United States Patent

Goossens et al.

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[54] **VIBRATION REDUCING ASSEMBLY FOR OBLONG DISCHARGE LAMP**

[72] Inventors: **Urbaan Paul Marguerite Goossens,** Elversele, Belgium; **Willem Lodewijk Van Hoorn; Gerard Marie Jules De Neve,** both of Essasingel, Netherlands

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

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[51] **Int. Cl.** **H01j 1/18,** H01j 19/12

[58] **Field of Search** 313/258, 252, 269, 26, 220

[56] **References Cited**

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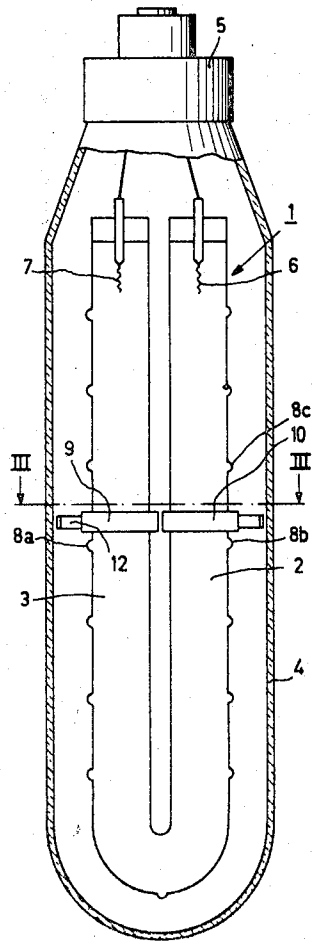
Primary Examiner—David Schonberg
Assistant Examiner—Toby H. Kusmer
Attorney—Frank R. Trifari

[57] **ABSTRACT**

Shock and vibration are dampened in an oblong discharge lamp having a u-shaped tube, by the inclusion of resilient supports about each portion of the u-shaped tube to act as a buffer between the tube and outer envelope. The resilient supports include means for preventing rotation of the resilient supports about the legs of the u-shaped tube.

6 Claims, 4 Drawing Figures



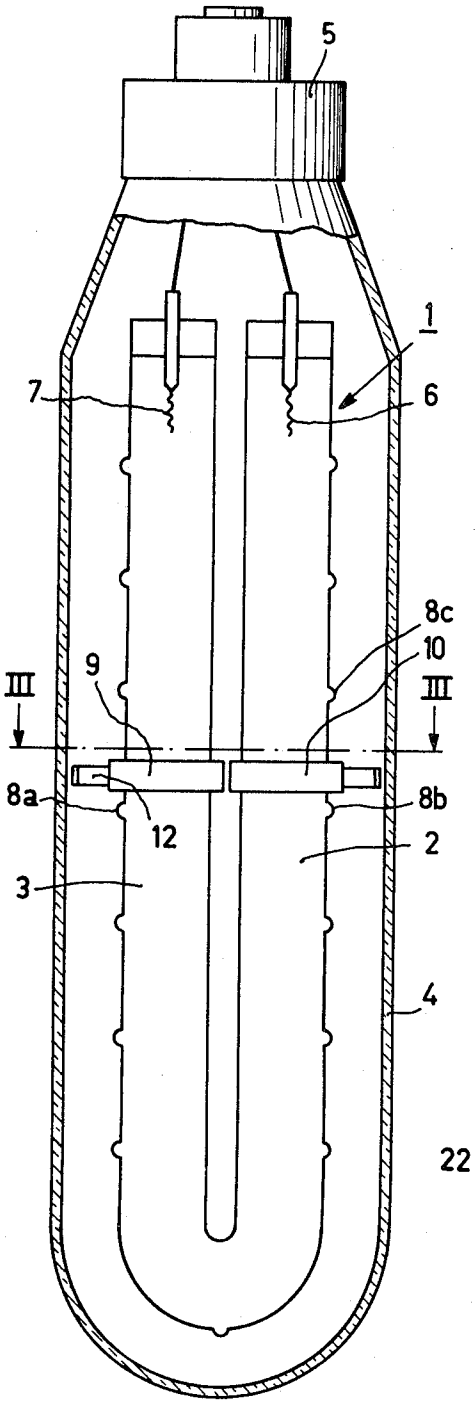


Fig.1

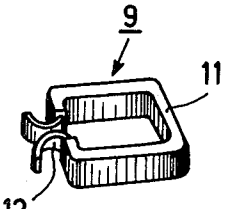


Fig.2

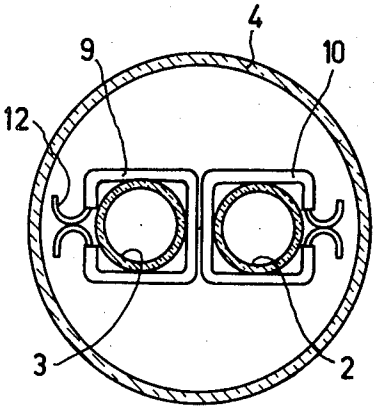


Fig.3

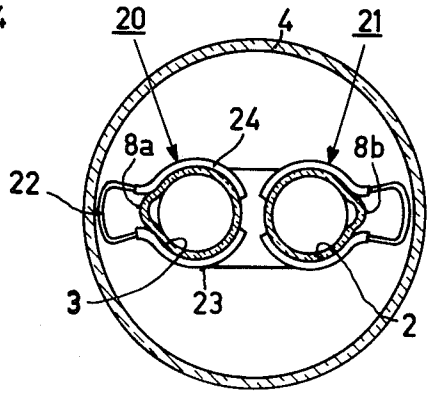


Fig.4

INVENTORS
URBAAN P.M. GOOSSENS
WILLEM L. VAN HOORN
GERARD M.J. DE NEVE
BY
Frank R. Trifari
AGENT

VIBRATION REDUCING ASSEMBLY FOR OBLONG DISCHARGE LAMP

The invention relates to an oblong discharge lamp, particularly a low-pressure sodium vapor discharge lamp, comprising a discharge tube and an outer envelope encompassing this tube, a resilient member being provided near the center of the lamp, at least a part of the resilient member being present between the discharge tube and the outer envelope and which serves to limit transverse movements of the discharge tube relative to the outer envelope.

A known lamp of the above-mentioned kind is described, for example, in U.S. Pat. No. 2,797,311. The lamp described in this patent specification is a mercury lamp equipped with a linear discharge tube. In this case the resilient member serves to prevent the center of the discharge tube from engaging the outer envelope. The risk of this is not imaginary because an oblong lamp is concerned. In this connection "oblong" is to be understood to mean a length of at least 70 cms.

An oblong discharge lamp in which the discharge tube is U-shaped and in which the distance between the two legs of the discharge tube is shorter than the distance between such a leg and the outer envelope is also known per se. A difficulty presents itself when in this lamp a support for the discharge tube is required so as to prevent the center of the discharge tube from engaging the outer envelope when this lamp is exposed to shocks and vibrations. Such shocks etc. may occur, for example, when such a lamp is fixed to a lamp post. Motorized traffic or squalls may then cause these shocks and vibrations in the lamp. An additional difficulty at the U-shaped discharge tube is often that the distance between the legs changes when the temperature changes.

The object of the present invention is to provide also a satisfactory support of the central portion of a U-shaped discharge tube.

According to the invention the discharge tube is U-shaped and the distance between the two legs of the discharge tube is shorter than the distance between such a leg and the outer envelope, while at least two substantially equal resilient members are present, one leg of the discharge tube protruding through one resilient member and the other leg protruding through the other resilient member, while each resilient member co-operates with a part of the lamp in such a manner that a rotation of a resilient member about a leg of the discharge tube is prevented.

An advantage of this lamp is that, although the discharge tube is U-shaped, the central part of the discharge tube is satisfactorily supported resiliently so that also in this case there is no risk of the discharge tube engaging the outer envelope and the two legs of the discharge tube engaging each other.

It is not necessary for a resilient member in the rest condition to be in contact with the interior of the outer envelope. However, the distance between a resilient member and the outer envelope must be comparatively small in order that the amplitude of possible shocks may be damped satisfactorily. It is neither necessary that the two resilient members are in contact with each other. Thus, for example, one resilient member may be shifted over a few centimeters (in the longitudinal direction of the lamp) relative to the other resilient member.

A resilient member may consist of, for example, a ring through which the relevant leg of the discharge tube protrudes, which rings are provided with projections which prevent a rotation. In this connection "rotation" is to be understood to mean the rotation of such a ring about the relevant leg of the discharge tube.

It is feasible that these projections are provided in such a manner that the second ring ensures that the first ring cannot rotate. In this case the second ring constitutes the above-mentioned lamp part which prevents the rotation. However, the rotation may alternatively be prevented in a different manner.

The lamp part co-operating with a resilient member preferably consists of the other resilient member, the two resilient members facing each other. Each resilient member also consists preferably of a sleeve having a substantially square cross-section. This solution has the advantage that these resilient members can be manufactured easily and that the securement against rotation may be obtained in a very simple manner.

The sleeve-form embodiment of a resilient member is preferably constructed in such a manner that the sides of the sleeves remote from each other are each provided with a supporting member consisting of leaf spring, which supporting members face the inner wall of the outer envelope.

In this case a very satisfactory resilient support of the discharge tube can be obtained.

In a further embodiment of a discharge lamp according to the invention the lamp part co-operating with a resilient member is constituted by a bulge present on the discharge tube and each resilient member consists of a bent portion at the area of the bulge and of two portions clamping around the leg of the discharge tube.

The said bulge is in this case, for example, one of the known bulges which serve as small sodium reservoirs by which an even distribution of the sodium in the discharge lamp is maintained.

A resilient member consists of, for example, a resilient metal strip.

Each resilient member preferably consists of steel strip which is at least partly surrounded by an insulating sleeving.

An advantage of this embodiment is that such a member not only has favorable resilient properties, but is also strong and has few sharp parts so that the risk of damage of the discharge tube and of the outer envelope is small. In this embodiment the occurrence of cracks in the discharge tube as a result of the movement of metal ions (for example, sodium ions) through the glass wall of the discharge tube is prevented. The steel strip is, for example, a chrome-nickel steel strip.

In order that the invention may be readily carried into effect some embodiments thereof will now be described in detail by way of example with reference to the accompanying diagrammatic drawing in which:

FIG. 1 shows a discharge lamp (partly) in a cross-section) according to the invention;

FIG. 2 is a perspective view of a resilient member as mounted in a lamp according to FIG. 1;

FIG. 3 is a cross-sectional view (taken on the line III—III) in the vicinity of the resilient members through the lamp of FIG. 1;

FIG. 4 is a cross-sectional view similar to that in FIG. 3 in which, however, two other resilient members also according to the invention are provided in the lamp.

In FIG. 1 the reference numeral 1 denotes a U-shaped discharge tube of a low-pressure sodium vapor discharge lamp. One leg of the discharge tube 1 is denoted by the reference numeral 2 and the other leg is denoted by 3. The discharge tube is surrounded by an outer envelope 4. The lamp has a lamp cap 5. An electrode 6 is provided at one end of the leg 2 while an electrode 7 is provided at one end of the leg 3. The discharge tube 1 is provided with a plurality of bulges such as, for example, 8*a*, 8*b* and 8*c* which serve to maintain an even distribution of the sodium in the tube 1. The reference numerals 9 and 10 denote two resilient members which serve as a central resilient support of the discharge tube of the outer envelope 4.

The ends of the tube 1 including the electrodes 6 and 7 as well as the so-called bend of the tube 1 (that is to say the portion connecting the legs 2 and 3 together) may be supported in a manner not further described by centering members as described, for example, in United Kingdom Pat. specification No. 1,170,874. The support of the electrode side of the tube 1 is preferably formed in such a manner that these ends of the legs cannot contact each other upon vibrations or shocks.

FIG. 2 is a perspective view of the resilient member 9 of FIG. 1. This resilient member consists of a sleeve part 11 and a supporting member which consists of two leaf springs 12. The part 11 consists of a chrome-nickel steel strip having a width of approximately 4 mms and a thickness of 0.3 mms, which steel strip is surrounded by an insulating sleeving. The leaf springs 12 form one assembly with the metal of part 11. The leaf springs 12 are, however, not covered with insulating sleeving. The two leaf springs 12 are welded together in the vicinity of part 11.

FIG. 3 is a cross-sectional view (taken on the line III—III) of the lamp of FIG. 1, thus near the resilient members 9 and 10. FIG. 3 shows again that the leg 3 of the discharge tube 1 protrudes through the resilient member 9 and the leg 2 protrudes through the resilient member 10. In the rest condition the supporting member 12 of the resilient member 9 is present at a distance of a few millimeters from the inner wall of the outer envelope 4. This also applies to the supporting member of the resilient member 10.

In one embodiment the lamp was a low-pressure sodium vapor discharge lamp of 180 Watts. The total length of lamp was approximately 110 cms. The inner diameter of the outer envelope 4 was approximately 6.1 cms. The outer diameter of a leg (2,3) of the discharge tube was approximately 2 cms. The distance between the two legs 2 and 3 was approximately 0.3 cms and the distance between a leg and the inner wall of the outer envelope 4 was approximately 0.9 cms. In the relevant case the distance between a supporting member (for example, 12 of the resilient member 9) and the inner wall of the outer envelope 4 was approximately 0.2 cms.

To illustrate the construction of the resilient members clearly, some dimensions, for example, the distance between the legs of the discharge tube have been shown in exaggerated manner.

In FIG. 4 the reference numerals 2 and 3 again denote the legs of the discharge tube 1 in the outer envelope 4.

A large part of the leg 3 is now surrounded by a resilient member 20 at the area of the bulge 8*a* (for the bulge 8*a* see FIG. 1). A large part of the leg 2 is surrounded by a resilient member 21 at the area of the bulge 8*b* (for the bulge 8*b* see FIG. 1). The bulge 8*a* prevents the rotation of the resilient member 20 and the bulge 8*b* prevents the rotation of the resilient member 21. The resilient members 20 and 21 are formed in the same manner. The resilient member 20 has a bent portion 22 (around the bulge 8*a*). This portion merges into two ring-shaped parts 23 and 24 which fit round the leg 3 in a clamping manner. The two ring-shaped parts of each resilient member consists of steel strip surrounded by an insulating sleeving. The parts of the supporting members (for example, the part 22 of the resilient member 20) facing the interior of the outer envelope 4 exclusively consist of steel strip.

It is not necessary that the two resilient members 20 and 21 face each other. Thus, for example, in a further embodiment the resilient member 20 may be present at the area of the bulge 8*a* and the resilient member 21 may be present at the area of the bulge 8*c* instead of at the bulge 8*b* (for the bulges, see FIG. 1).

What is claimed is:

1. An oblong discharge lamp, particularly a low-pressure sodium vapor discharge lamp, comprising a discharge tube and an outer envelope encompassing said tube, a resilient support being provided near the center of the lamp, at least a part of the resilient member being present between the discharge tube and the outer envelope and which serves to limit transverse movements of the discharge tube relative to the outer envelope, wherein the discharge tube is U-shaped and the distance between the two legs of the discharge tube is shorter than the distance between such a leg and the outer envelope said resilient support comprising at least two substantially equal resilient members, each of said resilient members also having a supporting member one leg of the discharge tube protruding through and clamped by one of said resilient members and the other leg protruding through and clamped by the other of said resilient members, said supporting members face the inner wall of said outer envelope, each of said resilient members cooperating with a part of the lamp in such a manner that a rotation of the resilient member about a leg of the discharge tube is prevented.

2. A discharge lamp as claimed in claim 1, wherein the lamp part co-operating with a resilient member consists of the other resilient member, the two resilient members facing each other.

3. A discharge lamp as claimed in claim 2, wherein each of said resilient members includes a sleeve having a substantially square cross-section.

4. A discharge lamp as claimed in claim 3, wherein each of said supporting members being provided on the sides of said sleeves remote from each other, and wherein each supporting member consists of a leaf spring.

5. A discharge lamp as claimed in claim 1, wherein the lamp part co-operating with a resilient member is constituted by a bulge present on the discharge tube and that each resilient member consists of a bent portion at the area of the bulge and of two portions clamping around the leg of the discharge tube.

6. A discharge lamp as claimed in claim 1, wherein each supporting member consists of steel strip which is at least partly surrounded by an insulating sleeving.

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