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FLUORESCENT LAMP

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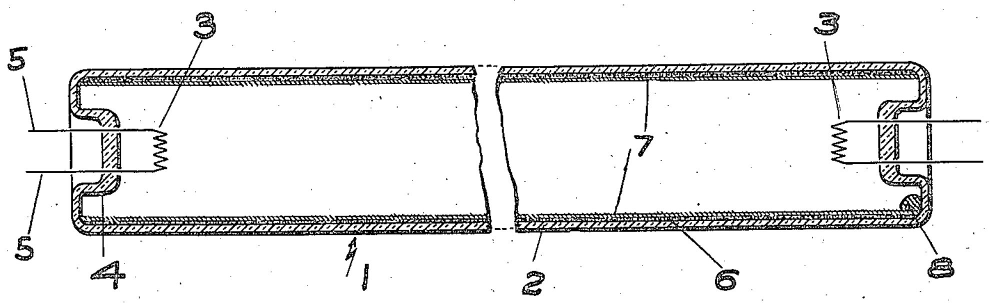

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FLUORESCENT LAMP

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12 Claims. (Cl. 176—122)

This invention relates to fluorescent lamps, particularly to the type in which a fluorescent coating is excited into luminescence.

Lamps of the character referred to, after a few hours of operation, rapidly lose their efficiency. An object of this invention is the provision of such a lamp in which said rapid loss of efficiency is prevented or reduced.

It is believed that this loss of efficiency is due to the action of the discharge on the fluorescent coating and particularly to the action of the mercury vapor atoms. It has been found that mercury vapor in its normal or unexcited state does not affect the coating. It is believed that the excited and metastable mercury atoms produced during the discharge cause this loss of efficiency of the fluorescent coating upon contact therewith. I have found that by providing a protective coating on the fluorescent material to isolate said material from the excited and metastable atoms of the discharge this loss of efficiency is prevented. Furthermore, I have found that a suitable coating for this purpose can be formed from a stable oxide compound, particularly a metallic oxide such as for example aluminum oxide. It is therefore another object of this invention to provide a suitable protective coating for the fluorescent material.

Other and further objects of this invention and the foregoing object will be best understood from the following description of an exemplification thereof, reference being had to the drawing in which the figure is a cross-sectional view of an embodiment of my invention.

Referring now to the figure, the fluorescent lamp 1 is comprised of an envelope 2 having oppositely disposed electrodes 3 which are, as shown, of the coiled filament type and are preferably coated with an electron emitting material such as barium or strontium oxide or the like. The electrodes are connected and supported by suitable lead-in and supporting conductors arranged in the stem presses 4 provided at each end of the lamp to external contact terminals 5.

A fluorescent coating 6 of any suitable material, such as for example zinc silicate, is provided on the interior surface of the envelope 2 which coating is adapted to be excited by the ultraviolet radiations generated during a discharge and to translate the energy of the ultra-violet light into visible light.

Prior to sealing off the lamp a stable gas 7, such as argon, neon, or other noble monatomic gases at several millimeters of pressure, is introduced into the envelope together with an ionizable vapor such as that supplied by a small quantity of mercury 8. The electrodes 3 are designed to be heated by a suitable current, and upon application of a suitable potential between said electrodes a discharge occurs therebetween. The discharge vaporizes the mercury within an extremely short period of time with the result that ultraviolet light, particularly of the 2537 Angstrom units wave length, is generated.

The excited and metastable mercury atoms participating in the discharge are preferably isolated from the fluorescent material 6 by a suitable coating. I have found that aluminum oxide is preferable for this purpose. Other stable oxides that may be used satisfactorily are magnesium, vanadium and titanium. While barium, calcium, and strontium oxides may be used for this purpose they are somewhat more difficult to apply than aluminum oxide.

The coating of aluminum oxide may be formed by sputtering aluminum onto the fluorescent coating in the presence of an atmosphere of oxygen. An alternative way of producing the coating is to vaporize aluminum in an atmosphere of oxygen adjacent the fluorescent coating and to allow the aluminum oxide to settle onto the coating surface.

I have found that the loss of efficiency of lamps of the character referred to is considerably reduced by the provision of such a coating. This protective coating produces a longer operative life for such a lamp with greatly enhanced efficiency throughout said life.

According to my present understanding of the theory of operation of fluorescent lamps using mercury vapor, the excited or metastable mercury atoms have a great affinity for the oxygen atoms of the fluorescent material, such as for example the oxygen of the zinc silicate. Such excited and metastable mercury atoms behave chemically like atoms of aluminum vapor. In lamps not having a protective coating these mercury atoms reduced the outer surface of the fluorescent coating by robbing the zinc silicate of its oxygen atoms leaving a coating or layer of zinc and silicon on the outer surface of the fluorescent coating. The captured oxygen atoms are released as soon as the mercury atoms become normal again. The released oxygen atoms then combine with any of the metallic constituents within the envelope and are dispersed into various parts of the lamp. These oxygen atoms may combine with the metal of the lead-in conductors or the electrode coatings, etc. As a result of the loss of these oxygen atoms a thin coating of zinc and silicon forms on the outer surface of the fluorescent material. This coating absorbs a substantial part of the ultra-violet light. However, once this coating is formed it serves to protect the lower layers of the fluorescent material and thereafter the efficiency of the lamp diminishes at a greatly reduced rate. This theory seems to explain the observed operation of such lamps. When, therefore, in accordance with this invention, a coating of a stable oxide compound is formed this stable coating protects the fluorescent material from the excited mercury atoms. I believe that this is due to the fact that the oxide compounds I employ are so stable that they are not reduced by the excited mercury vapor. Also, the excited or metastable mercury atoms never come in contact with the fluorescent material and so the fluorescent coating is not reduced. The aluminum oxide coating and other oxide coatings mentioned are substantially transparent to both the visible light and the ultra-violet light generated within the lamp, particularly so, since they are comparatively thin.

While I have described in specific detail one embodiment of my present invention it will readily be apparent that modifications may be made therein without departing from the spirit of my invention. For example, the arrangement of the electrodes or of the fluorescent coating or of the protective coating on the fluorescent material might be altered as will be apparent to anyone versed in the art. It is accordingly desired that the appended claims be given a broad interpretation commensurate with the scope of the invention within the art.

What is claimed is:

1. A gaseous electric discharge lamp comprising an envelope, an ionizable medium at substantial pressure in said envelope for generating light radiations in said envelope, means for producing an electrical discharge in said envelope for exciting said ionizable medium, a coating of fluorescent material arranged in the path of the light radiations, and a substantially transparent coating of a non-vitreous material stable in the presence of atoms of the medium excited in the discharge arranged between the fluorescent coating and the medium.

2. A gaseous electric discharge lamp comprising an envelope, an atmosphere including mercury vapor at substantial pressure in said envelope for generating light radiations in said envelope, means for producing an electrical discharge in said envelope for exciting said mercury vapor, a coating of fluorescent material arranged in the path of the light radiations, and a substantially transparent coating of a non-vitreous metallic oxide stable in the presence of atoms of the mercury vapor excited in the discharge arranged between the fluorescent coating and the mercury vapor.

3. A gaseous electric discharge lamp comprising an envelope, an ionizable medium at substantial pressure in said envelope for generating light radiations in said envelope, means for producing an electrical discharge in said envelope for exciting said ionizable medium, a coating of fluorescent material arranged in the path of the light radiations, and a substantially transparent coating composed substantially of aluminum oxide arranged between the fluorescent coating and the medium.

4. A gaseous electric discharge lamp comprising an envelope, an ionizable medium at substantial pressure in said envelope for generating light radiations in said envelope, means for producing an electrical discharge in said envelope for exciting said ionoizable medium, a coating of fluorescent material arranged in the path of the light radiations, and a substantially transparent coating composed substantially of an oxide of the aluminum, magnesium, vanadium and titanium family arranged between the fluorescent coating and the medium.

5. A gaseous electric discharge lamp comprising an envelope, means for producing an electrical discharge in said envelope, an ionizable medium in said envelope for generating light radiations, a coating of fluorescent material arranged in the path of the light radiations, and a substantially transparent coating of an oxide of the barium, calcium and strontium family arranged between the fluorescent coating and the medium.

6. A gaseous electric discharge lamp comprising an envelope, an atmosphere including mercury vapor at substantial pressure in said envelope for generating light radiations in said envelope, means for producing an electrical discharge in said envelope for exciting said mercury vapor, a coating of zinc silicate arranged in the path of the light radiations, and a substantially transparent coating of a non-vitreous oxide stable in the presence of atoms of the mercury vapor excited in the discharge arranged between the fluorescent coating and the mercury vapor.

7. The method of forming a protective layer on a fluorescent coating in an electrical discharge lamp which comprises vaporizing an easily oixdizable metal onto said coating, and oxidizing said vaporized metal.

8. The method of forming a protective layer on a fluorescent coating in an electrical discharge lamp which comprises vaporizing an easily oxidizable metal onto said coating in the presence of an oxidizing atmosphere.

9. The method of forming a protective layer on a fluorescent coating in an electrical discharge lamp which comprises vaporizing a metal of the aluminum, magnesium, vanadium and titanium family onto said coating, and oxidizing said vaporized metal.

10. The method of forming a protective layer on a fluorescent coating in an electrical discharge lamp which comprises vaporizing a metal of the aluminum, magnesium, vanadium and titanium family onto said coating in the presence of an oxidizing atmosphere.

11. The method of forming a protective layer on a fluorescent coating in an electrical discharge lamp which comprises vaporizing aluminum onto said coating, and oxidizing said vaporized aluminum.

12. The method of forming a protective layer on a fluorescent coating in an electrical discharge lamp which comprises vaporizing aluminum onto said coating in the presence of an oxidizing atmosphere.

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