

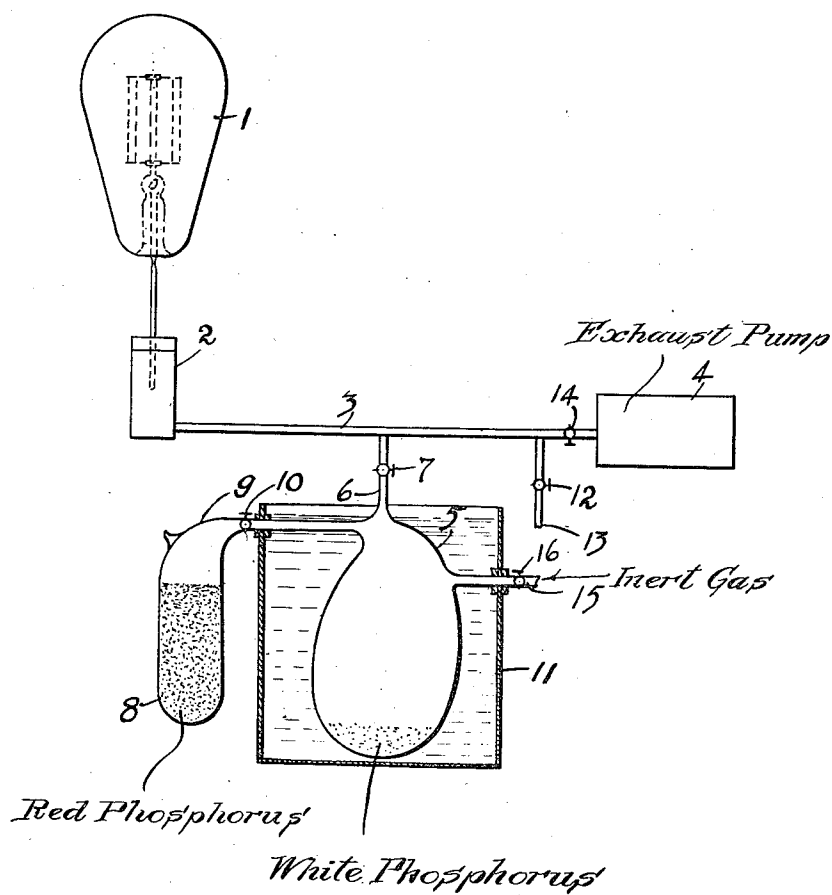
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D. MacRAE

METHOD OF INTRODUCING GETTER MATERIALS INTO INCANDESCENT LAMPS

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INVENTOR
DUNCAN MACRAE

BY

J. F. Ebert
ATTORNEY

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DUNCAN MACRAE, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA.

METHOD OF INTRODUCING GETTER MATERIALS INTO INCANDESCENT LAMPS.

Application filed July 28, 1921. Serial No. 488,098.

To all whom it may concern:

Be it known that I, DUNCAN MACRAE, a citizen of the United States, and a resident of East Orange, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Methods of Introducing Getter Materials Into Incandescent Lamps, of which the following is a specification.

This invention relates to the manufacture of incandescent electric lamps and more particularly to the feature of introducing gases and vapors into the envelopes of the lamps.

An object of this invention is the provision of a novel method for introducing one or more materials into an envelope of an incandescent lamp.

Another object of the invention is to provide a method for mixing gases and vapors in predetermined quantities and in introducing them into lamp envelopes.

A further object of the invention is to provide a method for introducing a chemical material, in its more active state, into a lamp envelope wherein it assists in forming a first class vacuum, and to so regulate the amount of the material introduced that the most satisfactory result is obtained.

Other objects of the invention will be apparent from a reading of the following description.

It has been the practice in the manufacture of incandescent electric lamps to introduce into the envelopes thereof materials which assist in increasing the efficiencies of the lamps. As, for instance, mixtures of materials known in the art as getters have been placed in lamps and vaporized whereby they serve to eliminate certain detrimental effects of residual gases and filament particles. Another instance is the introduction of inert gases, such as argon or nitrogen, which function beneficially throughout the lives of the lamps.

The present practice of introducing the getter materials into lamps is to combine them with certain binders and mount them on the filaments. It has been the aim of the manufacturers to eliminate the use of these binders. While binders are not required for using in gas-filled lamps, it is found that there is no satisfactory manner of introducing getter materials in vapor form in combination with the gas. Up to the present time, two known methods of introducing mate-

rials into lamps without the use of binders have been developed. One of these methods is set forth in my co-pending application for improvements in getters and method of applying the same, filed May 19, 1921, Serial No. 470,672, wherein is described a method of fusing certain materials to filament wires. This method, although satisfactory for the introduction of some materials, does not provide means for introducing all of the materials desired. The other method consists in coating a top tube or exhaust tube with phosphorus and heating the coated portion during the exhaust operations. This method has not proved successful and it is further undesirable because it requires two separate and additional operations as well as an extra handling of each envelope.

The present invention contemplates a method for successfully and easily introducing predetermined amounts of materials into lamp envelopes whereby the difficulties above outlined are overcome. In addition, my method is particularly adapted for introducing phosphorus into the various types of lamps to render harmless any water vapor which may be present. The application of this method and of the method set forth in my co-pending application, admits of the introduction of desired materials without the use of binders to materially increase the efficiencies of the lamps.

My method for economically and easily introducing desired materials into the lamp envelopes may be stated in one manner as consisting in regulating, over wide ranges, the vapor pressure of the desired material in order to evolve definite quantities of vapor, and to conduct the vapor to lamp envelopes. It is known that the pressure of the vapor of a material may be governed or regulated by varying the composition, temperature, or pressure of a solid or liquid material in contact with and capable of evolving the desired vapor. In regulating the pressure of the vapor by varying the composition, a non-volatile substance is preferably employed, in order to avoid the introduction into the lamp of the vapor of such substance. I take advantage of this phenomenon and regulate the pressure of the vapor of a particular material to be introduced into the lamp envelope to thereby regulate the quantity of the material to be conducted to the lamp. In any particular in-

stance, the vapor evolved will fill the space in a container above the material in its solid or liquid form and create a pressure which will prevent the evolving of any further amount of the vapor. When this pressure is reduced, as by removing certain quantities of the vapor, the material will give off vapor until the pressure of the vapor above the material prevents the evolving of further vapors and thus restores equilibrium.

The application of my method for introducing a desired material into the lamp envelopes without the use of binders will be described in detail in connection with the introduction of phosphorus into both vacuum-type lamps and gas-filled lamps.

In the accompanying drawing, the single figure is a diagrammatic illustration of a portion of an automatic exhaust machine and a container connected thereto for carrying the material to be vaporized.

Referring now to the drawing, an envelope 1 of a vacuum lamp is in normal position in one of the holders 2 of an automatic exhaust machine and is connected, by a conduit 3, to an exhaust pump 4. The material to be introduced, in vapor form, into the envelope is placed in a suitable container 5 which is connected to conduit 3 by a short conduit 6 having therein a stop cock 7. In introducing phosphorus, I find that the desired white phosphorus may be economically obtained in its more active form by vaporizing the commercial form of red phosphorus and by regulating the temperature of its condensate or white phosphorus to obtain the desired pressure of the vapor. To this end, I provide a separate container 8 connected to container 5 by conduit 9 which is also provided with a stop cock 10. After the red phosphorus has been introduced into container 8 and the latter has been evacuated, I heat the phosphorus and allow the vapor to pass into container 5 where it is condensed. After a sufficient quantity of the white phosphorus has been condensed, the stop cock 10 may be closed to prevent the vapors of the white phosphorus from passing back into container 8. It is to be understood that, if desired, white phosphorus in bulk form may be introduced into the container 5 without deriving it from red phosphorus.

In regulating the temperature of the white phosphorus to evolve the desired quantities of vapor, I provide a suitable bath 11 of oil or other material which may be heated or cooled in any desired manner to give a substantially uniform temperature to the phosphorus and the vapor evolved therefrom. After the predetermined quantity of white phosphorus has been vaporized, stop cock 7 is opened and the vapor admitted to the envelope 1 which has been exhausted by the normal operation of the automatic exhaust machine. The phosphorus operates in the

lamp envelope, in the usual manner, to promote a first-class vacuum. The passing of a definite quantity of phosphorus vapor from the container 5 unbalances the existing state of pressure equilibrium which prevents further evaporation of the material. As soon as this unbalancing and reduction of pressure takes place, the phosphorus evolves vapor until the pressure within the container has again reached a value which prevents further vapor from being effectively evolved from the condensate or phosphorus at the temperature of the bath.

The time required for the vapor pressure to equalize within the bulb and within the container may be predetermined for a definite vapor pressure and size of the communicating passage, and the pressure thereafter produced in the bulbs may be controlled by maintaining said communicating passage open for a predetermined time.

The application of my method for introducing materials into gas-filled lamps is particularly advantageous as it permits vaporized phosphorus to be introduced and permits of a definite control of the quantities and operations of other materials. My method also provides a flexibility of operation in order that vapors of desired materials may be introduced into the lamp envelope before the gas, or that the vapors may be mixed with the gas and the mixture conducted into the lamp. In the first instance, when it is desired to introduce the vapor first at a lower pressure than that at which it is desired to introduce a gas, such as argon or nitrogen, I find it desirable to exhaust the lamp in the usual manner, close a stop cock 12 in conduit 13 for conducting gas from a suitable source (not shown) and open the stop cock 7 to permit the vapor to pass to the interior of the lamp. After the desired amount of vapor has been introduced, the stop cock 7 is closed and stop cock 12 is opened, thus permitting the gas, under desired pressure, to flow into the lamp. It is to be noted that stop cock 14 leading to the exhaust pump 4 will also be closed during these operations.

In the second instance, when it is desired to mix the gas with the vapor, I provide a conduit 15 leading from a suitable gas supply for the admission of the gas to container 5. The conduit 15 is provided with a stop cock 16 for closing off the supply of gas when desired. After the gas admitted to the container has become saturated with the vapor at the temperature of the bath the stop cock 7 is opened and the combined vapor and gas allowed to flow into the lamp envelope.

When the combined vapor and gas are introduced into lamps by means of a flush exhaust machine, it is found that a certain portion of the vapor will adhere to the

walls and to the mount of the lamp. The quantity of the vapor retained in the envelope may be regulated so that sufficient material will be present to render the water vapor or other deleterious materials harmless.

Although the foregoing description particularly applies to the introduction of phosphorus, in its vapor state, into the envelope of an incandescent lamp in a new and efficient manner, it is to be understood that my method is applicable to the evolving of vapors of other materials and to the introduction thereof into lamp envelopes or other containers wherein they operate in a beneficial manner to increase the life of incandescent lamps and to increase the operating efficiencies thereof.

What is claimed is:

1. The method of introducing a predetermined quantity of a vaporizable material into an envelope which consists in accurately regulating the temperature of said vaporizable material to create a predetermined vapor pressure thereof in an enclosed container, exhausting said envelope and conducting said vapor from said container into said envelope.

2. The method of introducing a predetermined quantity of a vaporizable material into an envelope which consists in heating said material to a predetermined temperature to create a definite vapor pressure thereof within a containing vessel, exhausting said envelope and conducting the vapor from said vessel into said envelope.

3. The method of introducing a predetermined quantity of a vaporizable substance into an evacuated envelope which consists in heating said substance in an enclosed container to a predetermined temperature to create a definite vapor pressure thereof and allowing the vapor pressure in the container and in the exhausted envelope to equalize.

4. The method of introducing a predetermined quantity of a vaporizable substance into an evacuated envelope which consists in accurately regulating the tempera-

ture of said substance in an enclosing vessel to create a predetermined vapor pressure thereof and allowing the vapor pressure in said vessel and in the exhausted envelope to equalize.

5. The method of introducing a predetermined quantity of the vapor of white phosphorus into an evacuated envelope which consists in accurately controlling the temperature of said phosphorus in an enclosing vessel to create a predetermined vapor pressure thereof and allowing the vapor pressure in said vessel and in said evacuated envelope to equalize.

6. The method of introducing an inert gas and an active vapor into an evacuated envelope which consists in heating to a predetermined temperature, in a container, a substance capable of evolving a vapor of the desired material, to create a definite vapor pressure thereof, conducting an inert gas into said container in contact with said vapor and then conducting the combined gas and vapor to the interior of said envelope.

7. The method of adding definite amounts of a vapor to an inert gas to be introduced into a lamp envelope which consists in disposing a body capable of evolving vapor at definite partial pressures in contact with an inert gas, heating said body to a predetermined temperature to evolve a definite amount of vapor and conducting said gas and vapor into said lamp.

8. The method of adding a definite amount of a vapor to a quantity of argon or nitrogen gas to be introduced into an incandescent lamp which consists in heating a body capable of evolving a desired vapor to a predetermined temperature to obtain a predetermined vapor pressure thereof, conducting the vapor evolved therefrom into a supply of said argon or nitrogen gas and passing the combined gas and vapor into the lamp envelope.

In testimony whereof, I have hereunto subscribed my name this 27th day of July 1921.

DUNCAN MACRAE.