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(54) **Mercury and lead free high pressure sodium lamp**

Quecksilber- und Bleilose Natrium-Hochdruckentladungslampe

Lampe au sodium sans mercure ni plomb

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- **PATENT ABSTRACTS OF JAPAN vol. 096, no. 002, 29 February 1996 (1996-02-29) & JP 07 272680 A (TOSHIBA LIGHTING & TECHNOL CORP), 20 October 1995 (1995-10-20)**

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Description

TECHNICAL FIELD

[0001] This invention relates to discharge lamps and more particularly to high pressure sodium lamps. Still more particularly, it relates to such lamps that are environmentally disposable.

BACKGROUND ART

[0002] JP-A 7 272 680 discloses a ceramic discharge lamp with sodium and a rare gas, but no mercury, being encapsulated in a discharge vessel.

[0003] Discharge lamps generally include a discharge chamber of quartz or alumina supported within an envelope of borosilicate or aluminosilicate glass. Disposal of these lamps at the end of life has been deemed an environmental hazard because the outer envelope glass includes lead and arsenic and the discharge chamber includes mercury. Further, the electrically conductive base may have the in-leads for the lamp attached thereto by a lead-based solder. The lead, arsenic and mercury are presumed to be hazardous to animal and human health.

DISCLOSURE OF INVENTION

[0004] It is, therefore, an object of the invention to obviate the disadvantages of the prior art.

[0005] It is another object of the invention to provide an environmentally safe lamp that may be disposed of easily.

[0006] Yet another object of the invention is the enhancement of lamp disposal.

[0007] These objects are accomplished, in one aspect of the invention, by the provision of a long-life, environmentally disposable high pressure sodium lamp comprising: an arc tube capable of withstanding internal wall temperatures of 1250 to 1300°C and having electrodes sealed therein and being designed for operation at a given wattage; a discharge space within the arc tube and an arc generating and sustaining medium within the discharge space, the medium being mercury-free and containing sodium in an amount of about 0.02 mg to 0.06 mg/watt of designed operation, and xenon at a pressure of 133 to 267 mbar (100 to 200 Torr); mounting means supporting the arc tube within a glass outer envelope, the glass outer envelope being lead-free and arsenic-free; and an electrically conductive base closing the outer envelope and containing lead-in wires affixed to the electrodes, the lead-in wires being attached to the base by welding.

[0008] Lamps so constructed may be safely and legally disposed of in conventional land fills.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The single figure illustrates a lamp embodying the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010] For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following disclosure and appended claims taken in conjunction with the above-described drawings.

[0011] Referring now to the drawing with greater particularity, there is shown a high pressure sodium vapour lamp 100 having a vitreous outer envelope 6 with a standard mogul screw base 4 attached to the stem end which is shown lowermost in the figure. A reentrant stem press 8 has a pair of relatively heavy lead-in conductors 10 and 12 extending through the stem 8 and having outer ends of conductors 10 and 12 connected to the screw shell 17 and eyelet 18 by welding, thus eliminating the need for lead-bearing solder.

[0012] The lamp 100 has an inner envelope or arc tube 14 centrally located within the outer envelope 6. The arc tube 14 is comprised of a length of light transmitting ceramic formed of polycristalline alumina ceramic that is translucent. The arc tube 14 contains a charge of an arc generating and sustaining medium which is mercury-free and contains sodium in an amount of 0.02 to 0.06 mg/watt of designed lamp operation (for lamps of 70 to 150 watt operation), and 133 to 267 mbar (100 to 200 Torr) of xenon, preferably, 187 to 213 mbar (140 to 160 Torr). The amount of sodium present is enough to operate the lamp in a saturated mode for the 24,000 hour life. The upper end of the arc tube 14 is closed by an alumina ceramic plug 20 through which a niobium inlead 26 projects and which supports an upper electrode (not shown) within the arc tube 14. The lower end of arc tube 14 has a closure which comprises a ceramic plug 21 through which extends a thin-walled niobium tube 26. The niobium tube 26 serves as an in-lead for arc tube 14. The shank of the lower electrode (not shown) of arc tube 14 projects into tube 26 and may be locked in place by crimping the tube 26 about the lower electrode at location 25. The arc tube 14 has a tungsten wire 50 coiled thereabout. The wire 50 is connected to one of the electrodes by a thermal switch 52 and is placed between the electrodes where the lowest breakdown voltage is achieved. The thermal switch opens when the lamp is warm so as to minimize electric fields across the tube wall

[0013] The arc tube 14 is of primary interest to the invention and has an arc chamber 40 defined by walls 42. The arc tube comprises magnesia in an amount of about 0.020 to 0.050 wgt. percent; zirconia in an amount of about 0.018 wgt. percent, and about 0.035 wgt. percent yttria; balance alumina. Such an arc tube is capable of operating with internal wall temperatures of 1250 to

1300°C and is shown in U.S. Patent No. 5,682,082, which is assigned to the assignee of the instant invention.

[0014] The outer envelope 6 is lead-free and arsenic-free and preferably is a borosilicate glass having a composition of 13.5 to 16.8 wt. % B_2O_3, 2.0 to 4.0 wt % Al_2O_3, 2.0 to 5 wt. % Na_2O, 1.3 to 4.0 wt. % K_2O, from 0 to 0.30 wt. % Li_2O, 0 to 1.0 wt. % CaO, 0 to 1.0 wt. % MgO, 0.05 to 0.17 wt. % Fe_2O_3, 0.005 to 0.06 wt. % CeO_2, and the balance SiO_2. Preferably, the amounts of Fe_2O_3 and CeO_2 comprise no greater than 0.19 wt. % and the sum of the amounts of Na_2O, K_2O and LiO_2 comprise no greater that 7.5 wt. %. Such a glass is shown, for example in US-A 6 118 216 (S.N. 09/085,989) filed 05/28/98 and assigned to the assignee of the present invention.

[0015] There is thus provided an environmentally safe, easily disposable discharge lamp that is free of lead, including lead solder, and mercury and arsenic. The lamp has a 24,000 hour life.

[0016] While there have been shown and described what are at present considered the preferred embodiments of the invention, it will be apparent to those skilled in the art that various changes and modifications can be made herein without departing from the scope of the invention as defined by the appended claims.

Claims

1. A long-life, environmentally disposable high pressure sodium lamp (100) comprising: an arc tube (14) capable of withstanding internal wall temperatures of 1250 to 1300°C and having electrodes sealed therein and being designed for operation at a given wattage; a discharge space within said arc tube (14) and an arc generating and sustaining medium within said discharge space, said medium being mercury-free and containing sodium in an amount of about 0.02 mg to 0.06 mg/watt of designed operation, and xenon at a pressure of 133 to 267 mbar (100 to 200 Torr), mounting means supporting said arc tube (14) within a glass outer envelope (6), said glass outer envelope (6) being lead-free and arsenic-free; and an electrically conductive base closing said outer envelope (6) and containing lead-in wires affixed to said electrodes, said lead-in wires being attached to said base by welding.

2. The lamp of Claim 1 wherein said arc tube (14) is formed from polycrystalline alumina containing minor amounts of MgO, ZrO_2, and Y_2O_3.

3. The lamp of Claim 2 wherein said minor amounts are about 0.02 wt. % MgO, 0.018 wt. % ZrO_2 and 0.035 wt. % Y_2O_3.

4. The lamp of Claim 1 wherein said outer envelope (6) is a borosilicate glass.

5. The lamp of Claim 4 wherein said borosilicate glass has a composition consisting essentially of B_2O_3, Al_2O_3, Fe_2O_3, Na_2O, K_2O, CeO_2, and SiO_2, with optional minor amounts of Li_2O, CaO, and MgO, said minor amount totaling less that 2.5 wt. %.

Patentansprüche

1. Umweltfreundlich entsorgbare Hochdrucknatriumlampe (100) mit langer Lebensdauer, die folgendes umfaßt: eine Lichtbogenröhre (14), die in der Lage ist, Innenwandtemperaturen von 1250 bis 1300ºC standzuhalten und in die Elektroden eingeschmolzen sind und die für Betrieb bei einer gegebenen Wattzahl ausgelegt ist; einen Entladungsraum in der Lichtbogenröhre (14) und ein Lichtbogenerzeugungs- und -aufrechterhaltungsmedium in dem Entladungsraum, wobei das Medium quecksilberfrei ist und Natrium in einer Menge von etwa 0,02 mg bis 0,06 mg/Watt des Betriebs nach Auslegung und Xenon unter einem Druck von 133 bis 267 mbar (100 bis 200 Torr) enthält, Befestigungsmittel, die die Lichtbogenröhre (14) in einem Glasaußenkolben (6) stützen, wobei der Glasaußenkolben (6) bleifrei und arsenfrei ist; und einen elektrisch leitenden Sockel, der den Außenkolben (6) verschließt und Zuleitungsdrähte enthält, die an den Elektroden befestigt sind, wobei die Zuleitungsdrähte durch Schweißen am Sockel befestigt sind.

2. Lampe nach Anspruch 1, wobei die Lichtbogenröhre (14) aus polykristallinem Aluminiumoxid ausgebildet ist, das geringe Mengen an MgO, ZrO_2 und Y_2O_3 enthält.

3. Lampe nach Anspruch 2, wobei die geringen Mengen etwa 0,02 Gew.-% MgO, 0,018 Gew.-% ZrO_2 und 0,035 Gew.-% Y_2O_3 sind.

4. Lampe nach Anspruch 1, wobei der Außenkolben (6) ein Borosilikatglas ist.

5. Lampe nach Anspruch 4, wobei das Borosilikatglas eine Zusammensetzung aufweist, die im wesentlichen aus B_2O_3, Al_2O_3, Fe_2O_3, Na_2O, K_2O, CeO_2 und SiO_2 besteht, wahlweise mit kleinen Mengen an Li_2O, CaO und MgO, wobei die kleine Menge insgesamt weniger als 2,5 Gew.-% beträgt.

Revendications

1. Une lampe (100) au sodium à haute pression, de longue durée et pouvant être jetée sans nuire à l'environnement comprenant : un tube (14) à arc apte

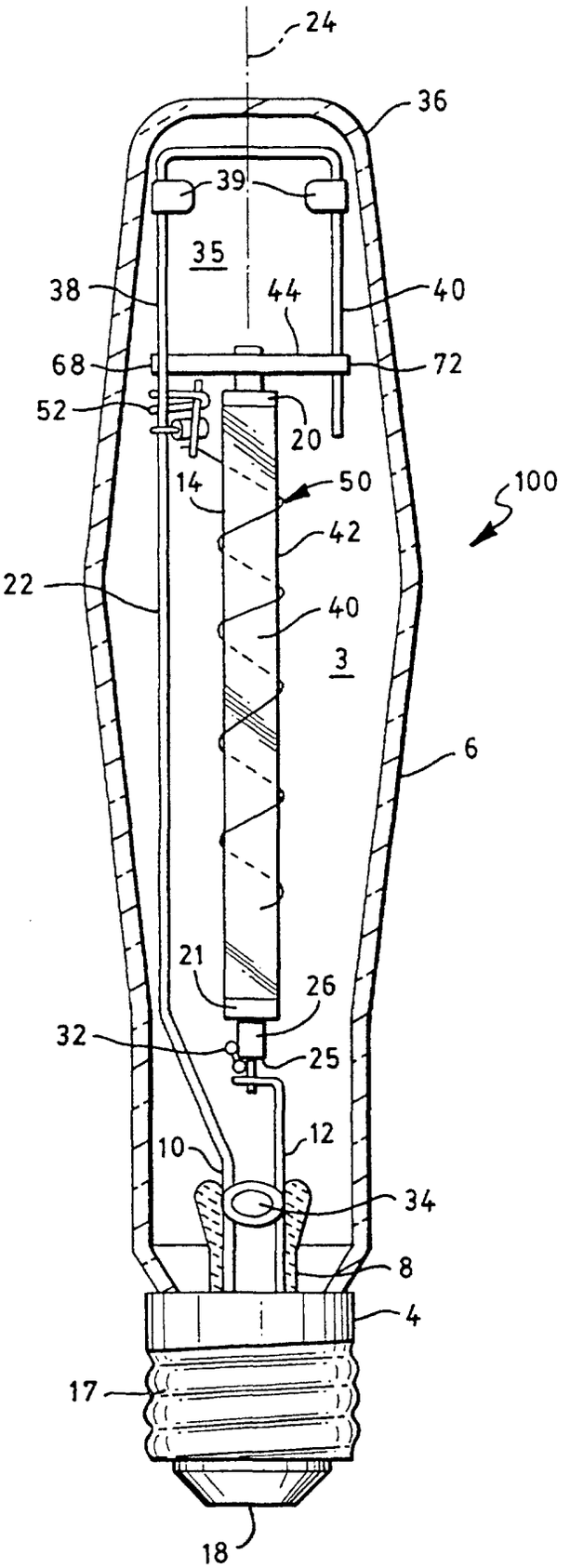
à résister à des températures de paroi interne de 1250 à 1300°C et ayant des électrodes qui sont scellées et conçu pour fonctionner à une puissance donnée ; un espace de décharge dans le tube (14) à arc et un milieu engendrant et maintenant un arc dans l'espace de décharge, le milieu étant exempt de mercure et contenant du sodium en une quantité d'environ 0,02 mg à 0,06 mg/watt de fonctionnement nominal, et du xénon sous une pression de 133 à 267 mbar (100 à 200 torr), des moyens de montage supportant le tube (14) à arc dans une ampoule (6) extérieure en verre, l'ampoule (6) extérieure en verre étant sans plomb ni arsenic et une embase conductrice de l'électricité, fermant l'ampoule (6) extérieure et contenant des fils d'entrée fixés aux électrodes, les fils d'entrée étant fixés à l'embase par soudage.

2. Lampe suivant la revendication 1, dans laquelle le tube (14) à arc est en alumine polycristalline contenant des quantités mineures de MgO, de ZrO_2 et de Y_2O_3.

3. Lampe suivant la revendication 2, dans laquelle les quantités mineures sont d'environ 0,02 % en poids de MgO, 0,018 % en poids de ZrO_2 et 0,035 % en poids de Y_2O_3.

4. Lampe suivant la revendication 1, dans laquelle l'ampoule (6) extérieure est en verre au borosilicate.

5. Lampe suivant la revendication 4, dans laquelle le verre au borosilicate a une composition consistant essentiellement en B_2O_3, Al_2O_3, Fe_2O_3, Na_2O, K_2O, CeO_2 et SiO_2 avec éventuellement de petites quantités de Li_2O, de CaO et de MgO, la petite quantité représentant au total moins de 2,5 % en poids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