,366

1 Claim. (Cl. 176—126)

This invention relates to devices wherein an ionizable medium is employed to give visible light solely for the purpose of illumination, or as a means of indicating a condition in an electrical circuit.

Gaseous discharge lamps have been employed extensively such lamps having many uses, and it is an object of the present invention, to provide a gaseous discharge lamp which may be manufactured at relatively low cost and which will be dependable in operation.

Another object of the invention is to provide a glow discharge lamp with electrodes having a relatively low voltage drop capable of use on commercial line voltages.

Another object of the invention is to provide a material applicable to spaced conductive elements to lower their voltage drop and to serve as a clean-up agent for deleterious gases.

Other objects and advantages of the invention will be more clearly understood by reference to the following description together with the accompanying drawing in which:

Fig. 1 shows an ordinary incandescent lamp having a filament and with the leads treated with a material to provide electrodes of low voltage drop in accordance with the present invention, the bulb in the drawing being in vertical cross section;

Fig. 2 shows another form of lamp in which a pair of lead wires extend into the bulb and are coated with a material to provide a low voltage drop therebetween, the bulb of the lamp being in vertical cross section; and

Fig. 3 is an enlarged perspective view of a portion of a lead wire having a material deposited thereon to convert the lead wire into an electrode of low voltage drop.

The present invention is of advantage in various types of discharge lamps and is of particular importance when practiced in connection with what is termed a lamp failure indicator such as shown and described in copending application Serial No. 502,052 filed December 13, 1930 by W. E. Anderson and assigned to the present assignee.

Lamps such as shown in the said copending application are of the type used for Christmas tree lighting and are connected in series. These lamps are of the usual standard construction with a helical filament and, by reason of the series connection, if the filament in a lamp breaks the rest of the lamps in the series go out and it is difficult to detect the lamp which has failed.

In accordance with the invention in the said copending application, the lead wires of the lamps are treated with a material capable of lowering the voltage drop across the leads and an ionizable medium is provided within the bulb. When a filament breaks, therefore, the line voltage is impressed across the leads of the lamp which has failed and by reason of the material with which the leads are treated, they become discharge electrodes and the gaseous medium is ionized to give a glow which indicates the defective lamp. Although the material employed for the treating of the leads, as practiced in the said copending application, has been found satisfactory in commercial and practical use, it is desirable to provide an improved material which will serve to more effectively lower the starting potential and also perform the function of a clean-up agent.

In accordance with the present invention, I have found that a mixture of sodium silicate and magnesium powder as heretofore used, was difficult to apply since it became lumpy after standing a short while and gave high momentary currents due to local arcing when a filament failed. These high momentary currents very often burn out some of the remaining lamps on the string and when more than one lamp is burned out in one string, the burned out lamps will not function as glow lamps. I found that a mixture of magnesium powder and two or more alkalies may be used so that their partial vapor pressure would be additive gave good results.

In practice successful results have been obtained by the use of a composition consisting of one part magnesium, one half part caesium dichromate and one half part potassium dichromate with a suitable binder such as nitrocellulose. It has also been found that an additional alkali may be employed such as sodium chloride in which case the following proportions may be used:

	Grams
Potassium dichromate	66
Caesium dichromate	66
Sodium chloride	66
Magnesium metal	200

and a binder of nitrocellulose to give the mixture the consistency of a paste.

The powders i. e., the alkali salts and the magnesium metal are mixed together and shaken through a forty mesh screen the binder is added in an amount to make the paste suitable for use in applying the material to the lead wires of a device to provide the same with electrodes of low potential drop. Although it has been found desirable to use magnesium as a reducing agent, other agents may be used such as misch metal

which is a mixture of the cerium group of rare earth metals, comprising mainly cerium and, secondly, lanthanum.

When using the present composition as electrode material in a Christmas tree lamp, a lamp such as shown in Fig. 1 may be employed. This lamp may include a bulb 5 having a base 6. Lead wires 7 and 8 connected with the base may extend through the bulb and may be held in spaced relation by a glass bead 9. The ends of the leads may be welded or clamped at 10 to the terminals of a coiled filament 11. It has been found that a practical glow discharge will be had by the use of a filling of about 99.5% of neon and about .5% of argon at a pressure of about 3 c. m.

In practice portions of the lead wires at 12 and 13 are covered with a layer of the present composition for reducing the voltage drop. The composition may be applied to the leads of a mount which is then sealed into the bulb in the usual way and the bulb may then be exhausted of air. The gaseous atmosphere may then be introduced into the bulb which is then sealed off. When each lamp of a series is provided with portions of the lead wires treated as above described it will function to indicate a break in the filament. For example, a series of eight lamps is burned in series on the usual commercial 110 or 115-volt line and when the filament of a lamp breaks, the full-line voltage will be impressed across the electrodes or treated portions of the leads of the lamp that has failed and a glow will occur. The remaining lamps in the series serve as a ballast resistance and will not be heated to incandescence.

During the life of the lamp (i. e. filament life) there are indications that the magnesium reduces some of the alkalies which in turn pacify the gas thus prolonging filament life.

It has also been found that by using the present composition an indicator lamp may be made by using extensions of the lead-in wires as supports for a coating of the said composition to provide electrodes of low voltage drop.

As shown in Fig. 2 a bulb 15 is provided with lead wires 16 and 17 having their ends electrically connected to a base 18 in the usual manner. The other ends of the leads extend into the bulb and in the selected construction are formed to provide a double helix. The helical portions are coated with the present composition to provide electrodes 19 and 20 which results in providing a discharge lamp which may be used as an indicator or for other use. When used on commercial line voltages a suitable resistance is employed as an impedance or ballast.

It has been found that by reason of the present composition for lowering the voltage drop that it is possible to use lead wires of dumet consisting of a nickel iron core 21 (see Fig. 3) in an outer casing of copper 22. Heretofore when making a discharge lamp the electrode material differed from the material of the lead wire and it was necessary to include the operation of welding the electrode to the lead. By reason of the present composition straight through wires are practical which greatly reduces the cost of manufacture. This is an important factor in an article of the present character which must be made at a high rate of speed and in large quantities.

When the present composition is used in a lamp having a filament such as the Christmas tree lamp the material is activated under the normal operation of the lamp. In a glow lamp such as that shown in Fig. 2 it is necessary to activate the composition by a heat treatment such as is obtained by glowing in a steep wave front generator.

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 appended claim.

What is claimed is:

A glow discharge lamp comprising a bulb, an ionizable medium in said bulb, a pair of electrical conductors in said bulb and a material on said conductors for lowering the voltage drop therebetween, said material consisting of magnesium, caesium, potassium and sodium chloride.

DANIEL S. GUSTIN.