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COATED FILAMENTS AND THEIR PRODUCTION

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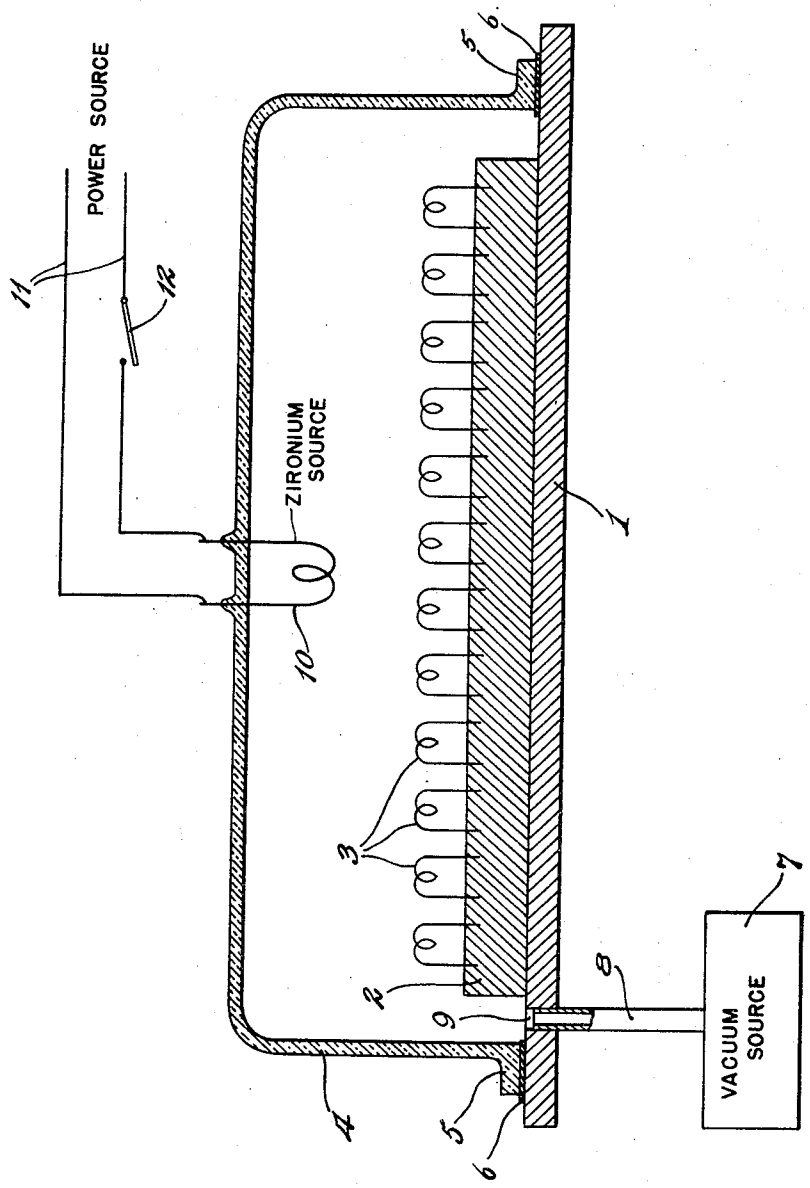

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COATED FILAMENTS AND THEIR PRODUCTION

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3 Claims. (Cl. 117—217)

This invention relates to a form of coated filament for use in incandescent lamps and electron emissive devices and to their production.

An object of the invention is to provide incandescent filaments and electron emissive cathodes with a coating of zirconium on the tungsten filament forming a part thereof, as a foundation for a coating of red phosphorous and coating of electron emissive material respectively, whereby the zirconium coating is interposed between the filament and the red phosphorous or the emissive coating.

Another object of this invention is to provide an improved filament for incandescent lamps and an improved heater for electron emissive coating which contribute to a better life and better lumen maintenance by reason of less blackening when used in incandescent and fluorescent lamps.

Another object of the invention is to provide a simple and effective method of treating tungsten filaments in quantity in preparation for coating with electron emissive material or red phosphorous and the like for the purpose of providing a getter action for absorbing impurities such as oxygen from the incandescent lamps and electron discharge devices of which the coated filament is to become a part.

More specifically it is an object of this invention to provide tungsten filaments having a light microcrystalline coating of zirconium applied before treating the filaments with red phosphorus in preparation for addition of electron emissive coating materials.

Other objects and advantages of the invention will in part be obvious and in part appear hereinafter.

The invention, accordingly, is embodied in lamp filaments basically suitable for use in incandescent lamps, fluorescent lamps, or electron emissive devices, characterized by their having a light microcrystalline coating of a metal such as zirconium deposited over the entire surface of the filaments, which coating is present as an undercoating for the electron emissive material applied to the filament, and in the method of coating filaments with metal wherein the metal is evaporated in an enclosed space containing the filaments, the space being maintained at a vacuum of the order of 10 microns of mercury, preferably about 4, while the filaments are moved about in the space.

In the attached drawing the single figure is a diagrammatic illustration of an apparatus, partly in vertical, central cross-section, illustrating an apparatus suitable for practicing the method of the invention and in part illustrating the method.

It will be understood that the apparatus illustrated in the drawing is for diagrammatic purposes since its actual form can be widely varied by those skilled in the art to facilitate the practice of the invention. As illustrated it includes a suitable solid base 1, on which is placed a suitable support 2 for a plurality of tungsten filaments 3 which are to ultimately become electron emissive cathodes. It is a feature of this invention that these filaments may be treated in accordance with this method in large quantities in a single operation, and it is proposed, therefore, that the support 2 be of such size and dimensions as to support a large number of tungsten filaments 3. These filaments may be attached to the support 2 in any convenient manner, as for example, as illustrated, the ends thereof may be inserted into suitable spaced pairs of apertures so that the filaments will project above the support 2. A bell jar or housing of any suitable form of material, such as the above noted glass vessel 4, is placed over the support 2 so as to completely enclose the filaments 3. The housing 4 is provided with a peripheral flange 5 at its open side having a flat surface resting on a gasket 6 arranged on the base 1. In accordance with well known practice an effective seal against air leakage is thus provided and the sealing effect of the contacting surfaces can be enhanced by using some viscous material such as a grease.

Since the degree of vacuum preferred for the vessel is of the order of 10 microns, best quality high vacuum type sealing greases, free of volatile matter, are used.

As illustrated there is mounted in the bell jar 4 a heavy tungsten filament 10, which for example may be of a 1000 watt capacity. This filament is adapted to be connected by means of a power circuit 11 to a suitable source of energizing power, and can be controlled in an obvious manner by means of a switch 12.

The filament 10 provides the source of zirconium which may be associated therewith in different ways. For example the filament 10 may have zirconium incorporated therein, or preferably it may be wrapped with a light ribbon or wire of zirconium so that when the filament 10 is incandescent the zirconium will be heated to the boiling point and zirconium vapor will permeate the atmosphere of the bell jar 4. The zirconium can be associated with the heating filament 10 in any other way effective to cause boiling, and, therefore, evaporation thereof when the filament 10 is incandescent.

In operation it is found that a ribbon of zirconium may be coiled around the heater and when current flows the zirconium melts to provide the source of vapor. Generally it is preferable to provide for complete evaporation of the zirconium onto a single batch of filaments. Since the amount deposited on a filament is less than 1 per cent of its weight, and preferably only about 0.01 to 0.5 per cent, good control is effected by starting with a weight of zirconium thus related to the weight of the number of filaments to be coated.

The atmosphere within the bell jar is removed through a port 9 to which is connected any suitable form of vacuum source 7 by means of a flexible tube or pipe 8. The vacuum source may be any of the available power driven vacuum pumps or systems by means of which a very high vacuum may be created within the bell jar.

Although the method of the invention will be apparent from the above description, it may be noted that the filaments 3 are first mounted upon the support 2 which is placed on the bedplate 1, and the bell jar 4 is then inverted thereover. The vacuum source is set in operation and a very good vacuum is created within the space defined by the bell jar. The switch 12 is then closed, causing the heating filament 10 to attain incandescence and in turn causing the zirconium associated therewith to be heated to the evaporation point. The zirconium vapor permeates the space within the bell jar and condenses upon the tungsten filaments 3, providing them with a very thin coating of zirconium.

Because vapor generated in an evacuated space will condense on the cool surfaces of the filament coils

closest to the source of the vapor a uniform coating is best obtained by agitating them gently during the deposition operation. Since the bell jar in which they are enclosed is generally quite small it can be agitated by hand or mechanically. It appears that the vibrations thus induced in the filaments are adequate to accomplish uniform deposition of zirconium on their surfaces.

Examination of the coated filaments indicates the coating is of a microcrystalline form, uniformly deposited over the surface of the wires forming the coils.

When this operation has been completed switch 12 is opened, air is allowed to return to the interior of the bell jar 4, and the support with the coated filament 3 is then removed therefrom. These filaments are then ready for coating with red phosphorous or the usual emission coating materials commercially used in the treatment of cathodes for electron emissive devices. The coated filaments are then assembled on the usual stem tubes for most uses, as for example when employed in incandescent lamps and fluorescent lamps and incorporated in the final lamp.

As is well understood by those skilled in the art such coated filaments when in use are heated and the zirconium film will act as a getter to absorb the impurities of the device, including particularly any oxygen trapped therein.

It will be quite clear to those skilled in the art that this method is not limited to the application of a zirconium film to a purely tungsten filament. It is equally applicable for coating filaments of any of the other metals or mixtures or alloys thereof which are commonly known as the heater for cathodes having electron emissive coatings. It is intended, therefore, by any reference in the claims to tungsten filaments to include all the equivalent metallic filaments used as the heaters for electron emissive cathodes.

From the above description it will be apparent to those skilled in the art that the subject matter of this invention is capable of application in other forms of apparatus and with variations in the details of the method itself, and I do not, therefore, desire to be strictly limited to the illustrative example herein given, but rather by the claims granted me.

This application is a continuation-in-part of my application Serial No. 140,729, filed January 26, 1950, now abandoned.

What is claimed is:

1. A wire filament characterized by its having a thin microcrystalline surface coating of zirconium, said coating amounting to about 0.01 to 1 per cent of the weight of the filament and an electron emissive coating overlaying said zirconium coating.

2. A filament in accordance with claim 1 in which the base wire is tungsten and the coating is about 0.5 per cent of the weight thereof.

3. The method of preparing an electron emissive filament comprising providing a zirconium source and making it part of a resistor in an electric circuit, enclosing said zirconium source in an enclosed space, also enclosing in said space a plurality of metal heater filaments on which it is desired to deposit zirconium, evacuating said space to a high degree of vacuum, and passing electric current through said zirconium source sufficient to heat it to evaporation temperature, thereby to generate zirconium vapor in said evacuated space and to condense a thin layer of zirconium on said metal heater filaments in said enclosed space, agitating said filament during said evaporation, and thereafter coating said metal heater filaments with electron emissive material.

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