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FLUORESCENT GLOW LAMP

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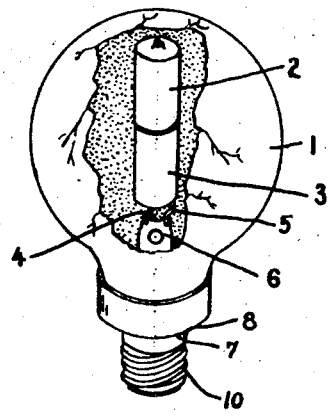

Fig. 1

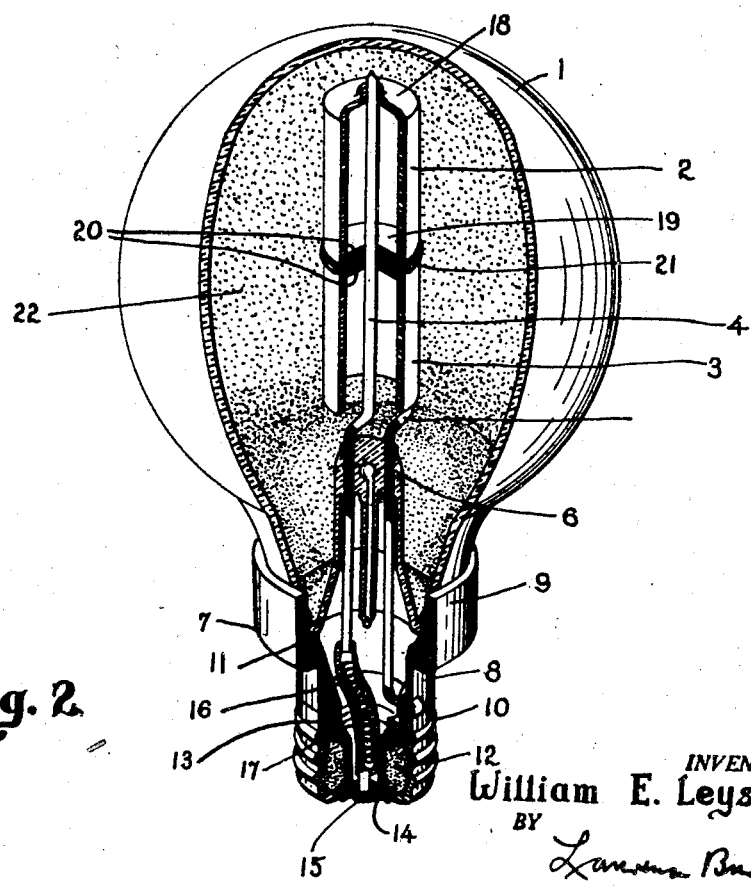

Fig. 2

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FLUORESCENT GLOW LAMP

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2 Claims. (Cl. 176—122)

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This invention relates to negative glow type discharge lamps and particularly to such lamps which are adapted to excite a luminous coating upon the inner wall of its envelope.

The invention has for its general objective to provide a lamp of low power consumption suitable for use in decorative or special lighting effects in groups or otherwise.

A further object of the invention is to produce a glow type lamp having cathodes designed to produce maximum radiating area commensurate with base dimensions which may be limited by practical requirements of manufacture or use.

A further object of the invention is to provide a glow type fluorescent lamp whose luminescence is excited by radiation within the Schumann region.

A further object of the invention is to provide a lamp having maximum and uniform visible light output over a long period of time.

A further object of the invention is to provide a lamp of the type indicated which is readily adapted to produce visible light of various colors by the selection of proper fluorescent material.

The lamp embodying the present invention was developed to be used for decorating purposes and the like but may be employed for any purpose requiring a lamp of its type and where special color effects are desired or as differential indicators.

Desirably the lamp is provided with an envelope of generally spherical shape but may have any suitable contour. The envelope enclosed a pair of closely spaced cylindrical cathodes arranged in end to end relation and disposed upon a common axis. The cathodes are supported upon a pair of lead wires extending upward from the stem of the lamp and which extend outside of the envelope for connection to an energizing source. A suitable resistance inserted in one lead wire limits the flow of current in the lamp.

To present a better understanding of the invention a particular embodiment thereof will be described and illustrated in the drawings in which:

Figure 1 is a general view of a lamp embodying the invention having its envelope partly broken away to show its cathode structure; and

Figure 2 is a cross section through the lamp showing the cathode and base construction.

The invention is particularly adapted to small fluorescent glow type lamps in which a variety of fluorescent powders may be used to produce lamps for radiating different colors depending upon the powder used. Powders are available for producing such colors as blue, green, yellow, and pink; e. g., calcium lead tungstate for blue, zinc orthosilicate, manganese-activated for green and yellow, and maganese-activated magnesium silicate for pink.

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The lamp desirably is provided with a glass envelope 1 for enclosing a pair of cylindrical cathodes 2 and 3. The cathodes are disposed in end to end relation upon a common axis and spaced apart a short distance. Desirably, the cathodes are of the same diameter and are supported in position by a pair of relatively rigid lead wires 4 and 5 which are sealed into the press 6 of the lamp and extend upward therefrom. The lead wires also extend downward into a base 7.

The base is composed of a core 8 of insulating material having an outwardly extending and upwardly turned flange 9 which embraces the neck portion of the envelope 1. The core 8 is reduced in diameter at its bottom end to receive a threaded metal sleeve 10 which is cemented to the core 8 and is adapted to be screwed into a candelabra screw base socket. If desired, however, a larger socket may be employed but the general construction of the lamp permits a small base to be employed which in turn permits the lamp to be employed in certain types of decoration such as the trimming of Christmas trees.

The long slim construction of the cathodes permits the construction of lamps having relatively small bases such as the conventional candelabra type wherein the neck of the envelope must be small. In which case the slim cathodes are readily introduced into the envelope when assembling the major parts of the lamp. Cathodes of this construction present a substantial area of radiation despite the structural limitations imposed by practical expediencies such as the desirability of using small sockets.

The core 8 may be fixed to the neck of the envelope 1 by a suitable cement 11 and the sleeve 10 may be fixed to the member 8 by means of the cement 12. The sleeve 10 may, of course, be affixed to the member 8 by any other suitable means, such as mechanical crimping. The core 8 is hollow to provide a chamber 13 the bottom end of which is closed by an insulating disc 14 secured to the end of the sleeve 10. The bottom end of the lead wire 4 extends through a central aperture in the disc 14 and is electrically connected to a contact member 15. The lead wire 5 extends into the chamber 13 and laterally outward through an aperture in the wall of the core 8 and is soldered or otherwise connected to the upper rim of the sleeve 10.

The operation of a lamp of this type requires a current limiting means. This limiting means may desirably be an ohmic resistance unit 16 inserted in series in either lead wire and is shown as connected in the lead wire 4 and provided with an insulating sheath 17. The lead wire 4 desirably extends axially through the cathodes 2 and 3 and is secured to the upper cathode 2 which is provided with an outwardly convexed

closed end 18. Any suitable means may be employed to secure the cathode 2 to the wire 4.

As shown herein an aperture is punched in the wall 18 within which the upper extremity of the wire is welded. The lead wire 5 extends upward into the cathode 3 and desirably is welded to the side wall thereof.

It may be found desirable to provide an insulating spacing member 19 between the two cathodes. This insulator may be provided with cylindrical portions 20 projecting into the cathodes and a spacer collar 21 which serves to positively determine and maintain the spacing of the cathodes. The spacer also serves to maintain the desired alignment of the cathodes. The material used for the spacer member 19 should fulfill certain requirements. It should be inorganic, stable under all operating conditions, and have a high dielectric property. Sintered alumina has been found to be a satisfactory material and is readily degassed by treatment prior to its assembly in the lamp.

In a preferred manufacturing procedure the lead wires are first formed. Wire 4 is bent inward from its point of emergence from the stem to lie substantially upon the axis of the cathodes while the wire 5 is bent outward to lie along the inner wall of the cathode 3. The cathode 3 is then welded to its lead wire 5. The spacer 19 is then slid down along the wire 4 which passes through a central aperture therein and moved down until its lower cylindrical portion enters the cathode 3. The cathode 2 is then placed in position over the upper cylindrical portion of the spacer 19 and with the lead wire 4 projecting into the aperture in the closed end of the cathode where it is welded into position. The cathode assembly thus constructed is extremely rigid and durable. The stem and cathodes are then sealed into their envelope in the conventional manner.

The envelope is provided with the conventional exhaust tube 22 which is shown sealed off after the proper atmosphere has been established within the lamp. The useful cathode radiation of the present invention takes place within the Schumann region the most effective portion of that region being at substantially 1200 Angstroms. To produce this emission the lamp is exhausted of all air and an atmosphere of gas is introduced consisting of approximately 20 to 30% krypton with the remainder argon and having a pressure of substantially 16 to 20 mm. Helium may be used in place of argon in the same proportion, but argon is preferable for good life and brightness.

The foregoing gas mixture may be used in the blue lamp with calcium lead tungstate as the fluorescent material, and in the green lamp with manganese-activated zinc orthosilicate. In the pink and yellow lamps, a mixture of neon and krypton may be used, at a pressure of about 35 mm., for example. About 95 to 99% neon and the rest krypton is satisfactory. Manganese-activated zinc orthosilicate can be used as the fluorescent material for the yellow, and manganese-activated magnesium silicate for the pink.

The cathodes 2 and 3 are coated with a low work function material such as barium dioxide which is reduced to barium oxide during a conventional cathode breakdown process performed prior to the introduction of gas into the envelope. A selection of materials for this purpose may be made from barium dioxide, strontium dioxide and calcium dioxide. The resistor 16 is of the order of 1000 ohms which maintains the power

consumption of the lamp at about 5 watts with 110 volts applied at its base terminals.

To produce the desired fluorescence, powders are selected which will fluoresce in the Schumann region and are applied in the form of a coating 22 to the inner wall of the envelope 1.

The gaseous atmosphere used in the present invention consists of true inert gases which do not condense at ambient or operating temperatures of the lamp. When atmospheres of certain materials such as mercury vapor are used the life and efficiency of the lamp is greatly impaired by condensation which blocks out a substantial portion of the visible light emitted from the lamp. An important feature of the present invention follows from the use of efficient fluorescent powders such as those used in mercury lamps but avoids the undesirable effect of condensation found in such lamps.

Lamps constructed in the manner described are extremely stable and economical in operation and have a greatly extended useful life.

What I claim is:

1. A fluorescent discharge lamp comprising a glass envelope of the bulbous type, a pair of hollow elongated cylindrical electrodes within the envelope disposed in end to end spaced relation and having a low work function coating thereon, a base secured to the envelope and having contacts, a lead wire sealed in said envelope extending from a base contact axially through both electrodes and connected to the outer end of the electrode remote from the base, a second lead wire sealed in the envelope connected to the other electrode and extending to a contact on the base, said envelope having an atmosphere comprising 20 to 30% krypton and the balance argon at a pressure of approximately 16 to 20 millimeters of mercury and a coating of fluorescent powder on the inner wall of said envelope.

2. A fluorescent discharge lamp comprising a glass envelope of the bulbous type, a pair of hollow, elongated, cylindrical electrodes within said envelope disposed in closely spaced end to end relationship on a common axis, a low work function coating on said electrodes, an insulating spacing member disposed between the adjacent ends of said electrodes, a pair of lead wires sealed in said envelope, said lead wires supporting said electrodes, one of said lead wires extending longitudinally through both of said electrodes and said insulating spacing member and secured to the closed end of the upper electrode, the other of said lead wires having an end thereof secured to the wall of said lower electrode, an atmosphere within said envelope consisting of between about 95% to 99% neon and the rest krypton at a pressure of approximately 35 millimeters of mercury, and a coating of fluorescent powder on the wall of said envelope.

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