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FLUORESCENT LAMP

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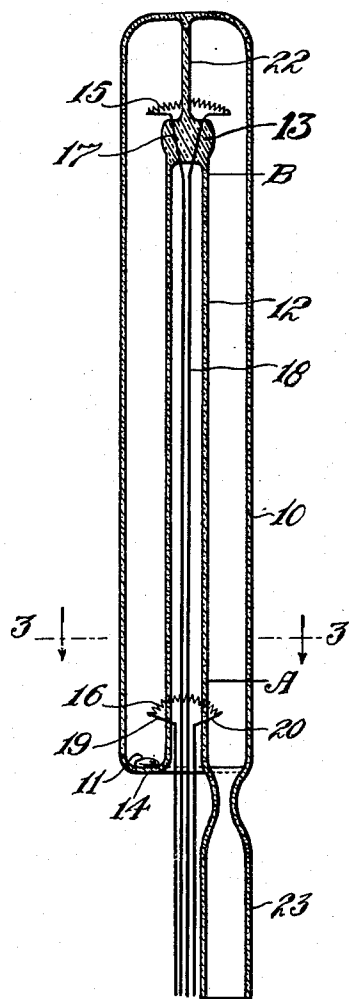


Fig. 1

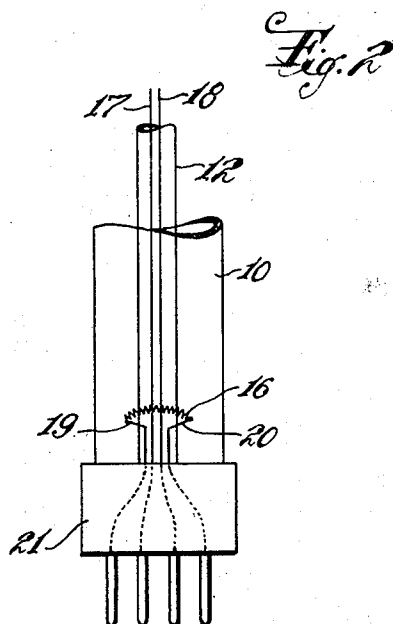


Fig. 2

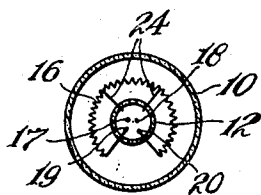


Fig. 3

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FLUORESCENT LAMP

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9 Claims. (Cl. 176—122)

My invention relates to improvements in fluorescent lamps for illuminating purposes.

The object of my invention is to provide an improved illuminating lamp which has advantages over the various constructions provided heretofore in the way of greater efficiency of operation and cost of construction.

Other objects and advantages will hereinafter appear.

For the purposes of illustrating my invention, an embodiment thereof is shown in the drawing, wherein

Figure 1 is a central sectional view of a lamp constructed and operating in accordance with my invention;

Fig. 2 is a fragmentary view showing the manner in which all electrical connections are made at one and the same end of the lamp; and

Fig. 3 is an enlarged sectional view taken on the line 3—3 of Fig. 1.

In the drawing, the reference numeral 10 designates an outer glass tube in which there is a small globule 11 of mercury and/or a rare gas such as neon, helium, xenon, krypton or argon. Each gas or mercury vapor, or a mixture of the same, constitutes a gaseous atmosphere.

An inner glass tube 12 is provided on the outside surface thereof with a coating of fluorescent material. The fluorescent coating is on the cylindrical portion of the tube, between A and B.

The end 13 of the inner tube 12 is sealed off, as shown, and the other end of this tube is sealed to the adjacent end of the outer tube 10 by the annular portion 14.

Supported or carried by the inner tube 12 at the opposite ends thereof are the thermionic electrodes 15 and 16, each of the latter being disposed in the sealed chamber or space between the tubes 10 and 12.

The thermionic electrode 15 is connected across the ends of two supporting wires 17 and 18 which are fused in the end 13 of the inner tube and extend through this tube to its other end. In like manner, the thermionic electrode 16 is connected across the ends of two supporting wires 19 and 20. The connecting wires 17, 18, 19 and 20 extend through the open end of the inner tube 12 and terminate at a socket member 21 fixed to the adjacent end of the outer tube 10.

A glass rod 22 fused to the sealed end 13 of the inner tube and to the adjacent end of the outer tube, operates to support the inner tube against vibration and breakage at the base.

In the process of manufacture, the space between the two tubes is first evacuated through the stem 23, after which mercury and the rare gas are introduced. The stem 23 is then sealed off.

In operation, the thermionic electrodes 15 and 16 are first connected in series and are heated

sufficiently to emit electrons, after which the series connection is broken and the circuit is made through the conducting gas and mercury vapor between the electrodes. The mercury vapor becomes ionized and emits ultra-violet light which excites the fluorescent material to emit a brilliant light.

If additional support is required for the thermionic electrode 16, this may be provided by short wires 24 fused in the tube 12, as shown in Fig. 3. Similar additional support may be provided for the thermionic electrode 15.

For any particular size of lamp, the amount of mercury and rare gas required for most efficient operation can best be determined by experiment. In some cases, satisfactory results have been obtained with 5 mm. of argon. The amount of mercury should be sufficient so that there is always an excess of the metallic mercury when the lamp is in operation, thereby assuring a substantially constant pressure of mercury vapor.

The outer tube 10 is elongated and preferably cylindrical, and the inner tube 12 is elongated and preferably cylindrical. The tube 12 is disposed in spaced concentric relation to the outer tube 10, providing a radially wide annular surrounding passage between the tubes 10 and 12, which extends continuously around the periphery of the inner tube 12. The radially wide surrounding passage is of particular importance. This radially wide passage produces a volume of gas and mercury vapor having a large cross-sectional area, so that it offers a low impedance to the electric discharge through the gas and mercury vapor, whereby a low voltage, such as is used in commercial lighting, may be employed. This radially large passage also permits of the rapid flow of the mercury when starting the lamp. The fluorescent material being applied to the outer surface of the inner tube, is within the annular surrounding passage between the inner and outer tubes to be properly acted upon by the ultra-violet light. This leaves the surface of the outer tube free from such coating of fluorescent material, whereby the outer tube may be transparent. As is well known, the efficiency of a lamp of this general type having fluorescent material applied to the surface of the outer tube, is materially reduced by the presence of such coating of fluorescent material, which renders the outer tube translucent, to a considerable extent, and further because the coating of fluorescent material obstructs the passage of light, to a considerable extent. By arranging the coating of fluorescent material upon the inner tube, the efficiency of the lamp is therefore greatly increased. The electrodes are mounted upon the inner tube, with the lead wires, and these elements may be first assembled upon the inner tube which is subsequently inserted into the outer tube, after which

the open end of the inner tube may be fused to the outer tube. The electrodes are arranged within the annular surrounding passage and are spaced from both tubes, and extend throughout the major portion of the periphery of the inner tube. The outer end of the inner tube is open and the interior of the inner tube may be vented to the atmosphere. All lead wires extend through the inner tube for connection with the electrodes, and all lead wires pass out of the outer open end of the inner tube for connection with the terminals of the socket member.

In the claims, the term "tube" is used in the broad sense, and is intended to embrace a container or envelope which is not necessarily cylindrical.

It will be understood that various modifications are possible without departing from the spirit of my invention or the scope of the claims.

I claim as my invention:

1. In a fluorescent lamp, an outer tube, a gaseous atmosphere within the outer tube, an inner tube disposed within said outer tube and spaced therefrom, said inner tube being provided on the outside surface thereof with a coating of fluorescent material, thermionic electrodes carried by said inner tube and disposed near the opposite ends thereof, and lead wires connected with the electrodes, all lead wires passing through the same end of the inner tube.

2. In a fluorescent lamp, an outer tube, an inner tube disposed within said outer tube and spaced therefrom, said outer tube containing a rare gas and mercury, said inner tube being provided on the outside surface thereof with a coating of fluorescent material, thermionic electrodes carried by said inner tube and disposed near the opposite ends thereof, and lead wires connected with the electrodes, all lead wires passing through the same end of the inner tube.

3. In a fluorescent lamp, an outer tube containing a rare gas and mercury, an inner tube disposed within said outer tube and spaced therefrom, said inner tube being provided on the outside surface thereof with a coating of fluorescent material, cathodes carried by said inner tube and disposed near the opposite ends thereof and being in the form of thermionic electrodes, lead wires connected with the cathodes, all lead wires passing through the same end of the inner tube, and a socket member affixed to said end of said outer tube and providing terminals for said wires.

4. A fluorescent lamp comprising an outer tube which is substantially circular in cross-section, a gaseous atmosphere within the outer tube, an inner member which is substantially circular in cross-section arranged within the outer tube in spaced relation thereto for providing a surrounding passage about the inner member, said inner member having its outer surface coated with fluorescent material, thermionic electrodes mounted upon the inner member, at least one electrode being arranged within the passage and extending throughout the major portion of the periphery of the inner member, and lead wires connected with the electrodes.

5. A fluorescent lamp comprising an outer tube free from a coating of fluorescent material, an inner tube arranged within the outer tube in spaced relation thereto for providing a passage surrounding the inner tube, the inner tube having

its inner end closed and its outer end open, the outer open end of the inner tube being sealed to the adjacent end of the outer tube, the outer tube being sealed to the atmosphere, the inner tube having its outer surface coated with fluorescent material, a rare gas and mercury contained within the outer tube, thermionic electrodes arranged within the outer tube, and lead wires connected with the electrodes, all lead wires entering at the same end of the outer tube.

6. A fluorescent lamp comprising an outer tube, an inner tube arranged within the outer tube in spaced relation thereto, the inner tube having its inner end closed and its outer end open, the outer open end of the inner tube being sealed to the adjacent end of the outer tube, the outer tube being sealed to the atmosphere, the inner tube having its outer surface coated with fluorescent material, a rare gas and mercury contained within the outer tube, thermionic electrodes arranged within the outer tube near the ends of the inner tube, said electrodes being spaced from the inner and outer tubes, lead wires connected with the electrodes, all lead wires passing through the same outer open end of the inner tube.

7. A fluorescent lamp comprising an outer tube which is substantially circular in cross-section, a gaseous atmosphere within the outer tube, an inner member which is substantially circular in cross-section arranged within the outer tube and having a considerably smaller diameter than the inner diameter of the outer tube to provide a radially wide passage between the member and tube, the inner member being coated with fluorescent material, thermionic electrodes within the outer tube, and lead wires connected with the electrodes, the radially wide passage permitting the gaseous atmosphere to have a large cross-sectional area for affording low impedance to the electric discharge through the gaseous atmosphere.

8. A fluorescent lamp comprising an outer tube, an inner tube arranged within the outer tube and having a considerably smaller diameter than the inner diameter of the outer tube to provide a radially wide passage between the tubes, the inner tube having its outer surface coated with fluorescent material, thermionic electrodes within the outer tube and arranged near the opposite ends of the inner tube and spaced from the inner and outer tubes, a rare gas and mercury contained within the outer tube, and lead wires connected with the electrodes, the radially wide passage permitting the gas and mercury vapor to have a large cross-sectional area for affording low impedance to the electric discharge through the gas and vapor.

9. A fluorescent lamp comprising an outer tube which is substantially circular in cross-section, a gaseous atmosphere within the outer tube, an inner member which is substantially circular in cross-section arranged within the outer tube in substantially spaced concentric relation thereto, the inner member having its outer surface coated with fluorescent material, thermionic electrodes within the outer tube and arranged near the ends of the inner member and spaced from the inner member and outer tube, and lead wires connected with the electrodes.

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