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I. BRODY

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INCANDESCENT LAMP

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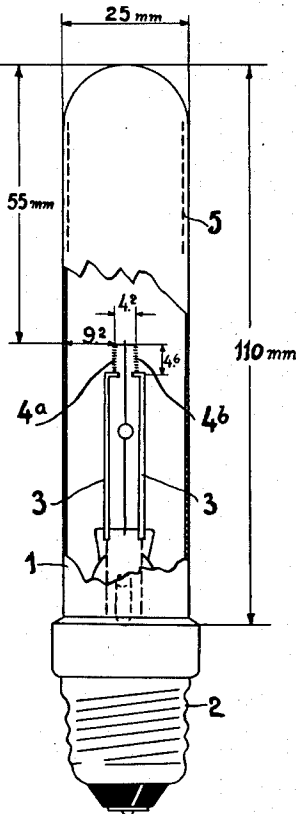


Fig. 1.

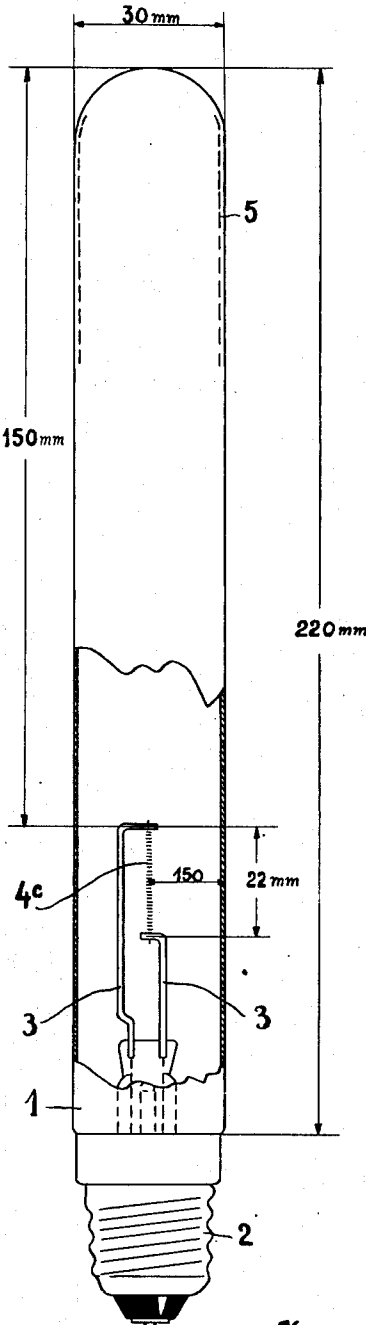


Fig. 2.

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UNITED STATES PATENT OFFICE

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INCANDESCENT LAMP

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mesne assignments, to General Electric Com-
pany, a corporation of New York

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In Austria November 18, 1932

1 Claim. (Cl. 176-16)

My invention relates to incandescent lamps, and more particularly to incandescent lamps of the type comprising a tubular bulb the length of which substantially exceeds its diameter, and which is filled with a gas under pressure. The term "tubular" as used in this specification and the appended claim is intended to include conical and other shapes approaching tubular configuration.

This application is a continuation-in-part of my copending application for U. S. Letters Patent Serial No. 697,020, filed November 7, 1933.

It is an object of this invention to provide lamps of the type aforesaid for the maintenance of the intensity of light initially emitted by the lamp.

It is another object of the invention to increase both economy and life of lamps of the aforesaid type.

Other objects, and the manner in which the same are attained, will appear from the following description.

Lamps comprising a tubular bulb the length of which is substantially greater than its diameter are principally, though not exclusively, used for projection purposes. In this case, by far the greater part of the light is projected in a direction perpendicular to the longitudinal axis of the bulb. For example, if the lamp is to be used for projection purposes, the longitudinal axis of the bulb may extend in vertical direction, while by far the greatest part of the light is directed in horizontal direction, for example, onto a screen or the like.

In lamps of this type, owing to the comparatively small diameter of the tubular bulb, the filament is always positioned in comparatively close proximity to the longitudinally extending glass walls of the bulb. Modern lamps of this type usually employ filaments made of a high melting metal, preferably tungsten, and a filling of gas under a pressure not exceeding one atmosphere. As is well known in the art, tungsten is evaporated from the filament during the operation of such lamps, and the tungsten so evaporated is deposited on the glass walls of the bulb.

In the tubular lamps of the prior art, the deposit of metal particles derived from the filament invariably took place on that part of the glass wall of the bulb which was located adjacent to the filament. Since the same part of the glass wall, however, was relied upon to admit the passage of by far the greatest part of the light emitted from the filament, the decided drawback was encountered that just the part of the bulb

responsible for the passage of practically the entire intensity of light to be utilized was blackened by the aforesaid deposit, whereby the intensity of light emitted by the lamp was rapidly reduced. This of course, resulted in the economy becoming increasingly bad, and the life of the lamp being abbreviated to an objectionably short period.

Ever since this drawback was first observed, it has been a desideratum in this art to eliminate such drawback and to prevent the parts of the bulb located in close proximity to the filament and therefore principally responsible for the passage of light emitted therefrom, from becoming blackened by the deposit of particles deriving from the filament. However, prior to the present disclosure no one succeeded in eliminating this disadvantage.

I have now found that the aforesaid drawback is completely eliminated, and the initial intensity of the light emitted by the lamp is maintained so as to insure optimum economy and an extended life of the lamp, if a lamp answering certain dimensional requirements is provided with a filling of a gas under a pressure of at least, and preferably exceeding, two atmospheres. Extended tests have shown that tubular lamps provided in accordance with the concept of the invention as generally outlined above are distinguished in that the deposit of particles derived from the filament no longer takes place on the parts of the bulb walls adjacent to the filament, but rather is displaced toward the top of the bulb where it does not hinder the passage of light.

This concept of the invention is based on the recognition that in the tubular projection lamp as hitherto known, the so-called Langmuir's gas layer, i. e., the stationary gas layer surrounding the filament, was so wide as to extend all the way from the filament to the walls of the bulb, and in consequence thereof no convection current of the gas capable of displacing the tungsten vapor from the vicinity of the filament to parts of the bulb where it would be less objectionable, could arise. In normal, gas-filled lamps, the gas outside of the Langmuir-layer, in circulating within the bulb, is instrumental in removing the tungsten vapor from the vicinity of the filament. In contradistinction to normal bulbs, however, such displacement did not take place in tubular lamps such as hitherto disclosed, since here, owing to the close vicinity of the filament to the glass wall, the Langmuir-layer was sufficiently wide to prevent any convection flow of the gas within

the bulb. In filling a tubular lamp bulb answering certain dimensional requirements with a gas under a pressure of at least two atmospheres, I reduce the width of the Langmuir-layer to an extent such that a gas filling the bulb is free to circulate therein so as to displace any particles derived from the filament, which formerly were deposited in the vicinity of the filament, toward the top part of the bulb where such deposit is not objectionable.

In the drawing affixed to the specification and forming part thereof, several embodiments of the invention are illustrated by way of example.

In the drawing,

Fig. 1 is a side elevation of a projection lamp comprising a tubular bulb and two spaced tungsten spirals forming the filament, the bulb being filled with a gas under a pressure exceeding two atmospheres; while

Fig. 2 illustrates, in side elevation a similar lamp comprising, however, only one tungsten spiral which serves as the filament.

Referring to the drawing, and first to Fig. 1, 1 denotes the tubular bulb which is provided with a socket 2 for vertical support. Leads 3 are provided for supporting the filament which comprises two tungsten spirals 4a and 4b. At 5, there is indicated the deposit of tungsten particles derived from the filament, this deposit being located in the top part of the bulb where it does not hinder the passage of light which takes place through the parts of the bulb adjacent to the filament.

As shown in Fig. 2, wherein like elements are denoted by the same reference numerals as employed in Fig. 1, only a single tungsten spiral 4c may serve as the filament, other conditions being substantially as described above with reference to Fig. 1.

In the execution of the invention, it is essential that the lamp is always arranged in substantially vertical position. The lamps shown in the drawing, for example, may be arranged either in the position shown where they would be mounted on a support, or else they might be arranged in an inverted position, so as to be suspended from above.

It is further essential that the length of the bulb is at least 3.5 times its diameter.

The filament is preferably provided in the form of one or several spirals of a high melting metal such as tungsten, the spiral or spirals being arranged in, or in parallel to, the axis of the bulb. The upper end of the spiral or spirals forming the filament is spaced from the top of the bulb about a distance equalling at least the length of each spiral. The spiral or spirals forming the filament are spaced from the side walls of the bulb about a distance which may be generally defined as increasing in proportion to any increase in length of the spiral or spirals.

I have found that the gas filling of the bulb should be under a pressure of at least two atmospheres, this being the critical limit below which no proper effect according to the invention is obtained. While a pressure of two atmospheres is the lower critical limit, the pressure may be optionally increased above this amount according to requirements without sacrificing the advantages of the invention.

The pressure intended to prevail in the bulb determines, to some extent, the dimensional re-

lationship between the bulb and the filament, in particular, the distance between the spiral or spirals of the filament and the side walls of the bulb. I have found that if this pressure is in the neighborhood of two atmospheres, the spiral or spirals of the filament should be spaced from the adjacent part of the bulb wall about a distance equalling the length of each spiral. If the pressure is in the neighborhood of eight atmospheres, this distance is reduced to about one half of the length of each spiral.

In order to further illustrate the invention, two examples of lamps built in accordance with the invention and obtaining the novel, advantageous effect of displacing the deposit toward the top of the bulb are stated below.

Example 1.—A lamp filled with a gas under a pressure of 2.1 atmospheres and adapted for operation at 30 v. and 100 w. was provided with a tubular bulb having a diameter of 25 mm. and a length of 110 mm. Two parallel tungsten spirals, electrically connected in series each having a length of 4.6 mm., were provided spaced from each other about a distance of 4.2 mm., the top ends of each spiral being spaced from the top end of the bulb about a distance of 55 mm., the distance between each spiral and the adjacent part of the bulb wall being 9.2 mm.

Example 2.—A lamp filled with a gas under a pressure of six atmospheres and adapted for operation at 115 v. and 200 w. was provided with a tubular bulb having a diameter of 30 mm. and a length of 220 mm. One tungsten spiral was provided at a length of 22 mm., the top end of this spiral being spaced from the top end of the bulb about a distance of 150 mm. The spiral was spaced from the adjacent part of the bulb wall about a distance of 15 mm.

I have further found it useful to establish between the dimensions and the glass material of the bulb a ratio such that the product of the tensile strength of the glass and the lowest wall thickness of the bulb is more than three times the product of the gas pressure in the bulb and the largest circumference of the bulb, the gas pressure being measured as usual at room temperature.

If it is desired to fill the bulb with gas under particularly high pressure, I have found it useful to cover the bulb with a protective netting.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

I claim:

An incandescent lamp of the type mounted in substantially vertical position, comprising in combination a tubular bulb having a length of at least 3.5 times its diameter, a gas under a pressure exceeding 2 atmospheres filling said bulb, and a filament of a high melting metal provided in said bulb, said filament comprising at least one spiral extending in parallel to the axis of said bulb, the upper end of said spiral being spaced from the top of said bulb about a distance at least equalling the length of said spiral, said spiral being spaced from the adjacent part of the bulb wall about a distance ranging, for the pressure range from above 2 up to about 8 atmospheres, from the length of the spiral to half said length.

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