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(54) **Fluorescent lamp with end of life arc quenching structure**

Fluoreszenzlampe mit einer Vorrichtung zur Bogenlöschung am Ende der Lebensdauer

Lampe fluorescente avec structure d'extinction d'arc en fin de vie

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Description

[0001] The invention relates to fluorescent lamps, and is directed more particularly to a fluorescent lamp having therein means for quenching the arc in the lamp at the end of lamp life.

[0002] U.S. Patent No. 5,142,202 describes an electronic ballast circuit having additional circuitry to shut down the system upon sensing cathode depletion.

[0003] Fluorescent lamps are increasingly being used with electronic ballasts that operate the lamp at high frequencies. Often such ballasts are of the "instant start" type wherein the open circuit voltage is sufficiently high to ignite the lamp directly, without the need for a separate cathode heating current.

[0004] The end of lamp life occurs when one of the electrodes is depleted of its emissive coating. At power line frequencies and with low open circuit voltage ballasts, the lamp arc is passively extinguished when the first electrode fails. However, in the case of electronic instant start ballasts, the lamp arc does not necessarily extinguish when the first electrode fails. The open circuit voltage provided by instant start ballasts is sufficiently high to cause the lamp to continue to operate in a "cold cathode" mode. During cold cathode operation, the cathode voltage rises from around 12 volts to 50 volts, or higher. Referring to FIGS. 1 and 2, in a lamp 2 having electrodes 4, 6 at either end of a glass envelope 8, respectively, upon failure of the first electrode 6, ion bombardment heats the tungsten coil 10, lead wires 12, 14, and any other metallic structures within the glass envelope 8. The heating of the metallic components is to such a high temperature that the components provide sufficient thermionic and secondary electron emission to sustain the arc. Wattage dissipation in the failed lamp end greatly increases. As a result, the end of the envelope 8 heats far above its normal operating temperature. The lead wires 12, 14 within the envelope 8 can become molten and melt through the envelope and/or cause the envelope to crack and sometimes break upon removal of the lamp from a fixture. The excessive heating of the lamp end can also cause damage to a socket or lamp fixture in which the lamp is mounted, or melting of a plastic lamp base.

[0005] To alleviate the problem, instant start electronic ballasts have been designed with additional circuitry to sense a rise in lamp voltage, or other events occurring upon cathode depletion, and shut down the system. However, such additional electronic components significantly increase the cost of the ballast. Further, many ballasts which do not include such a feature already exist in present lamp installations.

[0006] JP-A-56 003967 discloses means for preventing the overheating and burning damage in a metal vapor discharge lamp, the means consisting of a non-restoring type heat sensitive element, e.g., a fuse wire, which is operated at a current more than the nominal lamp current. Overcurrent due to break down in the sta-

bilizer causes the fuse wire having the higher current carrying property to take over, thereby preventing burning damage from the stabilizer.

[0007] SU-A-1 145 384 relates to an incandescent lamp including a filament 2 supported by a pair of lead wires 3. The outside portions of the lead wires are within a plate 6. The plate 6 is a portion of the glass mount that has an internal cavity through which the lead wires pass. A coating of a suspension of a metal hydride is applied on the internal volume of the plate below the blades (press seal) 4 to prevent internal arcing between the lead wires which would cause an unwanted short circuit in the bulb.

[0008] Accordingly, there exists a need for a fluorescent lamp which self-contains means for arc shut-down at the end of life of the lamp, which shut-down means does not include or require additional circuitry or electronic components.

[0009] The object of the invention is to provide a fluorescent lamp having such means for arc shut-down wherein the shut-down means requires no additional circuitry or electronic components.

[0010] This object is solved by a fluorescent lamp having the features of claim 1. Preferred embodiments are disclosed in the dependent claims.

[0011] The above and other features of the invention, including various novel details of construction and combination of parts, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular devices embodying the invention are shown by way of illustration only and not as limitations of the invention. The principles and features of this invention may be employed in various and numerous embodiments without departing from the scope of the invention according to the appended claims.

[0012] Reference is made to the accompanying drawings in which is shown an illustrative embodiment of the invention, from which its novel features and advantages will be apparent.

[0013] In the drawings:

FIG. 1 is a side elevational view of a prior art fluorescent lamp;

FIG. 2 is an enlarged diagrammatic view of an end portion of the lamp of FIG. 1;

FIG. 3 is similar to FIG. 2, but shows one form of fluorescent lamp illustrative of an embodiment of the invention; and

FIG. 4 is similar to FIG. 3, but shows another form of fluorescent lamp illustrative of an alternative embodiment of the invention.

[0014] Referring to FIG. 3, there is shown a fluorescent lamp 2 comprising a glass tube 8. An electrode 4, 6, (one shown in FIG. 3) is disposed at each end of the tube 8. A pair of lead wires 12, 14 extend through each sealed end of the tube and are joined to a coil 10 to form

the electrodes. A deposit 30 of metal hydride-containing paste is disposed in the tube 8 and is provided with a decomposition temperature higher than temperatures within the tube 8 during normal operation of the lamp. During normal lamp operation, the temperature of the paste is preferably maintained at about 150 °C or less. It will be seen that the electrode 6 is similar to that shown in FIG. 2, but has disposed on each of the lead wires 12, 14 the metal hydride-containing deposit 30. The deposit 30 preferably is joined to the lead wires 12, 14 at each end of the tube 8 at a point at which the lead wires 12, 14 emerge from a glass seal 32, that is, at the lead wire-glass seal interface.

[0015] In operation, at the end of the lamp life, caused by depletion of the cathode coating at one end of the lamp, the coil 10 in that end of the lamp rises to a temperature much higher than its normal operating temperature and is eventually burned off. The arc then attaches to a lead wire 12 or 14 and raises the temperature of that wire. Heat conducted down the wire thermally decomposes the metal hydride-containing paste deposit 30, and hydrogen is released within the lamp. During this period, the temperature of the paste reaches 650 °C or higher. The presence of hydrogen in the tube 8 raises the voltage required to sustain the discharge well above that provided by instant start ballasts, causing the lamp to go out passively, without significant end heating or glass cracking. The hydrogen release occurs rapidly enough to prevent damage to a fixture retaining the affected lamp. The quantity of hydrogen released, typically about one Torr-liter from a five milligram deposit, is sufficient to quench the arc in larger fluorescent lamps.

[0016] A preferred embodiment of paste is formulated by mixing 40 parts by weight of finely powdered titanium hydride and 60 parts by weight of colloidal alumina suspension in water. A deposit of this paste, which, when dried, weighs about five milligrams, is applied to the base of each lead wire 12, 14 where the lead wire emerges from the glass seal 32.

[0017] Alternative paste embodiments may be used, including binders other than colloidal alumina. Preferably, the binder is inorganic and not subject to outgassing once dried, such as, for example, montmorillonite clays and various silicates.

[0018] Referring to FIG. 4, there is illustrated an electrode configuration wherein a glass bead 40 is fixed on the two lead wires 12, 14 and the deposit 30 preferably is disposed on the surface of the glass bead nearest the coil 10, though the deposit may be applied to the sides or surface most removed from the coil.

[0019] The preferred metal hydride is titanium hydride, $TiH_{1.7}$. The metal hydride can be selected from a group including titanium, zirconium, hafnium, alloys of these metals with one another, and alloys of these metals with other metals such as cobalt, iron, nickel, manganese, lanthanum, or combinations of these other metals.

[0020] There is thus provided a fluorescent lamp hav-

ing means therein for causing shut-down at the end of lamp life, which means requires no additional circuitry or electronic components. The costs associated with the shut-down means are trivial and much lower than the cost of providing a shut-down circuit in the ballast, even though the ballast may survive several lamp lives.

[0021] It is to be understood that the present invention is by no means limited to the particular constructions herein disclosed and/or shown in the drawings, but also comprises any modifications or equivalents within the scope of the claims.

Claims

1. A fluorescent lamp comprising:

a glass tube (8),

an electrode (4,6) at each end of said tube (8); each of said electrodes (4,6) comprising a pair of lead wires (12,14) extending through a glass member (32,40) and joined to a coil (10); and

a deposit (30) of metal hydride-containing paste disposed on said glass member (32, 40) and having a decomposition temperature higher than temperatures within said tube (8) during normal operation of said lamp;

wherein said glass member (32, 40) is a glass seal (32) at an end of said tube (8) or a glass bead (40); and

wherein said deposit (30) is disposed on said glass member (32, 40) at the juncture of said glass member (32, 40) and said lead wires (12, 14) extending therefrom.

2. The fluorescent lamp in accordance with claim 1 wherein, in case said glass member (32, 40) is a glass bead (40), said deposit (30) is disposed on a surface of said glass bead (40) nearest said electrode (4, 6).

3. The fluorescent lamp in accordance with any of the preceding claims wherein the metal of said metal hydride contained in said paste (30) is a selected one from a group consisting of titanium, zirconium, hafnium, a titanium-zirconium alloy, a titanium hafnium alloy, and a zirconium-hafnium alloy.

4. The fluorescent lamp in accordance with any of claims 1 to 3 wherein the metal of said metal hydride comprises an alloy consisting of a selected one from a group consisting of titanium, zirconium, and hafnium, and a selected one from a group consisting of cobalt, iron, nickel, manganese, and lantha-

num.

5. The fluorescent lamp in accordance with any of claims 1 to 3 wherein said metal hydride comprises titanium hydride.

6. The fluorescent lamp in accordance with claim 5 wherein said paste (30) comprises 40 parts by weight of said titanium hydride and 60 parts by weight of said colloidal alumina suspension in water, said titanium hydride being in finely powdered form.

Patentansprüche

1. Fluoreszenzlampe, die umfasst:

eine Glasröhre (8),

eine Elektrode (4, 6) an jedem Ende der Röhre (8), wobei jede der Elektroden (4, 6) ein Paar von Anschlussdrähten (12, 14) umfasst, die sich durch ein Glaselement (32, 40) erstrecken und die zu einer Spule (10) verbunden sind; und

eine Abscheidung (30) einer Paste, die ein Metallhydrid enthält, die auf dem Glaselement (32, 40) abgeschieden ist und eine Zersetzungstemperatur hat, die höher als die Temperatur innerhalb der Röhre während des normalen Betriebes der Lampe ist;

wobei das Glaselement (32, 40) ein Glassiegel (32) an einem Ende der Röhre (8) oder ein Glastropfen (40) ist; und

wobei die Abscheidung (30) auf dem Glaselement (32, 40) an der Schnittstelle von dem Glaselement (32, 40) und den Anschlussdrähten (12, 14) ist, die sich von diesem aus erstrecken.

2. Fluoreszenzlampe mit den Merkmalen des Anspruchs 1, dadurch gekennzeichnet, dass in dem Fall, dass das Glaselement (33, 40) ein Glastropfen (40) ist, die Abscheidung (30) auf einer Oberfläche des Glastropfens (40) abgeschieden wird, die am nächsten zu der Elektrode (4, 6) ist.

3. Fluoreszenzlampe mit den Merkmalen eines der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass das Metall des in der Paste (30) enthaltenen Metallhydrids eines aus einer Gruppe ist, die aus Titan, Zirkon, Hafnium, einer Titan-Zirkon-Legierung, ei-

ner Titan-Hafnium-Legierung und einer Zirkon-Hafnium-Legierung besteht.

4. Fluoreszenzlampe mit den Merkmalen eines der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass das Metall des Metallhydrids eine Legierung umfasst, die aus einem Element aus einer Gruppe besteht, die aus Titan, Zirkon und Hafnium besteht und aus einem Element aus einer Gruppe besteht, die aus Kobalt, Eisen, Nickel, Mangan und Lanthan besteht.

5. Fluoreszenzlampe mit den Merkmalen eines der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass das Metallhydrid Titanhydrid umfasst.

6. Fluoreszenzlampe gemäß der Merkmale des Anspruchs 5, dadurch gekennzeichnet, dass die Paste (30) 40 Gewichtsteile des Titanhydrids und 60 Gewichtsteile der kolloidalen Aluminiumsuspension in Wasser umfasst, wobei das Titanhydrid in einer feinen, gepuderten Form vorliegt.

Revendications

1. Lampe fluorescente comprenant :

un tube de verre (8),
une électrode (4, 6) à chaque extrémité du dit tube (8), chacune des dites électrodes (4, 6) comportant deux entrées de courant (12, 14) traversant un élément en verre (32, 40) et reliées à une bobine (10); et
un dépôt (30) d'une pâte contenant un hydrure métallique disposé sur le dit élément en verre (32, 40) et présentant une température de décomposition supérieure aux températures régnant à l'intérieur du dit tube (8) pendant le fonctionnement normal de la dite lampe ;
dans laquelle le dit élément en verre (32, 40) est un scellement de verre (32) à une extrémité du dit tube (8), ou une perle de verre (40) ; et
dans laquelle le dit dépôt (30) est effectué sur le dit élément en verre (32, 40) à la jonction du dit élément en verre (32, 40) et des dites entrées de courant (12, 14) en faisant saillie.

2. Lampe fluorescente selon la revendication 1, dans laquelle, dans le cas où le dit élément en verre (32, 40) est une perle de verre (40), le dit dépôt (30) est disposé sur une paroi de la dite perle de verre (40) la plus proche de la dite électrode (4, 6).

3. Lampe fluorescente selon l'une quelconque des re-

vendications précédentes, dans laquelle le métal du dit hydrure métallique contenu dans la dite pâte (30) est l'un choisi dans le groupe comprenant le titane, le zirconium, l'hafnium, un alliage de titane et de zirconium, un alliage de titane et d'hafnium et un alliage de zirconium et d'hafnium. 5

4. Lampe fluorescente selon l'une quelconque des revendications 1 à 3, dans laquelle le métal du dit hydrure métallique est un alliage constitué par l'un au choix du groupe comprenant le titane, le zirconium et l'hafnium, et par l'un au choix du groupe comprenant le cobalt, le fer, le nickel, le manganèse et le lanthane. 10

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5. Lampe fluorescente selon l'une quelconque des revendications 1 à 3, dans laquelle le dit hydrure métallique est un hydrure de titane.

6. Lampe fluorescente selon la revendication 5, dans laquelle la dite pâte (30) comprend 40 parts en poids du dit hydrure métallique et 60 parts en poids d'une suspension colloïdale d'alumine dans de l'eau, le dit hydrure de titane étant en forme d'une fine poudre. 20

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30

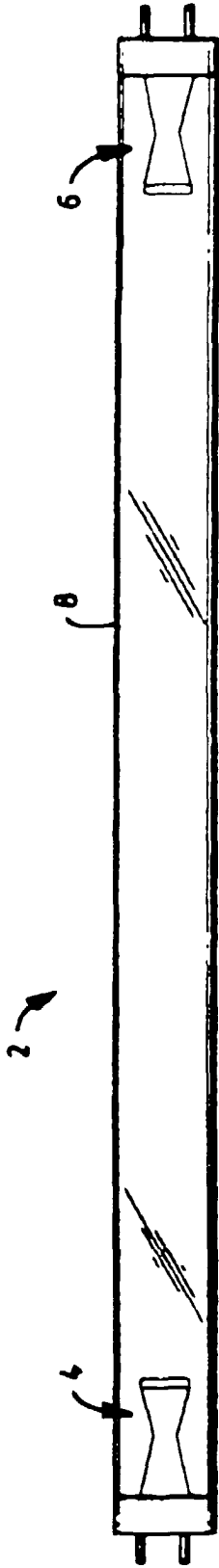
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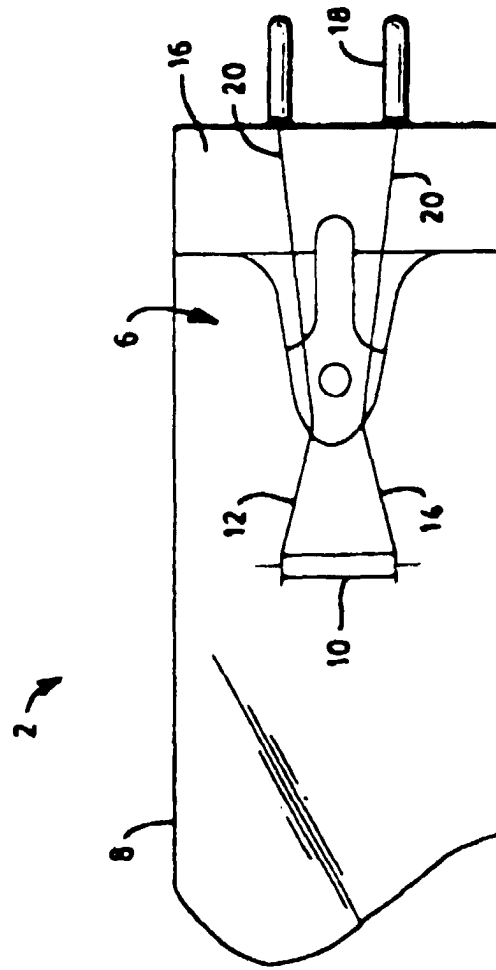
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PRIOR ART
FIG. 1



PRIOR ART
FIG. 2

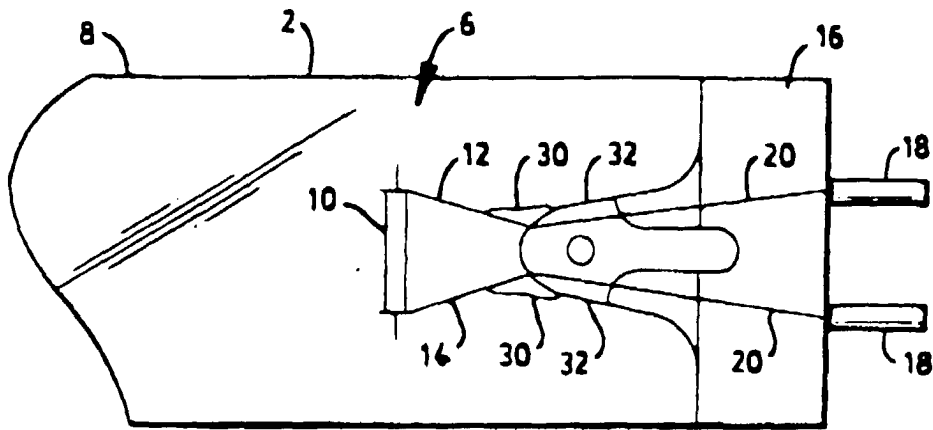


FIG. 3

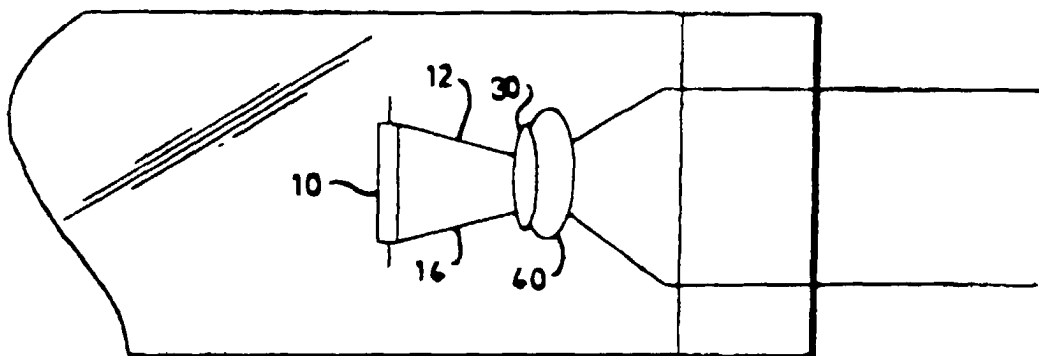


FIG. 4