

[54] LOW-PRESSURE MERCURY VAPOUR DISCHARGE LAMP

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[56] References Cited

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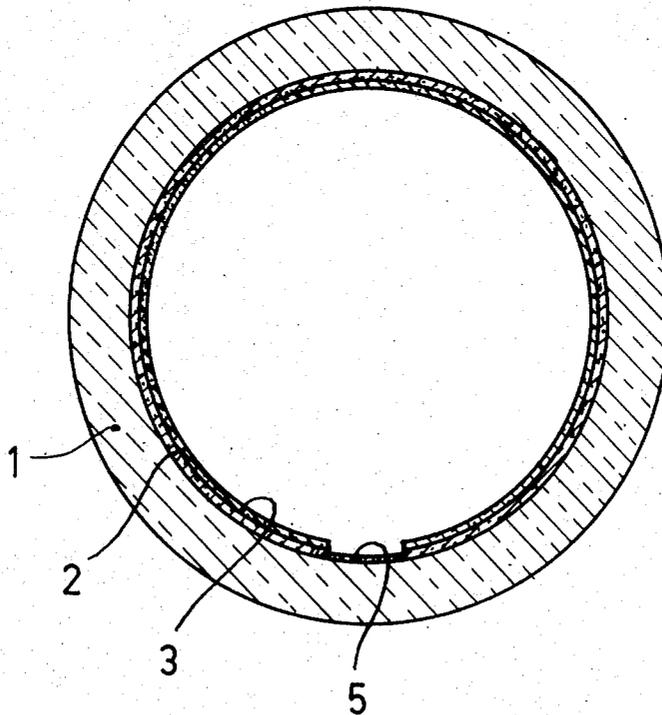
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[57] ABSTRACT

An aperture lamp, especially for phototype purposes in which the glass in the aperture is coated with a conducting transparent coating having a resistance of between 5 and 200 kOhms. This coating does not only reduce blackening of the glass in the aperture but also decreases the ignition voltage considerably.

7 Claims, 4 Drawing Figures



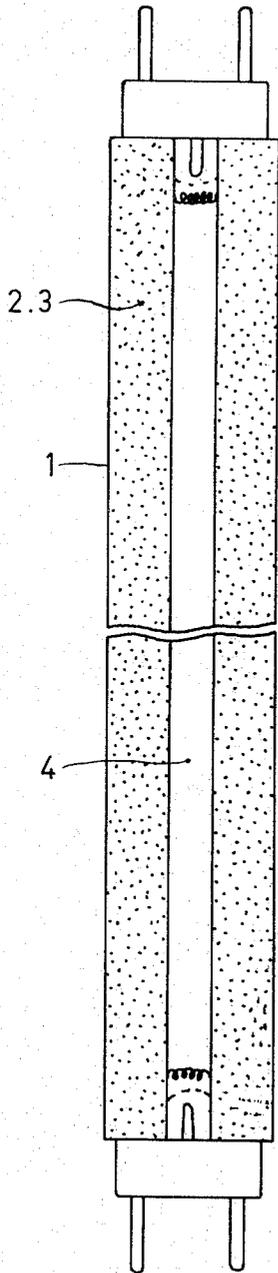


Fig. 1

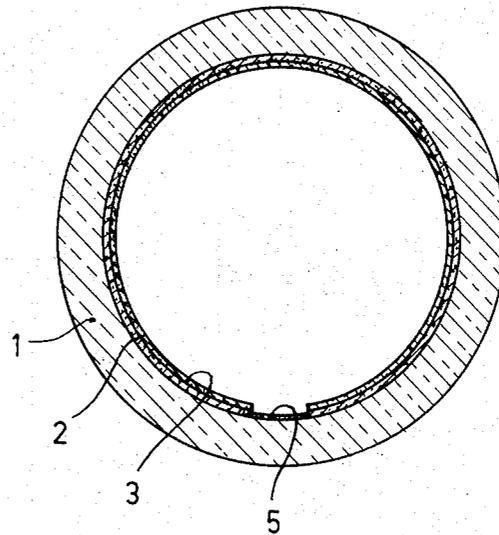


Fig. 2

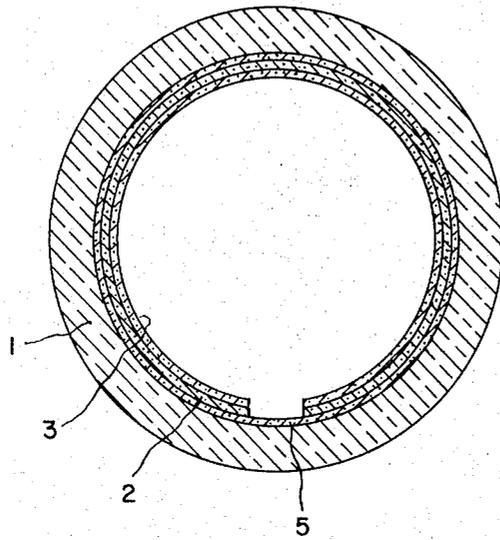


Fig. 3

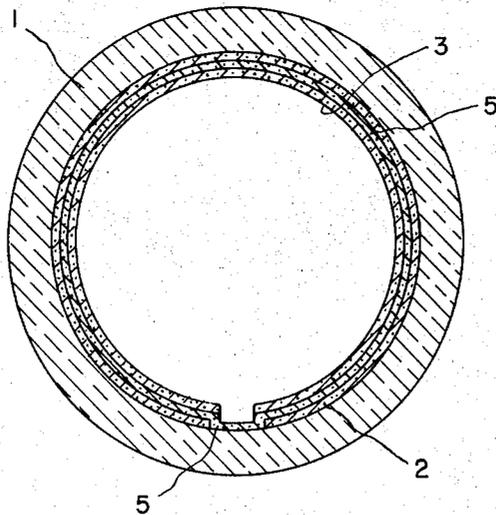


Fig. 4

LOW-PRESSURE MERCURY VAPOUR DISCHARGE LAMP

The invention relates to a low-pressure mercury vapour discharge lamp having a cylindrical glass envelope which includes means for generating a discharge and whose inner side is coated with a layer of luminescent material.

Lamps of the kind described above are known in many embodiments. They are used, inter alia, for general illumination, advertisement purposes and in phototype apparatus. In many cases lamps for phototype apparatus are not coated with the luminescent material over the entire inner circumference of the envelope. A longitudinal aperture in the luminescent coating in lamps of this kind through which a large part of the generated radiation emerges is often provided in order to have a strong directed radiation. The invention relates to the above-described aperture lamps which are particularly used for phototype apparatus.

In order to increase the radiation of light through the aperture it is ensured in special lamps that the radiation from the luminescent coating is reflected into the direction of the aperture. This object is achieved, for example, by using a relatively thick luminescent coating or by providing a special reflection coating between the envelope and the luminescent coating. In the first-mentioned embodiment part of the thick luminescent coating serves for generating the radiation and part serves for the reflecting thereof. When a separate reflection coating is used, it generally consists of titanium dioxide.

As described above the aperture is completely free from luminescent material and from reflecting material possibly present. It has been found that the glass in the aperture which is exposed to the direct influence of the discharge blackens after a given number of operating hours. As a result the radiation is of course inhibited. Particularly when the lamps have a high power in order to generate a strong radiation this blackening occurs quickly and to a strong extent. It has been known to obviate this blackening by coating the glass in the aperture with a transparent layer of aluminium oxide, silicon oxide or titanium dioxide.

As is known given auxiliary means are required for igniting low-pressure mercury vapour discharge lamps. These auxiliary means may consist of, for example, the provision of internal or external ignition strips made of widely divergent materials which are provided either on the glass or on the luminescent coating. It is also known to provide a transparent semiconducting layer for lamps without an aperture between the entire luminescent coating and the glass wall. Such a layer consists preferably of tin oxide which is rendered semiconducting by a given treatment, so-called doping. Known doping means are phosphorus, antimony, fluorine, oxygen and indium.

A further material having semiconducting properties is indium oxide with given doping materials, for example, tin. Such a material is used for a different purpose in sodium vapour discharge lamps but has not yet been proposed for low-pressure mercury vapour discharge lamps.

An object of the invention is to solve at the same time the problem of ignition and the problem of blackening of the glass in the aperture. This is achieved by coating the glass in the aperture on the inner side with a trans-

parent layer which, measured from end to end, has a resistance of between 5 and 200 kOhm and preferably between 20 and 100 kOhm.

Particularly, conducting tin oxide or conducting indium oxide is suitable as a material for coating the glass in the aperture.

In order to facilitate ignition even more, the conducting coating may be connected at one end to an emitter electrode.

The conducting coating may be provided in the aperture in different manners. The material of the coating may be sprayed on, it may be provided from a solution or it may be spread out with the aid of a pencil-like pin. This operation may be performed prior to or after the luminescent coating and the reflection coating possibly present have been provided. It is particularly simple to provide the material when conducting material is not only provided in the aperture but over the entire circumference of the envelope. In fact, the entire envelope may then first be coated on the inner side with the conducting material, whereafter the possible reflection coating and subsequently the luminescent coating may be provided.

It has surprisingly been found that in lamps according to the invention there is no stain formation as is known for lamps without an aperture which are coated over the entire envelope circumference with semiconducting tin oxide.

Alternatively, the reflection coating may first be provided and subsequently the entire inner circumference may be coated with the semiconducting material, for example, by spraying. The material is then directly located on the glass in the aperture and outside the aperture between the reflection coating and the luminescent coating.

The invention will now be described with reference to a drawing.

In the drawing

FIG. 1 is a perspective view of a lamp according to the invention.

FIG. 2 shows an enlarged cross-section through the centre of the lamp.

FIGS. 3 and 4 illustrate other embodiments of the lamp in cross-section.

In the Figures, 1 denotes the glass envelope of the lamp. A reflection coating 2 consisting of fine-grained TiO_2 is provided on the inner side of this glass envelope, which coating supports on its inner side the luminescent coating 3, for example, consisting of willemite. A longitudinal aperture 4 is recessed both in the reflection coating 2 and in the luminescent coating. The glass in the aperture is coated with a transparent coating of conducting tin oxide 5 obtained by spraying on a mixture of tin chloride, ethyl alcohol and a slight quantity of hydrofluoric acid. This spraying on was effected at a glass envelope temperature of approximately 600°C in such a manner that the resistance of the coating in the finished lamp measured from end to end was 30 to 50 kOhm.

For comparison of the ignition properties and the loss of light due to blackening of the aperture, lamps were also made without any coating of the glass in the aperture and lamps with a coating of transparent titanium dioxide on the glass in the aperture.

The table below shows that for lamps according to the invention the decline in the luminous flux due to blackening of the aperture is much smaller than for

lamps with uncoated glass and is of the same order as for lamps having a coating of titanium dioxide in the aperture. The ignition voltage for lamps according to the invention is, however, much lower than in the two comparative lamps both at room temperature and at 60° C. Apart from the coating of the aperture the lamps were completely identical. The internal diameter was 24 mms and the length between the electrodes was 425 mms. The width of the aperture was 7 mms in all lamps. The load in the measuring arrangement was 400 mA. The light measurement was effected in the centre of a lamp by placing a stop having an opening of 40 × 3 mms above the aperture and by measuring the incident light in arbitrary units.

TABLE

	Ignition voltage at 20° C. in volts	Ignition voltage at 60° C. in volts	Light output after p hours					
			0	20	100	300	500	750
Lamp with uncoated aperture.....	>230	>280	12.8	12.8	10.6	9.4	8.5	7.2
Lamp with aperture with TiO ₂	>230	>280	12.9	13.3	12.0	11.7	10.9	10.8
Lamp with aperture with SnO ₂	135	<150	11.4	12.5	11.4	11.3	10.6	10.3

If an indium oxide layer instead of a transparent conducting tin oxide layer is provided, use is made of, for example, a spraying solution which contains indium chloride and a small quantity of tin chloride as a doping material in butyl acetate. The comparative results obtained therewith do not essentially deviate from the results shown in the above-mentioned table.

Although in the drawing a straight lamp having an aperture is shown the invention may of course also be used for aperture lamps having a bent shape, for example, U-shaped lamps.

FIG. 3 illustrates a low pressure mercury vapour discharge lamp wherein the transparent coating extends over the entire circumference of the envelope and engages the glass at all areas. Layer 5 is the transparent coating, layer 2 is again the reflective layer and layer 3 the luminescent layer.

In FIG. 4, low pressure mercury vapour discharge lamp is shown wherein the transparent coating extends over the entire circumference of the envelope, the portion present outside the aperture being located between the reflection coating and the luminescent coating. Layer 2 represents the reflective coating and layer 3 the luminescent coating.

What is claimed is:

1. A low-pressure mercury vapour discharge lamp having a cylindrical glass envelope which includes means for generating a discharge and whose inner side is coated with a coating of luminescent material over

such a part of the circumference that a longitudinal aperture is free from said luminescent material, the glass in the aperture being coated on the inner side with a transparent coating of a material reducing attack and blackening of the glass, the transparent coating, measured from end to end, having a resistance of between 5 and 200 kOhms.

2. A low-pressure mercury vapour discharge lamp having a cylindrical glass envelope which includes means for generating a discharge and whose inner side is coated with a coating of luminescent material over such a part of the circumference that a longitudinal aperture is free from said luminescent material, a coating consisting of titanium dioxide being provided between

the glass envelope and the luminescent coating, which titanium dioxide coating reflects the radiation produced in the luminescent coating satisfactorily, the glass in the aperture being coated on the inner side with a transparent coating of a material reducing attack and blackening of the glass, the transparent coating, measured from end to end, having a resistance of between 5 and 200 kOhms.

3. A low-pressure mercury vapour discharge lamp as claimed in claim 2 wherein the transparent coating, measured from end to end, has a resistance of between 20 and 100 kOhms.

4. A low-pressure mercury vapour discharge lamp as claimed in claim 2 wherein the transparent coating in the aperture consists of conducting tin oxide.

5. A low-pressure mercury vapour discharge lamp as claimed in claim 2 wherein the transparent coating in the aperture consists of conducting indium oxide.

6. A low-pressure mercury vapour discharge lamp as claimed in claim 1, wherein the transparent coating extends over the entire circumference of the envelope and engages the glass at all areas.

7. A low-pressure mercury vapour discharge lamp as claimed in claim 2, wherein the transparent coating extends over the entire circumference of the envelope, the portion present outside the aperture being located between the reflection coating and the luminescent coating.

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