Patented Dec. 22, 1925. 1,566,848

UNITED STATES PATENT OFFICE.

GORTON R. FONDA, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INCANDESCENT LAMP.

No Drawing. Application filed January 26, 1922. Serial No. 532,044.

To all whom it may concern:

Be it known that I, GORTON R. FONDA, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Incandescent Lamps, of which the following is a specification.

The present invention relates to electric incandescent lamps. It is the object of my invention to improve their efficiency and life.

During the operation of an incandescent lamp, particularly lamps containing a filling of inert gas, discoloration of the bulb may sometimes occur early in the life of the lamp, which appears to be due to some cause other than expected gradual evaporation of the filament material at the high operating temperature.

Investigations indicate that this discoloration is due to gases, particularly water vapor, evolved from the glass bulb and perhaps also other interior parts of the lamp. Water appears to be held so tenaciously by glass that some of it is retained even when the glass bulb is baked during its manufacture. These small quantities of water vapor exert a deleterious effect on the filament or glower in the lamp and cause its disintegration. Moisture also may arise from chemical combination between hydrogen introduced in any way, as for example with the gas filling, with oxides also inadvertently introduced into the lamp.

I have discovered that the introduction into the bulb of a material which contains carbon, for example, acetylene gas, suppresses this early discoloration of the bulb, and besides improves the physical properties of the incandescent body.

The benefits of my invention are not limited to the utilization of a gaseous carbonaceous material. Free carbon in a finely divided condition may be applied to the exterior of the filament, as described and claimed in an application, Serial No. 540,611, filed March 2, 1922, by Percy A. Campbell.

In accordance with one method of carrying out my invention, a small quantity of carbonaceous gas is introduced into the lamp, preferably after the tungsten filament, or other glower, has been mounted therein. Besides acetylene, C_2H_2, various hydrocarbon gases may be used, for example, methane, CH_4, naphthalene vapor, $C_{10}H_8$, anthracene vapor $C_{14}H_{10}$ or the like. Preferably, a material which does not contain both oxygen and hydrogen is employed, as the latter liberate an excessive amount of water vapor by its decomposition.

The amount of carbon as an elementary constituent introduced into the bulb should be limited to substantially no more than about one to two-tenths (0.1 to 0.2%) of the weight of the incandescent body and preferably the amount of carbon should be materially less than this amount, say, five-hundredths of one per cent (.05%) of the lighting body by weight. A portion of the carbon may combine very early in the life of the lamp with water vapor or other deleterious oxygenous gases, but in any event the amount initially introduced should be insufficient to decrease the lighting efficiency of the glower.

After the acetylene, or other carbon-containing material, has been introduced into the bulb, the usual gas filling may be admitted, as for example, argon or nitrogen gas at a pressure a little below atmospheric pressure. In case the bulbs are sealed off while containing only the carbon-containing gas, they will remain essentially vacuum lamps, particularly so as the gas is quickly decomposed by the incandescent filament, and in any event has a pressure of less than fifty microns of mercury pressure (0.050 m.m.).

If desired, carbon may be introduced into the filament by incandescing the filament in the presence of a carbonaceous vapor of suitable composition and pressure and when a desired amount of carbon has been deposited on the filament mounting the same in a bulb. Carbon is introduced thereby into the lamp in such a manner as to be heated in contact with the gases in the lamp to a temperature of chemical activity by the normal incandescence of the filament.

The addition of the carbon-containing gas to the lamp decidedly improves the strength of an incandescent body consisting of ductile tungsten. The ductility and resistance to sag of the metal also are improved. These mechanical improvements in my opinion are due to the removal by chemical action of impurities between the grains of the metal. The average life of lamps embodying my in-

vention is longer than lamps operating at the same efficiency but unprovided with carbon in a condition adapted to combine with deleterious impurities in the lamp.

In accordance with an invention of Carl T. Fuller described in an application, Serial No. 532,047, filed January 26, 1922, an organic dye is placed in incandescent lamps to provide a visible record of the temperature attained during the manufacture of the lamp. As various dyes suitable for this purpose have an appreciable vapor pressure particularly at the operating temperature of the lamp, they will serve the added purpose of furnishing carbon for the purposes of my invention. Various dyes of the aromatic or benzene ring series may be used for this purpose, for example, dyes belonging to the triphenyl methane group, such as malachite green and methyl violet.

When in accordance with the above mentioned application Serial No. 540,611 free carbon is introduced into the lamp, it may be applied by spraying the filament with a suspension of carbon, as for example, with a suspension of aquadag in water. I desire by the appended claims to cover all the above described improvements and other modifications of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. An electric lamp comprising the combination of an incandescent body of refractory metal, a sealed bulb, a carbon-containing material in said bulb available for chemical reaction with gases in said bulb at the operating temperature of said body and in such quantity that by combination thereof with impurities in said lamp the operating properties of said body are improved.

2. An incandescent lamp comprising the combination of an incandescent body of tungsten, a sealed bulb, a filling of gas therein inert with respect to tungsten at incandescence and a quantity of a gaseous compound of carbon in quantities sufficient to materially suppress bulb discoloration at the beginning of the life of said lamp, but insufficient to deleteriously affect said incandescent body.

3. An electric lamp comprising the combination of a sealed container, a refractory lighting body therein, and a quantity of carbonaceous material in said container located with respect to said body as to be heated to a temperature of chemical activity, while in contact with gas residues in said lamp, the amount of carbon being limited to about five-hundredths of one per cent of the weight of the lighting body but sufficient in quantity to suppress premature discoloration of the bulb.

4. An electric device comprising the combination of a sealed glass bulb, a lighting body therein consisting of refractory metal and a quantity of carbonaceous material in said bulb within the heating zone of said body, said material being capable of introducing no more than about five-hundredths of one per cent of carbon into said body.

5. An incandescent lamp comprising a sealed bulb, a metal filament therein and a quantity of carbonaceous material so placed with respect to said filament that under the operating conditions of the lamp said material is capable of combining chemically with deleterious gases given off by the bulb or other parts of said lamp, thereby reducing premature discoloration and improving the physical condition of said filament.

6. An incandescent lamp comprising a sealed bulb, a refractory metal filament and a quantity of carbonaceous material therein in contact with said filament during the operation of the lamp, capable of forming substantially no more than about one to two-tenths per cent of combined carbon in said filament.

7. An electric lamp comprising the combination of a sealed container, a refractory metal body therein capable of reacting with carbon at incandescence, and a quantity of carbon-containing vapor in said device adapted to introduce about three-hundredths of one per cent of carbon into said metal body.

8. The method of preventing the premature blackening of lamps containing a metal filament which consists in introducing into the filament a material which is capable of combining with water vapor, the quantity of said material being insufficient to materially affect the constitution of said filament, and heating said material to the reactive temperature by the normal operation of said lamp.

9. The method of improving the operation of a tungsten incandescent body in a lamp which consists in introducing into contact with said body at incandescence, gaseous carbonaceous material in sufficient amount to combine with deleterious gases but insufficient to decrease the lighting efficiency of said lamp.

In witness whereof, I have hereunto set my hand this 25th day of January, 1922.

GORTON R. FONDA.