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(71) Applicant: **N.V. Philips' Gloeilampenfabrieken**
Groenewoudseweg 1
NL-5621 BA Eindhoven(NL)

(72) Inventor: **Verweij, Hendrik**
c/o INT. OCTROOIBUREAU B.V. Prof.
Holstlaan 6
NL-5656 AA Eindhoven(NL)
Inventor: **Kock, Albertus Johannes**

Hyacinthus Maria
c/o INT. OCTROOIBUREAU B.V. Prof.
Holstlaan 6
NL-5656 AA Eindhoven(NL)
Inventor: **Offermans, Paulus Hubertus**
Gerardus
c/o INT. OCTROOIBUREAU B.V. Prof.
Holstlaan 6
NL-5656 AA Eindhoven(NL)

(74) Representative: **De Jongh, Cornelis**
Dominicus et al
INTERNATIONAAL OCTROOIBUREAU B.V.
P.O. Box 220
NL-5600 AE Eindhoven(NL)

(54) **High pressure discharge lamp.**

(57) High-pressure discharge lamp having a closed discharge vessel (1) of translucent sintered aluminium nitride in which electrodes (2,3) are arranged each connected to a respective current lead-through (4,5). The current lead-throughs (4,5) consist of molybdenum and/or tungsten.

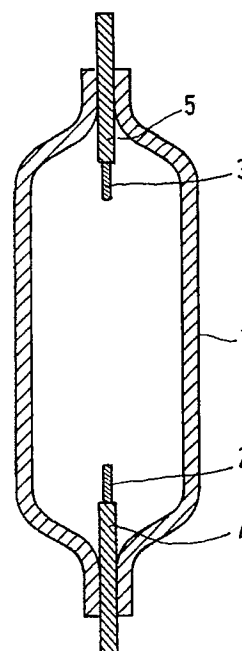


FIG.1

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The invention relates to a high-pressure discharge lamp comprising a closed discharge vessel of translucent sintered aluminium nitride in which electrodes are arranged between which the discharge is maintained during lamp operation, the electrodes being connected each to a respective current-lead throughs passed to the exterior through the discharge vessel wall.

A high-pressure discharge lamp of the kind described is known from the Japanese Patent Application published under number 60-193254 (1985).

The known lamp is a high-pressure sodium vapour discharge lamp which contains sodium, mercury and xenon and which has current lead-throughs made of niobium. The aluminium nitride has good light transmission characteristics and a good heat conduction so that the discharge vessel assumes an even temperature (substantially isothermal) during operation and also has a great resistance to thermal shocks.

A disadvantage of this known lamp is that the niobium current lead-throughs become brittle during operation, so that the electrodes can easily break off the current lead-throughs. It has been found that this embrittlement is caused by a chemical reaction of the niobium with nitrogen originating from the aluminium nitride of which the discharge vessel wall is made. A further disadvantage of the known lamp is that leaks easily occur at the area of the current lead-throughs. It has been found that these leaks are caused by the relatively great difference in thermal coefficient of expansion between the niobium current lead-throughs and the aluminium nitride of the discharge vessel (the coefficient of expansion of AlN is no more than approximately 60 % of that of the Nb). As a result, mechanical stresses occur during lamp operation, giving rise to the said lamp leaks.

The invention has for its object to provide an improved high pressure discharge lamp in which the disadvantages referred to are obviated.

According to the invention, a high-pressure discharge lamp of the kind described in the opening paragraph is characterized in that the current lead-throughs consist at least substantially of molybdenum and/or tungsten.

A high-pressure discharge lamp with a long operational life is thus obtained in which both the embrittlement of the current lead-throughs and the occurrence of leaks at the area of the current lead-throughs are prevented. This is because the molybdenum or tungsten substantially does not react with the nitrogen of the aluminium nitride and as a result retains its mechanical strength, while its coefficient of expansion is similar to that of the aluminium nitride. Furthermore, there is good adhesion between aluminium nitride and molybdenum

or tungsten at temperatures above 1700 °C, so that it is possible to sinter the current lead-throughs directly in the aluminium nitride during lamp manufacture without the use of a melting ceramic.

In a favourable embodiment of a high-pressure discharge lamp according to the invention, the lamp is constructed as a high-pressure sodium vapour discharge lamp of which the aluminium nitride discharge vessel contains sodium, mercury and rare gas.

The use of molybdenum or tungsten current lead-throughs in high pressure sodium vapour discharge lamps gives the further advantage that these current lead-throughs are chemically resistant to the sodium and the mercury in the discharge.

Another favourable embodiment of a high-pressure discharge lamp according to the invention is characterized in that the lamp is constructed as a high-pressure mercury vapour discharge lamp of which the aluminium nitride discharge vessel contains, besides mercury and rare gas, one or several halides.

Among the examples of halides are sodium iodide, thallium iodide, indium iodide, cadmium iodide, aluminium iodide, lanthanum iodide and yttrium iodide.

It has been found that not only the current lead-throughs made of molybdenum or tungsten but also the aluminium nitride discharge vessel has a good chemical resistance to such iodides.

A further favourable embodiment of a high-pressure discharge lamp according to the invention is characterized in that the aluminium nitride discharge vessel is accommodated in a glass outer bulb which is provided with two electrical contacts, the current lead-throughs being each connected to a respective electrical contact.

The outer bulb may, for example, be provided with a lamp cap with two electrical contacts at one end. It is alternatively possible to use a, for example tubular, outer bulb which has an electrical contact at each of its two ends.

Thus the discharge vessel with its current lead-throughs is protected against atmospheric influences (prevention of the generation of Al₂O₃ and of volatile tungsten oxides and molybdenum oxides) and against strong fluctuations of the ambient temperature.

The outer bulb may be evacuated. Preferably, however, the outer bulb is filled with an inert gas, by which evaporation of the aluminium nitride and the resulting deposition of an aluminium layer on the outer bulb are counteracted, especially in the case of a discharge vessel having a high operating temperature. The inert gas also provides cooling of the discharge vessel, so that the latter does not exceed the maximum admissible operating tem-

perature, and high wall loads (W/m^2) of the discharge vessel are made possible (compact discharge vessel).

The inert gas preferably is nitrogen under an operating pressure of 0.5 to 1 bar.

Embodiments of the high-pressure discharge lamp according to the invention are explained with reference to the drawings, which are diagrammatic and not drawn to scale.

In the drawings:

Fig. 1 shows a high-pressure sodium vapour discharge lamp in longitudinal section,

Fig. 2 shows a high-pressure mercury iodide discharge lamp partly in elevation and partly in longitudinal section.

The lamp according to Fig. 1 comprises a discharge vessel 1 which is closed in a vacuum-tight manner and is made of translucent sintered aluminium nitride, in which are present sodium, mercury, and a rare gas, for example xenon. In the discharge vessel 1 are arranged electrodes 2 and 3 made of tungsten between which the discharge is maintained during lamp operation. The electrode 2 is connected to a current lead-through 4 which consists of a tungsten pin which is passed through the wall of the discharge vessel to the exterior. The electrode 3 is connected to a current lead-through 5 which also consists of a tungsten pin which is passed through the wall of the discharge vessel 1 to the exterior. The tungsten pins 4 and 5 are sintered directly in the aluminium nitride wall of the discharge vessel 1, they do not become brittle under the influence of nitrogen originating from the aluminium nitride, and they have a coefficient of expansion which substantially corresponds to the coefficient of expansion of the aluminium nitride, so that mechanical stresses, which could lead to lamp leaks, are prevented during lamp operation. The tungsten pins also have a good chemical resistance to the sodium and the mercury of the discharge. If so desired, current lead-throughs of molybdenum instead of tungsten may be used in this lamp.

Although the current lead-throughs are sintered directly into the wall of the aluminium nitride discharge vessel in this case, it is alternatively possible to use a melting glass as a connecting material.

The aluminium nitride discharge vessel 1 may be accommodated in an outer bulb which is provided with a lamp cap having two electrical contacts, or provided with two electrical contacts situated at opposite ends (not shown in the drawing). Such an outer bulb may be filled with an inert gas, such as nitrogen.

The lamp of Fig. 2 has a discharge vessel 11 which is closed in a vacuum-tight manner and is made of translucent sintered aluminium nitride in which mercury, a rare gas such as argon, and a

few halides such as sodium iodide, thallium iodide and indium iodide are present. In the discharge vessel 11 are arranged electrodes 12 and 13 made of tungsten between which the discharge is maintained during lamp operation. The electrode 12 is connected to a current lead-through 14 which consists of a molybdenum tube and which is passed to the exterior through the wall of the discharge vessel. The electrode 13 is connected to a current lead-through 15 which also consists of a molybdenum tube which is passed to the exterior through the wall of the discharge vessel. The current lead-through 14 is connected to an aluminium nitride plug 17 by means of a connecting glass 16 which is resistant to the filling present in the discharge vessel 11. The current lead-through 15 is fastened to an aluminium nitride plug 18 by means of connecting glass 16. The plugs 17 and 18 are sintered in a vacuum-tight manner to the wall of the discharge vessel 11. The discharge vessel 11 is accommodated in a glass outer bulb 19 which is provided with a lamp cap 20 which has two electrical contacts (bottom contact and side contact in usual fashion). Current lead-through 14 is connected to one of the two electrical contacts of the lamp cap 20 through a current conductor 21. Current lead-through 15 is connected to the other electrical contact of the lamp cap 20 through current conductor 22.

The outer bulb 19 is filled with nitrogen under an operating pressure of, for example, 1 bar.

The molybdenum current lead-throughs 14 and 15 do not become brittle under the influence of the nitrogen originating from aluminium nitride of the discharge vessel or from the nitrogen present in the outer bulb. The molybdenum current lead-throughs 14 and 15 have a coefficient of expansion which corresponds substantially to that of the aluminium nitride discharge vessel 11 and of the aluminium nitride plugs 17 and 18, so that mechanical stresses and the concomitant lamp leaks are prevented. The molybdenum current lead-throughs 14 and 15 furthermore have, as does the aluminium nitride, a good chemical resistance to the mercury and the halides in the discharge vessel 11. If so desired, the current lead-throughs 14 and 15 in this lamp may be made of tungsten instead of molybdenum.

The nitrogen filling of the outer bulb 19 ensures that evaporation of aluminium nitride from the wall of the discharge vessel 11 is counteracted during lamp operation, so that no aluminium film will be formed on the outer bulb 19.

Claims

1. A high-pressure discharge lamp comprising a closed discharge vessel of translucent sintered

aluminium nitride in which electrodes are arranged between which the discharge is maintained during lamp operation, the electrodes being connected each to a respective current-lead throughs passed to the exterior through the discharge vessel wall, characterized in that the current lead-throughs consist at least substantially of molybdenum and/or tungsten.

2. A high-pressure discharge lamp as claimed in Claim 1, characterized in that the current lead-throughs are directly sintered into the aluminium nitride discharge vessel wall. 10

3. A high-pressure discharge lamp as claimed in Claim 1 or 2, characterized in that the lamp is constructed as a high-pressure sodium vapour discharge lamp of which the aluminium nitride discharge vessel contains sodium, mercury and rare gas. 15
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4. A high-pressure discharge lamp as claimed in Claim 1 or 2, characterized in that the lamp is constructed as a high-pressure mercury vapour discharge lamp of which the aluminium nitride discharge vessel contains, besides mercury and rare gas, one or several halides. 25

5. A high-pressure discharge lamp as claimed in Claim 1, 2, 3 or 4, characterized in that the aluminium nitride discharge vessel is accommodated in a glass outer bulb which is provided with two electrical contacts, the current lead-throughs being connected each to a respective electrical contact. 30
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6. A high-pressure discharge lamp as claimed in Claim 5, characterized in that outer bulb is filled with an inert gas. 40

7. A high-pressure discharge lamp as claimed in Claim 6, characterized in that the inert gas is nitrogen under an operating pressure of 0,5 to 1 bar. 45

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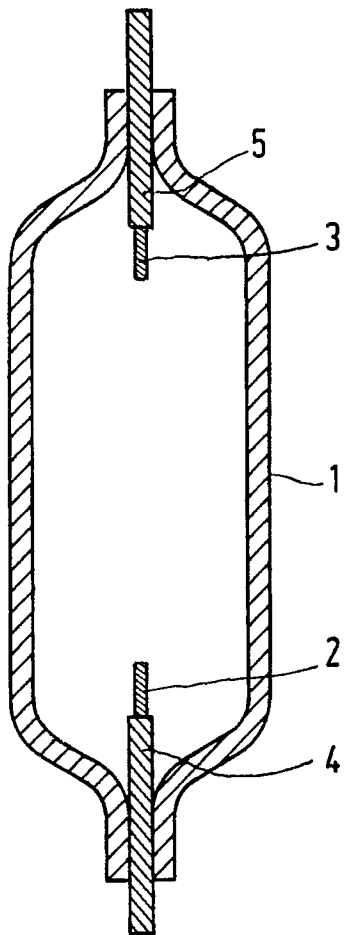


FIG.1

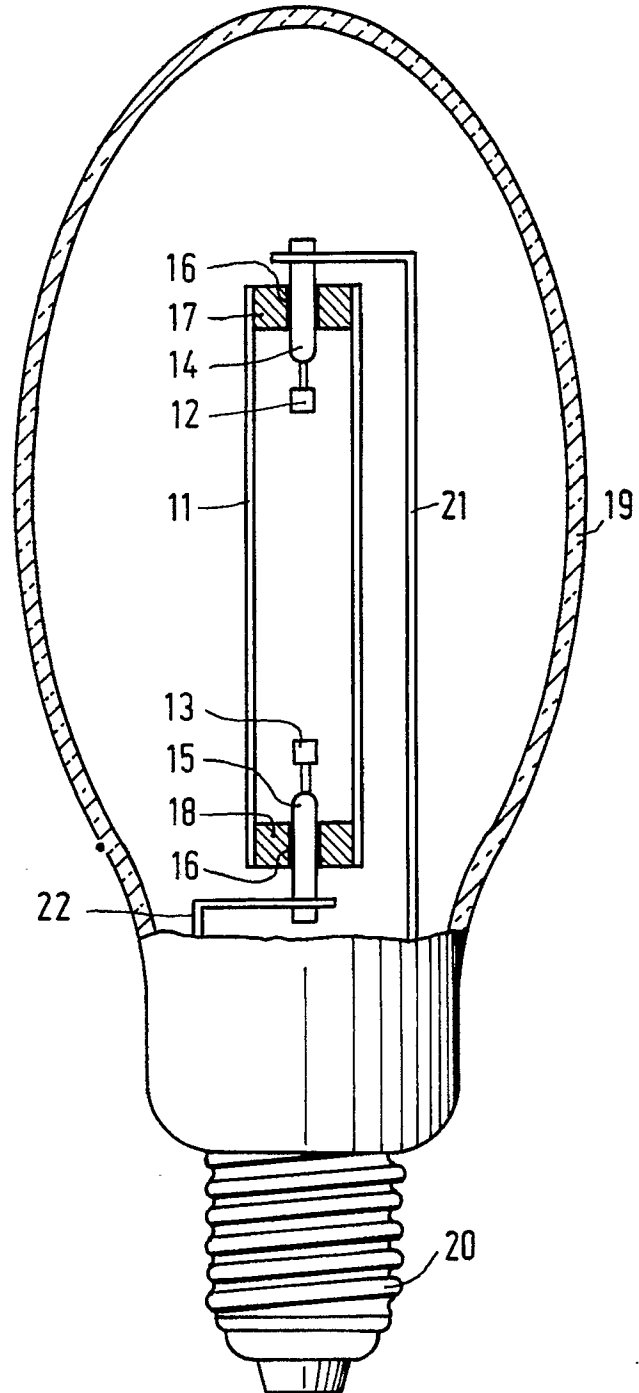


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 0610

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,Y	PATENT ABSTRACTS OF JAPAN vol. 10, no. 35 (E-380)(2092) 12 February 1986, & JP-A-60 193254 (TOKUYAMA SODA) 01 October 1985, * the whole document *	1,3-6	H 01 J 61/36
Y,A	US-A-3 234 421 (G.REILING) * column 2, lines 27 - 72 ** column 3, lines 22 - 27 @ column 3, lines 7 - 13 @ column 3, lines 22 - 28 @ column 3, lines 52 - 57 ** column 3, lines 70 - 72 ** column 5, lines 59 - 66 ** column 6, lines 1 - 5 EP 91200610030** column 6, line 69 - column 7, line 2; figure 1 *	1,3-6,2,7	
Y,A	EP-A-0 178 700 (N.V PHILIPS' GLOEILAMPEN-FABRIEKEN) * page 4, line 21 - page 5, line 2 ** page 5, lines 8 - 21; figures 1, 2 *	1,5,2	
P,X	EP-A-0 371 315 (ELEKTRISCHE GLÜHLAMPEN) * column 3, lines 51 - 57 ** column 4, lines 22 - 38 ** column 5, lines 50 - 51 @ column 6, lines 20 - 25; figures 1-4 *	1,5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H 01 J 61/00
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		27 June 91	ROWLES K.E.G.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document			