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TREATMENT OF ELECTRIC LAMP ENVELOPES

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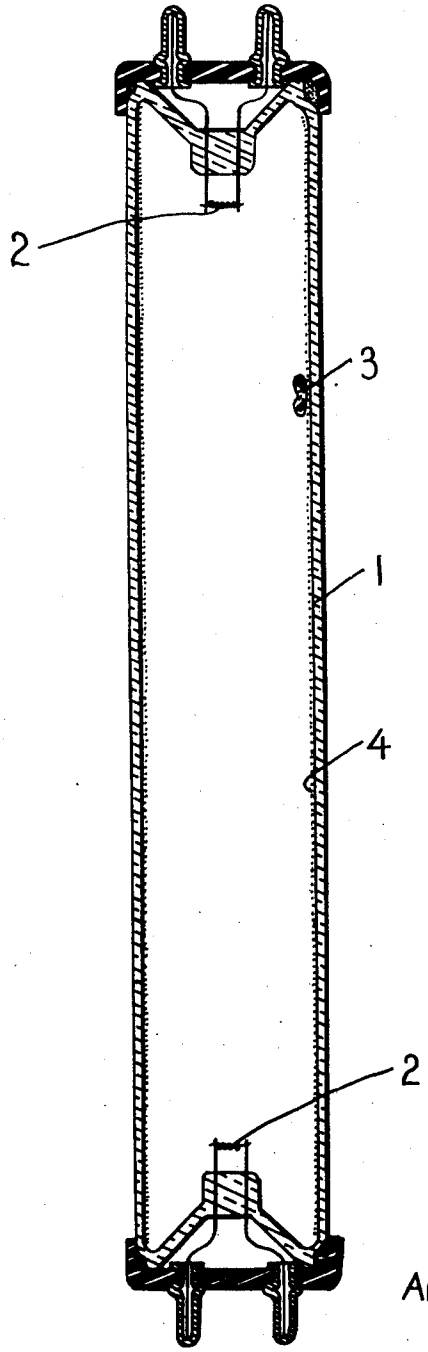

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TREATMENT OF ELECTRIC LAMP ENVELOPES

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This invention relates to electric gaseous discharge devices and more particularly to those which contain mercury therein.

An object of this invention is to provide means whereby the decrease in light output of electric gaseous discharge devices during life may be retarded.

Another object is to provide means for reducing the discoloration which develops on the walls of electric gaseous discharge devices during life.

Further objects, advantages and features will be apparent from the following description thereof when read in conjunction with the accompanying drawing in which the single figure is a side elevational view in section of a lamp embodying the teaching of my invention.

In the art of manufacturing electric gaseous discharge devices, such as fluorescent and germicidal lamps, for example, it has been known that the light output of these devices drops off during life. It has also been noted that the walls of the envelope of these devices becomes discolored during life and that this discoloration increases as the life or length of time during which the device has been used increases. I have found that the decrease in light output and the development of discoloration may be substantially retarded by providing the inner wall of the envelope with a thin surface coating of an oxide of antimony.

A specific application of the teaching of my invention is the treatment of the glass envelope of a 15-watt T–8 germicidal lamp designed for operation in refrigerators. In the figure, the lamp comprises an elongated tubular glass envelope 1, having filamentary electrodes 2 sealed therein at the extremities thereof. These filamentary electrodes are provided with a coating of electron-emissive material, usually an oxide of one or more of the alkaline earth metals. The lamp contains a small amount of mercury 3 such as about 25 mg. for example, and a filling of inert gas, such as argon, at about 3 mm. pressure. The inner wall of the envelope 1 is provided with a thin surface coating 4 of an oxide of antimony.

In accordance with my invention, the inner wall of the tubular glass envelope 1 is coated with a suspension containing an oxide of antimony. This suspension comprises a binder, a vehicle in which the binder is soluble, and the antimony. When ethyl cellulose is used as the binder, xylol may be employed as the vehicle. If nitrocellulose is used as the binder, butyl acetate or amyl acetate may be employed as the

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vehicle. However other binders and suitable solvents therefor may be employed without departing from the spirit of my invention.

In preparing the suspension I add a small amount of powdered oxide of antimony to a mixture of ethyl cellulose and xylol. The inner wall of the glass envelope is then coated with this suspension and the coated envelope is heated to a temperature high enough to break down the ethyl cellulose, i. e. about 450° C. to about 550° C. thus leaving a thin surface layer of an oxide of antimony on the wall of the envelope. The lamp is then processed in the conventional manner well known to those skilled in the art. The data below shows the marked improvement in retarding the decrease in light output during life of 15-watt T–8 germicidal lamps. In this test the "control" represents several lamps which were not provided with a surface layer of antimony on the inner wall of the lamp envelopes whereas the "1 mg. Sb_2O_3" represents several lamps which were coated, in the manner described above, with a suspension containing 1 mg. of Sb_2O_3. The lamps in this test were operated at an ambient temperature of about 32° F., since the lamps are designed for use in refrigerating apparatus. The figures in the table represent percent of ultra violet output compared with initial output.

Table

Hours of Operation	0	112	295	507
1 mg. Sb_2O_3	100	64.2	54.0	46.0
Control	100	58.6	41.0	27.6

This test clearly shows that when the inner wall of the lamp envelope is provided with a thin surface layer rich in antimony, the decrease in light output during life is retarded substantially. The discoloration of the envelope wall in the case of the lamps having the oxide of antimony coating was slower in developing and less intense than the discoloration of the controls.

Although the test illustrated in the table was made with germicidal lamps, similar beneficial effects may be obtained in the case of other electric gaseous discharge devices, such as fluorescent lamps for example. In the case of fluorescent lamps, the inner wall of the tubular glass envelope may be treated in the manner described above, before the coating of fluorescent material is applied.

The lamps used in the test of the table were

15 watt T–8 lamps and the lamp envelope was coated with a suspension containing 1 mg. of Sb_2O_3. However, between 0.5 mg. to 5 mgs. may be added. If less than 0.5 mg. is added, there doesn't appear to be enough antimony present to effect any substantial improvement. If more than 5 mgs. of Sb_2O_3 are added, yellow bands develop on the wall of the envelope.

In the specific example above, 1 mg. of Sb_2O_3 was added to a suspension with which the envelope of a 15 watt T–8 lamp was coated. This is equal to about .02 mg. per square inch. Correspondingly, conversion of the 0.5 mg. to 5 mgs. range described above results in a range of between .01 mg. per square inch to 0.1 mg. per square inch. Since about 70% of the Sb_2O_3 is lost during baking when the binder is burned off, the amount of Sb_2O_3 left in the finished lamp is between .003 mg. per sq. in. to .03 mg. per sq. in.

Although I have used antimony trioxide, any oxide of antimony, such an antimony pentoxide for example, may be used.

What I claim is:

1. An electric gaseous discharge device comprising: a sealed, glass, light-transmitting envelope; a filling of inert gas at a pressure of a few millimeters in said envelope; a filling of mercury in said envelope; spaced electrodes contained within said envelope; a coating of an oxide of at least one of the alkaline earth metals on said electrodes; and a single coating on the inner wall of said envelope, said coating consisting essentially of between about .003 mg. to about .03 mg. per square inch of an oxide of antimony.

2. An electric gaseous discharge device comprising: a sealed, glass, light-transmitting envelope; a filling of inert gas at a pressure of a few millimeters in said envelope; a filling of mercury in said envelope; spaced electrodes contained within said envelope; a coating of an oxide of at least one of the alkaline earth metals on said electrodes; and a single coating on the inner wall of said envelope, said coating consisting essentially of about .006 mg. per square inch of an oxide of antimony.

3. An electric gaseous discharge device comprising: a sealed, glass, light-transmitting envelope; a filling of inert gas at a pressure of a few millimeters in said envelope; a filling of mercury in said envelope; spaced electrodes contained within said envelope; a coating of an oxide of at least one of the alkaline earth metals on said electrodes; and a single coating on the inner wall of said envelope, said coating consisting essentially of between about .003 mg. to about .03 mg. per square inch of Sb_2O_3.

4. An electric gaseous discharge device comprising: a sealed, glass, light-transmitting envelope; a filling of inert gas at a pressure of a few millimeters in said envelope; a filling of mercury in said envelope; spaced electrodes contained within said envelope; a coating of an oxide of at least one of the alkaline earth metals on said electrodes; and a single coating on the inner wall of said envelope, said coating consisting essentially of about .006 mg. per square inch of Sb_2O_3.

5. An ultra violet electric gaseous discharge lamp comprising an elongated tubular envelope, said envelope having a portion of glass which is transmissive of ultra violet radiations, a filling of inert gas at a pressure of a few millimeters sealed in said envelope; a small quantity of mercury also sealed in said envelope, spaced electrodes sealed into the ends of said envelope, a coating of an oxide of at least one of the alkaline earth metals on said electrodes, and a single coating on th inner wall of said envelope, said coating being relatively thin and consisting of antimony trioxide.

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