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[54] MERCURY VAPOR LAMP

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[52] **U.S. Cl.** **313/23,** 313/24, 313/26, 313/35, 313/220, 313/225, 313/228, 313/229, 313/312, 313/317
[51] **Int. Cl.** **H01j 61/52**
[58] **Field of Search** 313/17, 22–26, 313/28, 35, 36, 220, 223, 225, 227–229, 312, 317, 324

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[57] ABSTRACT

In a doped mercury vapor lamp having an elongate vertical burner, an upper portion of the surface of the burner is maintained at a lower temperature than a lower portion to reduce separation of the dopant. Heat-emission from the upper portion of the surface of the burner may be increased compared to the lower portion of the burner by increasing the diameter (and hence the heat-exchange area per unit length) in the upper portion, by reducing the thickness of an air gap to an envelope in the upper portion, or by playing coolant selectively on to the upper portion of the surface of the burner.

10 Claims, 6 Drawing Figures

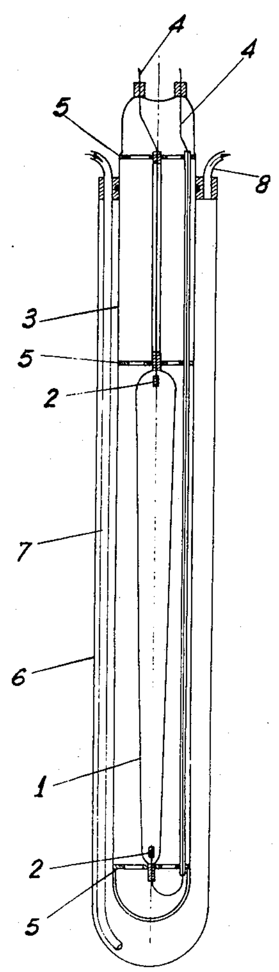


FIG.1

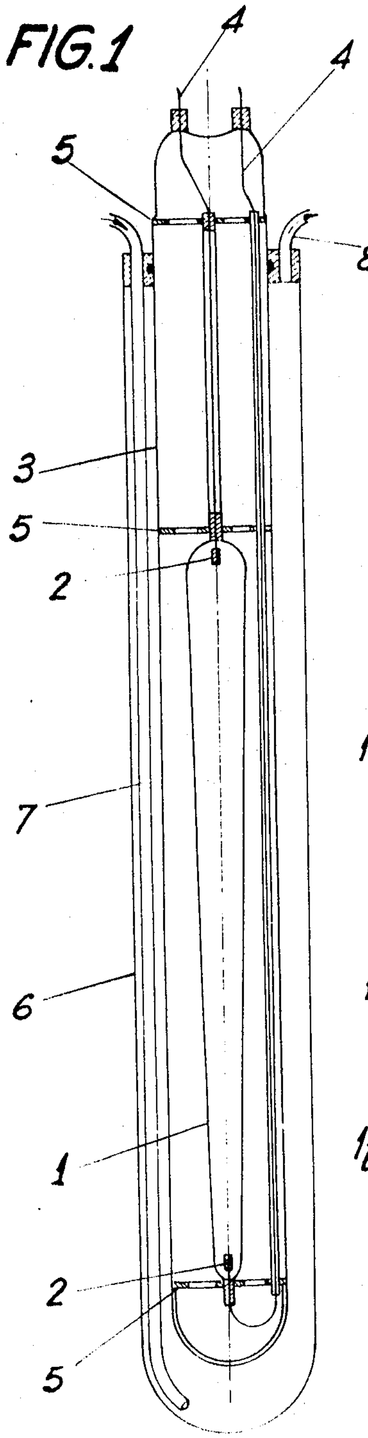


FIG.2

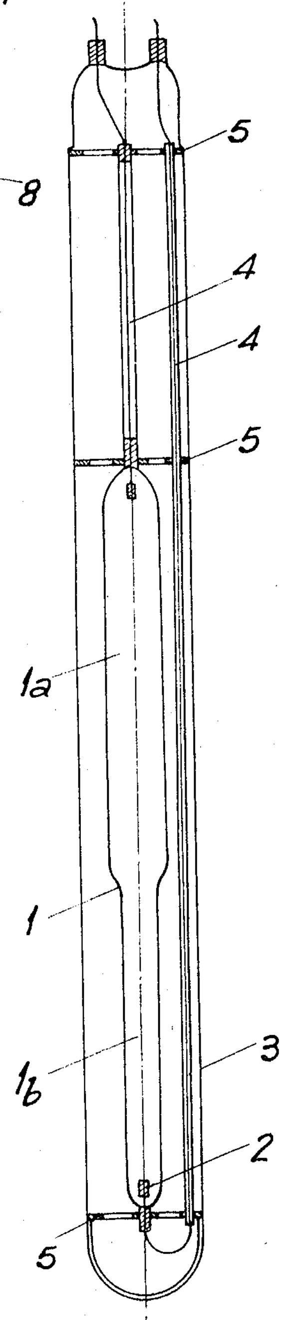


FIG.3

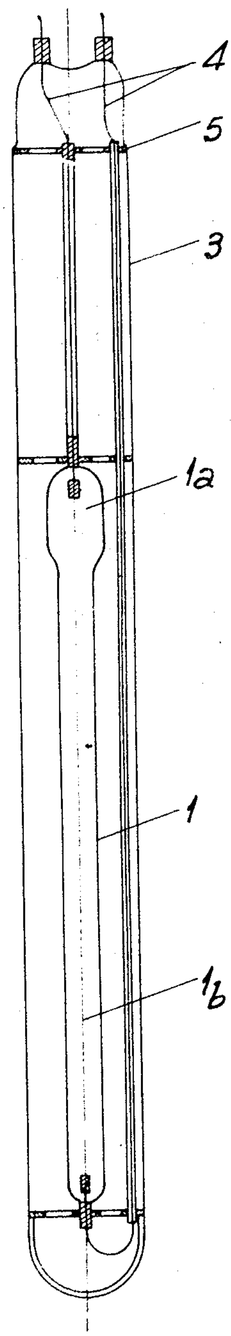


FIG. 5

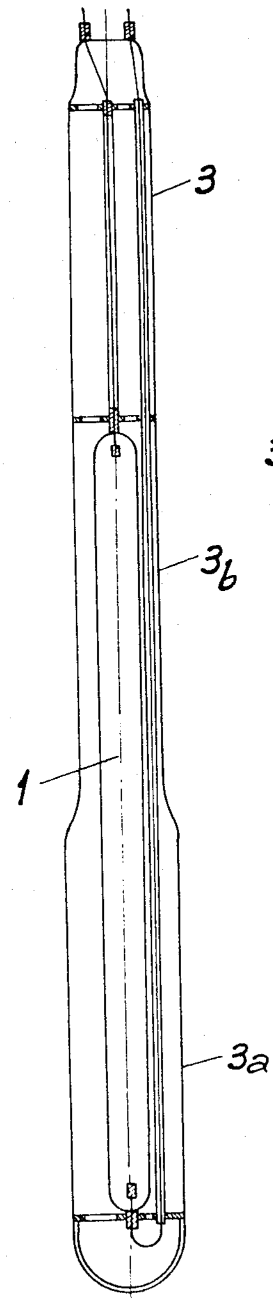


FIG. 4

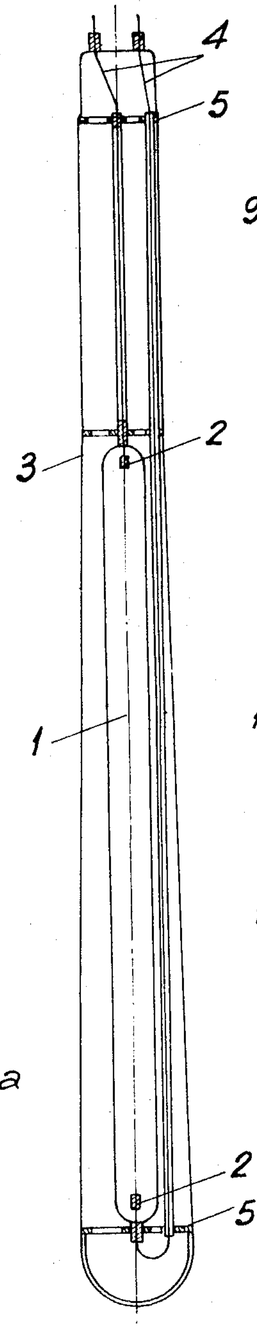
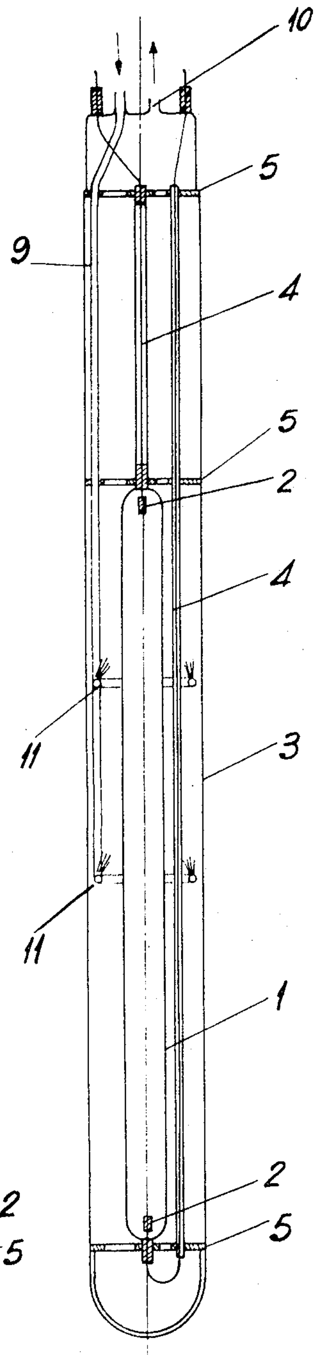


FIG. 6



MERCURY VAPOR LAMP

BACKGROUND OF THE INVENTION

The present invention relates to a mercury vapor lamp, and in particular to a high-pressure lamp of this kind which may be used in photochemical processes, for example. Such a lamp generally comprises a burner in the form of an elongate transparent bulb, for example of quartz, through the sealed ends of which there pass electrodes which are often made of tungsten or molybdenum.

This burner is itself enclosed in a transparent envelope normally of toughened glass resistant to thermal shock.

Electrical conductors for applying voltage to the electrodes can pass through seals in the envelope. The envelope is sometimes surrounded by a jacket, which is also transparent and through which a transparent coolant, generally water, is circulated. The envelope usually contains a gas which may be air in fairly low-power lamps, but which, for lamps having powers in excess of around 10 kW, may be an inert gas such as nitrogen, containing no water vapor.

These lamps are often operated in the vertical position and this is in particular the case where they are used in photochemical reactions.

It is possible to have inside the burner, besides the mercury, certain matter which is excited by the electric arc and emits its own light radiation. Such additional matter is generally constituted by metals or compounds thereof, and more especially by metal halides. Thus, iodides are quite commonly used, for example thallium iodide which produces green light, etc. This additional matter is termed dopant material and lamps containing dopant material are said to be "doped." The proper choice of dopant material makes it possible to obtain light radiation of predetermined wavelengths which will for example promote the yield of a photo-chemical reaction.

However, experience indicates that when a doped lamp arranged in a vertical or substantially vertical attitude is in continuous operation, after a period of time the dopant material tends to separate out and concentrate in the bottom part of the burner. The result is that the light spectrum varies considerably from one end of the burner to the other and in some cases, the situation may deteriorate to the extent that the bottom part of the burner is emitting the desired wavelengths whilst the rest of the burner behaves as if it only contained mercury vapor.

SUMMARY OF THE INVENTION

An object of the present invention is to alleviate this problem, and one aspect of the invention provides a doped mercury vapor lamp comprising an elongate burner for operation with its length generally vertical, and a transparent envelope in which said burner is disposed, the lamp being adapted to operate with a first portion of the surface of said burner at a lower temperature than a second portion thereof which is disposed below said first portion.

Another aspect of the invention provides a doped mercury vapor lamp comprising an elongate burner for operation with its length generally vertical, and a transparent envelope in which said burner is disposed, the lamp being adapted to operate with a greater dissipation of heat per unit height of the burner from a first portion of the surface of the burner than from a second portion thereof which is disposed below said first portion.

The dissipation of the heat in the upper portion of the burner can be promoted in a variety of ways, for example by using the following features either separately or in combination:

giving the upper portion of the burner a larger heat exchange area per unit height with the surrounding environment than the lower portion;

giving the space which surrounds the upper portion of the burner a lower means thickness than that at the lower portion;

scavenging part of the burner surface by means of a fluid at an appropriate temperature.

DESCRIPTIONS OF THE DRAWINGS AND EMBODIMENTS

Other features and advantages of the invention will appear from the following description of embodiments thereof, given by way of example, with reference to the accompanying drawings, in which:

FIGS. 1 to 6 are schematic, longitudinal views partly in section of various doped mercury vapor lamps in accordance with the invention.

In the embodiment illustrated in FIG. 1, the mercury vapor lamp comprises a burner 1 constituted by an elongate quartz bulb containing doped mercury. The ends of the bulb are traversed by electrodes 2.

The burner is mounted in a sealed envelope 3 filled with a gas such as nitrogen. The envelope 3 contains sealed lead-throughs for electrical leads 4 and 5 connected to the electrodes 2.

Perforated washers 5 of refractory material locate the ends of the burner and the sleeves of the conductors in the envelope 3.

This envelope 3 is surrounded by a jacket 6 closed by an annular plug through which there passes a tube 7 supplying fluid, for example water, the tube 7 terminating at the bottom of the envelope, and an upper exit tube 8 for said fluid.

The bulb which constitutes the burner 1 has a frusto-conical lateral surface which joins with substantially hemispherical ends.

The larger end of the frusto-conical part of the bulb is located at the top of the bulb when the lamp is in its normal operating position, which is that shown in FIG. 1 or a position close thereto.

For example, for a burner whose height is about 1.5 m, in which the external diameter of the larger end of the frusto-conical part is 60 mm, and in which the external diameter of the smaller end thereof is 45 mm, a satisfactorily uniform spectrum has been maintained over a period of time.

The cross-section of the envelope 3 is constant and circular over the whole of the height occupied by the burner.

In the lamp of FIG. 2, which is basically similar to the lamp shown in FIG. 1, similar elements are used (the jacket 6 and its accessories being omitted from the drawing for simplicity), but the bulb forming the burner 1 has two cylindrical sections of different diameters, the top section **1*a*** having a larger diameter than the bottom section **1*b***.

The enclosure 3 is again substantially cylindrical.

For example, with mercury vapor doped with indium mono-iodide (I*In*), a bulb 1.5 m high in which the sections **1*a*** and **1*b*** have substantially the same height 0.75 m, gives good results if the external diameter of the top section **1*a*** is around 53 mm and that of the bottom section **1*b*** 46 mm.

In FIG. 3, the lamp is similar to that of the preceding example but the height of the top section **1*a*** is much less than that of the bottom section **1*b***, of the burner.

Again taking a burner 1.5 m high, in this example the top section **1*a*** has a height of around 15 cm and an external diameter of 46 mm, the bottom section **1*b*** having an external diameter of only 33 mm, and satisfactory results are obtained with mercury vapor doped with thallium moni-iodide (ITl).

In the foregoing examples, the heat exchange area per unit height presented by the top section of the burner is larger than that offered by the bottom section. Since the envelope 3 is cylindrical, the thickness of the annular space surrounding the top section is smaller than that of the annular space surrounding the bottom section. These two features combine to favour heat exchange at the top section of the burner. However, either feature on its own will yield satisfactory results.

For example, in the lamp shown in FIG. 4, the bulb which constitutes the burner 1 is substantially cylindrical apart from its hemi-spherical ends but that portion of the envelope 3 which surrounds the burner has a frusto-conical shape the larger end of which is located near the bottom of the burner whilst the smaller end is located near the other top.

The mean thickness of the space surrounding the burner in the envelope **3** is thus smaller at the top end than at the bottom end and, consequently, the heat liberated by the burner is dissipated more rapidly from the top than it is from the bottom, even though the heat exchange area per unit height of the burner **1** is constant.

In the lamp shown in FIG. **5**, the burner **1** is again substantially cylindrical in form, but the bottom section **3**_a_ of the envelope, which is located opposite the bottom half of the burner, has a larger diameter than the top section **3**_b_ which surrounds the upper part of the burner. In this fashion, a similar result is obtained to that obtained with the preceding example.

The lamp shown in FIG. **6** comprises a burner **1** and an envelope **3**, both substantially cylindrical in form, and an auxiliary cooling arrangement consisting of an entry tube **9** and an exit tube **10** for a coolant gas, the entry tube **9** having annular jets **11** located around the top section of the burner, which project the gas on to the top section of the burner **1** but not directly on to the bottom section. This feature can be used in conjunction with one or both of the two already mentioned, or for that matter with both of them. The jacket **6** can be omitted from this lamp, even if it would be desirable in the absence of the auxiliary cooling arrangement.

I claim:

1. A doped mercury vapor lamp comprising an elongate burner for operation with its length generally vertical, and a transparent envelope in which said burner is disposed, means for effecting the existence of a temperature differential within said burner between higher and lower portions thereof, the higher temperature being effected relative to said lower portion.

2. A lamp as in claim **1** wherein said means is provided by the shape of said burner surface itself, said burner being shaped to provide increased surface area in the region of said higher portion, whereby greater heat dissipation is effected than in said lower portion with resulting lower temperature in said higher portion.

3. A lamp as claimed in claim **1** wherein said means is afforded by the shape of said envelope, said envelope being shaped to provide lower surface area in the region of said higher portion than in the region of said lower portion, whereby heat in said higher portion is dissipated at a greater rate than in the region of said lower portion.

4. A lamp as claimed in claim **3** wherein the space between said higher portion and said envelope has a smaller mean thickness than the space between said lower portion and the envelope.

5. A lamp as claimed in claim **2** wherein the surface of the burner in and between said higher and lower portions is of frusto-conical shape, the larger cross-sectional portions thereof being disposed above the smaller cross-sectional portions in use, the said envelope being of uniform cylindrical shape.

6. A lamp as claimed in claim **2** wherein said higher and lower portions are of cylindrical shape, said higher portion having a larger diameter than said lower portion, same as above.

7. A lamp as claimed in claim **3** wherein said envelope has a smaller internal diameter adjacent said higher portion than adjacent said lower portion, the said burner being of uniform cylindrical shape.

8. A lamp as claimed in claim **7** wherein adjacent and between said higher and lower portions the shape of the internal surface of the envelope is frusto-conical and the larger cross-sectional portions thereof are located below the smaller cross-sectional portions in use, the said burner being of uniform cylindrical shape.

9. A lamp as claimed in claim **7**, wherein said envelope has cylindrical internal higher and lower portions, said higher portion having a smaller diameter than said lower portion.

10. A lamp as claimed in claim **1** wherein said means comprises a scavenging device for directing a fluid on to the higher portion of said burner but not directly on to said lower portion.

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