United States Patent

Goossens

[15] 3,646,378

[45] Feb. 29, 1972

[54] LOW-PRESSURE SODIUM VAPOR DISCHARGE LAMPS

[72] Inventor: **Urbaan Paul Marguerite Goossens,** Waasmunster, Belgium

[73] Assignee: **U.S. Philips Corporation,** New York, N.Y.

[22] Filed: **June 22, 1970**

[21] Appl. No.: **48,045**

[30] **Foreign Application Priority Data**

Feb. 28, 1970 Netherlands.....7002894

[52] **U.S. Cl.**.....**313/27,** 313/220, 313/225, 313/227

[51] **Int. Cl.**.....**H01j 61/34**

[58] **Field of Search**.....313/25, 26, 27, 181, 186, 187, 313/220, 225, 227

[56] **References Cited**

FOREIGN PATENTS OR APPLICATIONS

1,158,700	1/1958	France	313/220
817,100	7/1959	Great Britain	313/25

Primary Examiner—Raymond F. Hossfeld

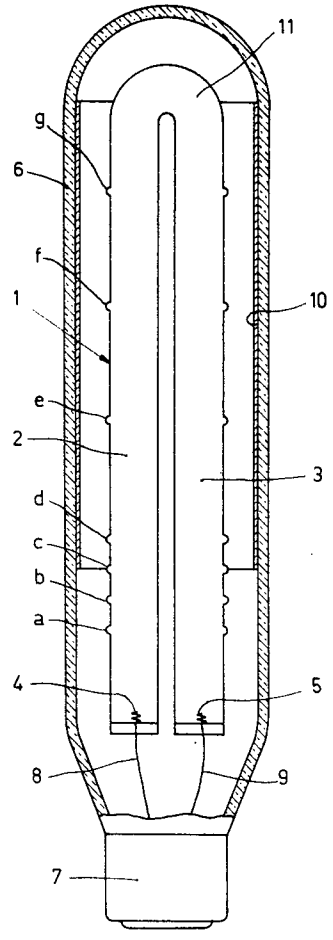
Attorney—Frank R. Trifari

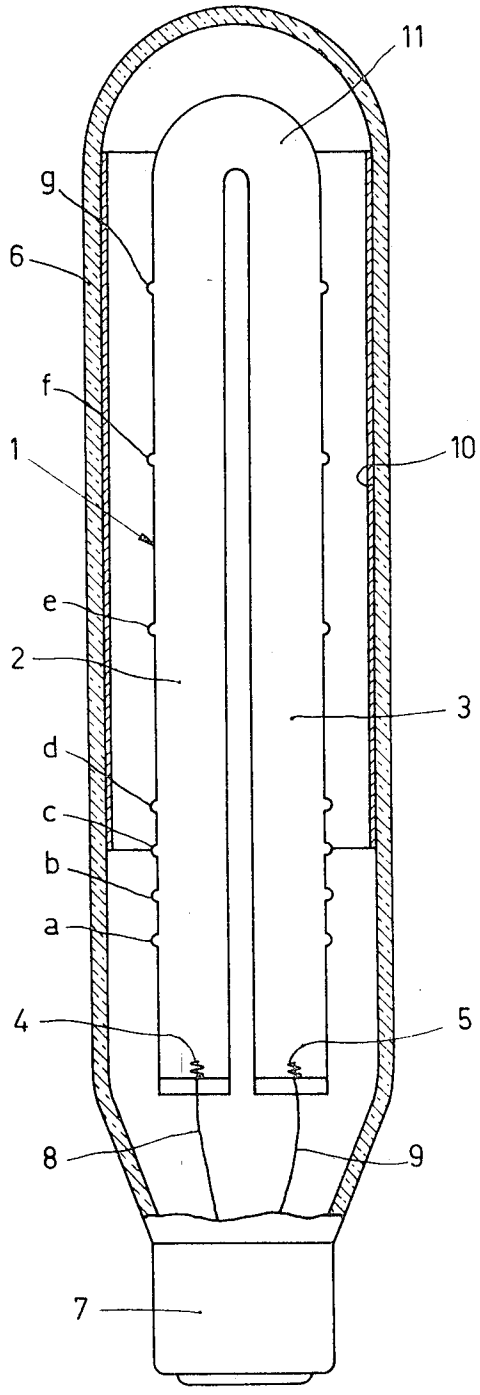
[57] **ABSTRACT**

A low-pressure sodium vapor discharge lamp having small reservoirs of sodium positioned near the electrodes in a manner so as to satisfy the condition $B/T \geq 0.5$, wherein B represents the overall contents of those reservoirs whose distance up to the nearest electrode is between 10 and 35 percent of half the length of the discharge path and T represents the overall contents of all reservoirs.

A heat-reflecting layer is positioned between the outer envelope and the discharge tube and extends over part of the length of the lamp to keep the reservoirs nearest the electrodes at cooler temperatures.

3 Claims, 1 Drawing Figure





INVENTOR.
URBAAN P. M. GOOSSENS
BY
AGENT

LOW-PRESSURE SODIUM VAPOR DISCHARGE LAMPS

The invention relates to a low-pressure sodium vapor discharge lamp provided with a U-shaped discharge tube including an electrode near both ends, the wall of the discharge tube having at least several humped bulges (small reservoirs of sodium) and the discharge tube being surrounded by an outer envelope.

In a known lamp of the kind described the said humped bulges serve to maintain the sodium uniformly distributed in the discharge tube. However, a drawback of the known lamp is that as the lamp operates for a longer period, more sodium travels to the so-called bend of the discharge tube. This sodium is then withdrawn from the region near the electrodes. The result thereof is that the power of the lamp (the watts of the lamp) increases. This is a drawback.

The object of the present invention is to provide a simple solution for a sodium lamp of the kind described in the preamble by which it is avoided or at least the risk is reduced that the sodium near the electrodes disappears completely.

A low-pressure sodium vapor discharge lamp according to the invention is provided with a U-shaped discharge tube that includes an electrode at both ends within an outer envelope. The wall of the discharge tube has at least several humped bulges and is characterized in that the condition $(B/T) \geqq 0.5$ is satisfied, wherein B represents the overall contents of all those bulges located at distance from the nearest electrode that lie between 10 percent and 35 percent of half the length of the discharge path, and T represents the overall contents of all bulges on the wall of the discharge tube.

The discharge path is to be understood to mean the path from one electrode through the so-called bend of the U-shaped discharge tube to the other electrode.

An advantage of this lamp is that much sodium can be stored near the electrodes in the relatively large reservoir of bulges. However, when sodium travels towards the bend of the discharge tube due to the operation of the lamp, sufficient sodium will remain present for a very long period in the said reservoir of bulges (near the electrodes) so that also sodium vapor remains present near the electrodes which gives rise to the wattage of the lamp varying only to a slight extent.

In a low-pressure sodium vapor discharge lamp wherein a transparent heat-reflecting layer, such as a layer of indium oxide, extends over part of the length of the lamp between the wall of the discharge tube and the inner wall of the outer envelope. This layer is preferably only present on areas whose distance to the nearest electrode of the discharge tube is larger than the distance between said electrode and the bulge located nearest said electrode.

An advantage of this preferred embodiment is that at least the first bulge near the electrodes can now be somewhat cooler than when the heat-reflecting layer would extend throughout the total length of the outer envelope. This gives rise to a delay in the movement of the sodium from the reservoir of bulges near the electrodes towards the bend.

In order that the invention may be readily carried into effect, an embodiment thereof will now be described in detail, by way of example, with reference to the accompanying diagrammatic drawing, which shows a low-pressure sodium vapor discharge lamp according to the invention.

An outer envelope of this lamp is shown in a longitudinal

section. The lamp shown is a 180-watt lamp. In the FIGURE the reference numeral 1 denotes a U-shaped discharge tube. One of the limbs of the tube 1 is denoted by the reference numeral 2, the other limb is denoted by the reference numeral 3. An electrode 4 is provided at one end of the limb 2, an electrode 5 is provided at one end of the limb 3 of the tube 1. The tube 1 is surrounded by a glass outer envelope 6. The reference numeral 7 denotes a lamp cap. The reference numerals 8 and 9 denote electric wires which connect the electrodes 4 and 5, respectively, to the lamp cap 7. The limb 2 is provided with seven humped bulges. These are denoted by the references a to g inclusive. Half the length of the discharge path (approximately one limb length) is approximately 96 cm. The bulge a is located at a distance of 12.5 cm. from the electrode 4. These distances for b, c, d, e, f and g are 17.5 cm., 22.5 cm., 27.5 cm., 45 cm., 62.5 cm. and 80 cm., respectively. It follows therefrom that the condition $(B/T) \geqq 0.5$ is satisfied, namely because the content of each bulge is approximately the same and because four out of seven bulges (to wit a to d inclusive) are located between 10 percent and 35 percent of half the length of the discharge path (that is to say, between 9.6 cm. and 33.5 cm., respectively) from the electrode 4. The limb 3 of the discharge tube 1 is likewise provided with bulges which are arranged in exactly the same manner as those on limb 2.

The reference numeral 10 denotes a heat-reflecting indium oxide layer. This layer is provided on the inner side of the outer envelope 6 and does not extend any farther than approximately 23 cm. from the electrodes 4 and 5. Due to this layer the bulges a and b are somewhat colder than they would have been if this layer would have extended throughout the total length of the outer envelope 6. As a result the transfer of sodium from these bulges a and b towards the bend 11 of the discharge tube is delayed. In the given case, the Wattage of the lamp had varied only less than 5 percent after 2,500 hours of operation.

It would alternatively be possible to use relatively large bulges near the electrodes instead of relatively many bulges near the electrodes (as in the case shown).

What is claimed is:

1. A low-pressure sodium vapor discharge lamp comprising an outer envelope, a U-shaped discharge tube having an electrode at both ends within said envelope, the wall of the discharge tube having at least several humped bulges for maintaining a uniform distribution of sodium in the discharge space characterized in that the condition $(B/T) \geqq 0.5$ is satisfied, wherein: B represents the overall contents of all those bulges whose distance up to the nearest electrode is between 10 percent and 35 percent of half the length of the discharge path, and wherein Trepresents the overall contents of all bulges on the wall of the discharge tube.

2. A low-pressure sodium vapor discharge lamp as claimed in claim 1, wherein a transparent heat-reflecting layer extends at least over part of the length of the lamp between the inner wall of the discharge tube and the outer wall of the outer envelope, characterized in that the heat-reflecting layer is only present on areas whose distance up to the nearest electrode of the discharge tube is larger than the distance between said electrode and the bulge located nearest said electrode.

3. A low-pressure sodium vapor discharge lamp as claimed in claim 2, wherein said layer is an indium oxide layer.

* * * * *