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MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS.

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This invention relates to the manufacture of incandescent electric lamps and more particularly to the treatment and introduction of suitable gas and getter material into gas-filled lamps.

An object of my invention is to simplify the manufacture of gas-filled lamps by providing a gas-filling of such a character, that the purification thereof is less complicated.

Another object of my invention is the introduction of getter material with the gas filling, when the lamp is made.

A further object of my invention is the provision of a gas of such a composition and containing such a getter material, that it is unnecessary to heat the bulbs of lamps during the exhausting operation, when it is intended to fill them with such a gas.

A still further object of my invention is the employment, for gas-filled lamps, of a carbonaceous getter, containing little or no oxidizing material, adapted to be admixed with hydrogen to prevent the formation of carbide on the filament and of such a vapor tension at normal temperatures, that it is suitable for introduction with the gas filling of the lamp.

Other objects and advantages of the invention will become apparent as the description proceeds.

In my copending application Serial No. 639,460, filed May 16, 1923, gas-filled incandescent lamps and getters therefor, and assigned to the Westinghouse Lamp Company, is disclosed a getter especially adapted for gas-filled incandescent electric lamps and consisting of an organic compound substantially free from oxygen and oxidizing material. Such a getter may be applied to the lamp filament in the form of a solution or introduced with the gas filling and is adapted to obviate the necessity of heating the lamp bulb during the exhausting process, as the getter is so active that it is adapted to clean-up moisture very efficiently. Some getters of this type, although adequately adapted for the purpose described, are of such a nature, that when used, a coating of carbide results on the surface of the filament making it more brittle and liable to breakage.

According to my invention, I obviate this defect by an admixture of hydrogen to the carbonaceous getter, which is especially adapted for lamps of the gas-filled type and is preferably introduced with the gas filling thereof. The proportion of hydrogen need not be very great and the preferable percentage thereof depends on the specific carbonaceous getter which is employed. The use of hydrogen admixed with the gas filling also serves the purpose of permitting the substitution of hydrogen for flushing the lamp previously to introducing the gas filling therein, thereby substituting the relatively-cheap gas hydrogen for the more expensive gas nitrogen, which is at present used for this purpose. The use of hydrogen facilities flushing and exhaust, because of its low viscosity. The addition of hydrogen to the filling gas also makes it possible to simplify the process of purifying the inert-gas filling for such lamps.

Without hydrogen admixed with the gas filling for lamps, a preferred composition for such filling, when in an unpurified condition, is about 86% of argon and about 14% of nitrogen which contains small amounts of oxygen, hydrogen, carbon dioxide and water vapor. Such mixture it is thought necessary to purify by passing through the tubes containing respectively, phosphoric anhydride, soda lime, hot copper and hot copper oxide. The hot copper is adapted to remove the oxygen and the hot copper oxide to remove the hydrogen from the mixture.

The copper and copper oxide tubes must be regenerated very frequently as often as once or twice a week, under present conditions, which is a costly proceeding and unnecessary when making lamps according to my invention. I propose to substitute hydrogen for nitrogen in the argon mixture and preferably use a smaller percentage of hydrogen than formerly used of nitrogen. The addition of hydrogen renders the copper oxide purifying tube unnecessary. Likewise there will be no need of regenerating the copper tube, since the hydrogen will do this, and thereby a troublesome and costly operation involved in gas purification will be eliminated.

By using hydrogen to flush the lamp bulbs to remove deleterious gases, prior to filling them with an inert gas mixture, considerable saving may be effected over the present use of nitrogen for this purpose, as the cost of hydrogen is only about one half the cost of nitrogen. At present it is necessary to

purify nitrogen in the same manner as argon, whereas the purification of hydrogen only requires drying tubes.

My invention may be better understood by a more specific description thereof as follows.

As the invention is particularly adapted for incandescent electric lamps of the gas-filled type, which gas filling is preferably largely argon, I will describe an embodiment thereof for making such lamps, although I do not wish to be restricted to such.

A bulb for a gas-filled lamp may have sealed therein, a mount of the usual type, after which the bulb is preferably flushed with dry hydrogen gas a plurality of times, to eliminate practically all of the air originally therein. It is then preferably exhausted to a moderate degree and filled with an argon mixture containing from 3% to 15% of hydrogen. A good general rule would be to use about 10% of hydrogen in the argon mixture. This argon mixture may be purified prior to introduction into the lamp without the use of a hot tube containing copper oxide, that is, it is merely necessary to pass the gas over phosphoric anhydride to remove the moisture, soda lime to remove carbon dioxide, hot copper to remove oxygen and preferably phosphoric anhydride again to remove moisture. The hot copper requires no additional regeneration when hydrogen is present in the argon mixture, because hydrogen serves as a regenerator for the copper.

Prior to an introduction into the lamp, there is preferably admixed with the filling gas the desired proportion of carbonaceous getter vapor. A preferred getter for this purpose is para-di-brom-benzene ($C_6H_4Br_2$) and in order to introduce such with the gas filling, it is merely necessary to allow the gas to pass over this solid, as the vapor tension thereof at room temperatures, is such that the desired proportion thereof becomes admixed with the filling gas. That is, the filling gas is preferably saturated or substantially saturated with this compound.

Although hydrogen is preferably used admixed with the argon for reasons heretofore explained, yet when using this particular carbonaceous getter, hydrogen is not necessary to prevent the formation of carbide on the filament, because the carbon content of this material is not high enough to effect such a result. For this reason such a compound and similar carbonaceous compounds may be employed as getters admixed with the gas filling and used with or without hydrogen.

Aniline ($C_6H_5NH_2$) may be used in place of para-di-brom-benzene, but greater care is necessary when using this compound, as the filament is apt to be attacked with the formation of tungsten carbide, if aniline is used in various proportions, without an admixture of hydrogen thereto. That is, when using aniline without hydrogen, it is necessary to prepare a mixture with a fairly definite proportion of aniline vapor therein. The use of hydrogen permits a greater latitude when using aniline, but the introduction thereof is not as simple as that of para-di-brom-benzene, because the saturation of the argon filling therewith would result in too much getter being introduced. For this reason, the argon line is preferably divided and only about one-tenth of the total amount of argon is allowed to bubble through aniline, so that the gas filling when introduced into the lamp preferably is about 10% saturated with aniline vapor. With this proportion of aniline vapor, it is permissible to use from 3 to 15% of hydrogen and satisfactory results are obtainable.

Petroleum-ether may readily be substituted for the carbonaceous materials before mentioned when used with hydrogen and satisfactory results have been obtained therewith. The gas filling containing a getter material such as aforementioned is introduced into the lamp bulb at a pressure corresponding to that usually employed and it is not necessary to heat the bulb at any time during the process of exhausting or filling with the gas.

Although I have enumerated several specific examples of carbonaceous materials suitable for getters and used, preferably with hydrogen, to prevent carbide formation on the filament, it is to be understood that this invention is very broad. It is considered that any hydrocarbon or carbonaceous material having sufficient vapor pressure to adapt it for introduction with the filling gas or if a solid of low vapor pressure, directly on the filament, and sufficiently free from oxygen and oxidizing materials to exert no appreciable oxidizing effect on the filament, may be employed within the spirit and scope of my invention as defined by the appended claims.

What is claimed is:

1. An incandescent lamp of the type employing a metallic filament operating in a gaseous atmosphere containing an inert gas filling with which is admixed hydrogen and a carbonaceous getter substantially free from oxygen and oxidizing material.

2. An incandescent lamp of the type employing a metallic filament operating in a gaseous atmosphere containing a small amount of aniline.

3. A metallic filament incandescent electric lamp comprising a bulb containing a mixture of argon, a small percentage of hydrogen and aniline vapor.

4. A metallic filament incandescent electric

lamp comprising a bulb having an argon-nitrogen gas filling containing a small proportion of hydrogen and aniline vapor.

5. A getter for gas-filled metallic filament incandescent electric lamps comprising a carbonaceous material, substantially free from oxidizing agents, and admixed with hydrogen.

6. A getter for gas-filled metallic filament incandescent electric lamps comprising a mixture of the vapor of a carbonaceous material, free from oxidizing agents, and admixed with hydrogen.

7. A getter for metallic filament incandescent electric lamps of the gas-filled type comprising aniline.

8. A getter for gas-filled metallic filament incandescent electric lamps comprising a mixture of aniline vapor and hydrogen.

9. A gaseous filling for metallic filament electric incandescent lamps comprising an inert gas mixed with hydrogen and the vapor of a carbonaceous compound, substantially free from oxidizing agents.

10. The method of avoiding the formation of carbide when using a carbon compound as a getter in gas-filled incandescent electric lamps comprising admixing hydrogen with the gas filling.

In testimony whereof, I have hereunto subscribed my name this 21st day of June, 1923.

DANIEL SNYDER GUSTIN.