(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 871 202 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.10.1998 Bulletin 1998/42

(51) Int. Cl.[6]: **H01J 61/36**, H01J 61/82

(21) Application number: **98104337.5**

(22) Date of filing: **11.03.1998**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **11.04.1997 JP 93856/97**

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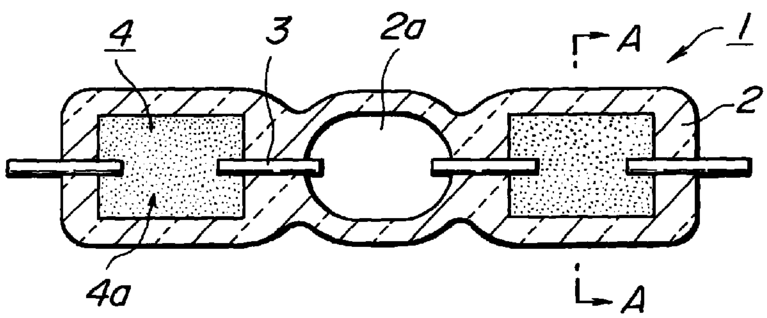
(54) **Metal halide discharge lamp**

(57) A metal halide discharge lamp 1 in which a metal foil leading-in wire 4 being held and sealed by a bulb 2 has at least one surface provided with a satin finish 4a, reduces the influence due to repetitive lighting and lighting-off to avoid an extreme short lift time.

Fig.1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a discharge lamp and, in particular, a discharge lamp in which metal halide is added into mercury vapor for improving color rendering property.

2. Background Art

FIG. 3 shows a construction of a metal halide discharge lamp of prior art. At the time of feeding from the exterior to a discharging electrode 92 disposed in a discharge room 91a of a bulb 91, in order to maintain the gastightness of the discharge room 91a, a metal foil leading-in wire 93 made of molybdenum etc. is held and sealed by thermally deforming the bulb 91.

The use of the metallic foil leading-in wire permits an increase of surface area as a conductive material and a reduction in pressure of the discharge room 91a per unit area. However, since the bulb in the softened state is subjected to pressure welding with the metal foil leading-in wire, both are merely in contact with a flat surface as shown in FIG. 4. By thermal stresses of temperature rise and fall due to the repetitive lighting and lighting-off, a contact between the two becomes gradually loose, leading to leaks.

Japanese Patent Publication No. Hei. 5-3703 describes a construction where sealing is performed by deposing a conductive material of round bar on a bulb by using a frit. However, the use of a round bar shaped conductive material displays a disadvantage that the ratio of the surface area to the volume, i.e., the ratio of the periphery to the sectional area, becomes small. Since the sectional area requires a specified value according to the discharge current value, if the periphery length is small for the same sectional area, the pressure of a discharge room applied per unit length is increased. Accordingly, for the whole conductive material, the pressure of the discharge room per unit area is increased, which is disadvantageous in preventing leaks.

As described, although a frit is interposed for increasing the adhesive strength between a bulb and a conductive material, the frit is melted at the time of sealing to deposit on the bulb and the conductive material. Therefore, at this melting, impurities contained in the frit or the composition of the frit evaporate and then enter the discharge room to damage discharge lamp properties.

SUMMARY OF THE INVENTION

The above mentioned problems are solved according to the present invention by a metal halide discharge lamp comprising a metal foil leading-in wire held and sealed by a thermally deformed glass bulb, characterized in that at least one of surfaces of the metal foil leading-in wire are furnished with a satin finish.

The metal halide discharge lamp including the metallic foil leading-in wire with the satin finished both surfaces that is held and sealed by a bulb is free from the problem of prior art that the lift time of halide discharge lamps is reduced depending upon the number of lighting and lighting-off. It is therefore possible to apply to cases where flickering is made frequently, e.g., head lamps of automobiles, to expand the use of metal halide discharge lamps of this type, and to improve the reliability.

In addition, the satin finish by a sand blasting finish using corundum abrasive grains or an electric field deposition using a melted metallic salt, prevents matters which will be harmful by heating for sealing with a bulb from entering the discharge room. This avoids an additional step, e.g., elimination of remaining abrasive grains, and facilitates to practice the discharge lamp of the present invention, without causing no cost rise.

Other features and advantages of the present invention will be apparent from the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a metal halide discharge lamp according to a preferred embodiment of the present invention.

FIG. 2 is a sectional view along line A-A of FIG. 1.

FIG. 3 is a sectional view of a metal halide discharge lamp of prior art.

FIG. 4 is a sectional view along line B-B of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. 1, reference numeral 1 indicates a metal halide discharge lamp according to one embodiment of the present invention. In the metal halide discharge lamp 1, a metal foil leading-in wire 4 made of molybdenum is employed as a conductive material so as to produce a greater surface area for sectional area, in order that the gastightness of a discharge room 2a is maintained when performing a feeding from the exterior to a discharging electrode 3 disposed in the discharge room 2a of a bulb 2.

Detailed description of the metal foil leading-in wire 4 is given herebelow. Metal materials as a material of the metal foil leading-in wire 4 are supplied in the market after they are formed, e.g., by means of rolling, into the form of foil (plate) by manufacturers so as to have a specified thickness, and further treated to have a fairly smooth surface, i.e., flaw-free, for increasing their commercial value.

Therefore, if the metal foil leading-in wire 4 is formed by such a commercially available metal material, it is impossible to obtain a peripheral length greater than that defined by its sectional shape. Hence, the present invention is directed to obtain a peripheral length greater than that defined by the sectional shape of a metal foil leading-in wire 4 by providing a satin finish 4a on at least one of the surfaces of the aforesaid metal material to produce fine irregularities thereon, as shown in FIG. 2.

Detailed description of the satin finish 4a is given herebelow. As a first means, there is a manner executed by mechanical means, such as sand blasting, in which abrasive grains that are fine powders of a material having an appropriate hardness are sprayed and collided on the surface of a metal foil leading-in wire 4 or of a metal material that is a material to form the metal foil leading-in wire 4.

As abrasive grains of this type, silicon carbide (SiC), hereinafter referred to as carborundum, is generally employed because of its outstanding work efficiency in addition to its hardness. However, from the test and examination conducted by the present inventors, it has been found out that the abrasive grains of silicon carbide have the following disadvantages.

Specifically, since the abrasive grains of silicon carbide have high hardness, they are strongly cut into the metal foil leading-in wire 4. It is therefore very difficult to eliminate the remaining abrasive grains on the surface after a sand blasting. The remaining abrasive grains sublime at the step of sealing, adhere to a discharging electrode 3 and disappear, which will then make the surface black.

On the other hand, alumina (Al_2O_3), hereinafter referred to as corundum, is not decomposed at temperatures required in a sealing step, i.e., about 2000°C, thus causing no influence on the life time of discharge lamps. Therefore, the present invention employs alumina as an abrasive grain. This avoids a step of eliminating such remaining abrasive grains as described above to reduce the number of steps as a whole.

As a second means for forming a satin finish 4a, there is chemical means, such as an electric field deposition using a melted metallic salt. The following description is made taking an example of molybdenum but not limited to this alone. Other metals or metal mixtures are useable for the metal foil leading-in wire 4.

Generally, it is impossible to execute an electric field deposition from an aqueous solution with a metal, e.g., molybdenum, whose ionization tendency is greater than that of hydrogen (H). Because the melting point of molybdenum is 2893 K, an electric field deposition in the solution state requires high equipment and technical levels, making it further difficult to apply it into practice.

The use of molybdenum chloride ($MoCl_5$) having a low melting point permits an easy practical application. Specifically, molybdenum chloride is melted in a crucible under an argon atmosphere and then subjected to an electric field deposition by using molybdenum as an electrode.

In this occasion, the molybdenum is deposited in a manner of ($Mo^{5+}+5e^- \rightarrow Mo$) on a cathode side, and therefore, by forming a metal foil lead-in wire 4 with this deposited molybdenum as a material, it is possible to obtain the metal foil leading-in wire 4 that has an increased surface area due to fine irregularities on the surface, i.e., a satin finish 4a, as in the case of a sand blasting.

At the same time, the molybdenum electrode on an anode side is in the state of ($Mo \rightarrow Mo^{5+}+5e^-$), i.e., a state where electrical corrosion has been caused, thereby producing fine irregularities in the same manner. It is therefore possible to use as a material of a metal foil leading-in wire 4 that has a great surface area as in that of the cathode. It should be noted that no abrasive grain is required in this manner and thus requires no step of eliminating remaining abrasive grains.

The test and examination for the satin finish 4a conducted by the present inventors show that to improve the adhesive strength with a bulb 2, it is effective to set the surface roughness in a proper range. Test samples of the satin finish 4a having a different surface roughness were prepared and their surface roughnesses were measured according to JIS B0601(1982) standards, in order to obtain an optimum range of surface roughness.

In the following description, arithmetical mean deviation of profile is referred to as "Ra", and ten point height of irregularities is referred to as "Rz". For fifty samples of satin finish 4a having a surface roughness of Ra=0.2 μm and Rz=1.1 μm, 60% of the samples peeled off a bulb 2. This shows that the surface is too smooth to improve the adhesive strength. The length measured at that time was 0.8 mm.

Next, with $Ra<0.25\mu m$ and $1.1\mu m<Rz$, samples of satin finish 4a were prepared to conduct the test under the same conditions. The result was 0%, i.e., no sample peeled off a bulb 2, which satisfied the above object. The mean interval (Sm) of the counted irregularities not less than ±1 μm in mean line was $Sm \leq 40\mu m$.

It is extremely difficult to obtain $Ra>0.5\mu m$, $Rz>4.5\mu m$ by means of sand blasting or electric field deposition as previously described. But even if failed to reach these values, it is possible to determine whether a satisfactory effect for the object is obtained or not. Thus, in the present invention, the arithmetical means deviation of profile is defined as $0.25 \leq Ra \leq 0.8 (\mu m)$ and the ten point height of irregularities is defined as $1.1<Rz \leq 4.5 (\mu m)$.

Operation and effect of the metal halide discharge lamp 1 with the above mentioned construction is described herebelow. The increase of surface area of the metal foil leading-in wire 4 by the presence of the satin finish 4a enables to extend the life time of the discharge lamp 1 by suppressing that a contact with the bulb 2 is loosen by thermal stresses due to repetitive lighting and lighting-out to allow the outside air to enter the discharge room 2a.

According to the test results, when a conventional molybdenum foil with a smooth surface is employed as a metal foil leading-in wire 4, on the average 2,000 repetitions of lighting and lighting-off caused peeling between a bulb 2 and the metal foil leading-in wire 4 to cause leaks. On the other hand, when used a metal foil leading-in wire 4 of the present invention, on the average 12,000 repetition of lighting and lighting-off caused a gradual leak. This shows about six times improvement.

In this manner, the metal halide discharge lamps of the present invention that suppress a reduction in life time due to repetitive lighting and lighting-off, are extremely useful because in recent years, metal halide discharge lamps have been finding their ways into uses where lighting and lighting-off are more frequent than that of conventional lamps for lighting, e.g., head lamps for automobiles, light sources for projection type television receiving sets.

While there has been described what is at present considered to be a preferred embodiment of the invention, it will be understood that various modifications may be made thereto, and it is intended that the appended claims cover all such modifications as fall within the true spirit and scope of the invention.

Claims

1. A metal halide discharge lamp comprising a metal foil leading-in wire held and sealed by a thermally deformed glass bulb, characterized in that at least one of surfaces of the metallic foil leading-in wire is furnished with a satin finish.

2. The metal halide discharge lamp as set forth in claim 1, wherein both surfaces of the metallic foil leading-in wire are furnished with a satin finish.

3. The metal halide discharge lamp as set forth in claim 1, wherein the satin finish is performed by a sand blasting finish using corundum abrasive grains.

4. The metal halide discharge lamp as set forth in claim 1, wherein the satin finish is performed by an electric field deposition using a melted metallic salt.

5. The metal halide discharge lamp as set forth in claim 2, wherein the satin finish is performed by a sand blasting finish using corundum abrasive grains.

6. The metal halide discharge lamp as set forth in claim 2, wherein the satin finish is performed by an electric field deposition using a melted metallic salt.

7. The metal halide discharge lamp as set forth in claim 1, wherein a surface roughness of the satin finish is defined as $0.25 \leq Ra \leq 0.8$ (μm), $1.1 < Rz \leq 4.5$ (μm), and $Sm \leq 40$ (μm) according to JIS B0601 (1982), where Ra represents arithmetical mean deviation of profile, Rz represents ten point height of irregularities, and Sm represents mean interval of irregularities.

8. The metal halide discharge lamp as set forth in claim 3, wherein a surface roughness of the satin finish is defined as $0.25 \leq Ra \leq 0.8$ (μm), $1.1 < Rz \leq 4.5$ (μm), and $Sm \leq 40$ (μm) according to JIS B0601 (1982), where Ra represents arithmetical mean deviation of profile, Rz represents ten point height of irregularities, and Sm represents mean interval of irregularities.

9. The metal halide discharge lamp as set forth in claim 4, wherein a surface roughness of the satin finish is defined as $0.25 \leq Ra \leq 0.8$ (μm), $1.1 < Rz \leq 4.5$ (μm), and $Sm \leq 40$ (μm) according to JIS B0601 (1982), where Ra represents arithmetical mean deviation of profile, Rz represents ten point height of irregularities, and Sm represents mean interval of irregularities.

10. The metal halide discharge lamp as set forth in one of the claims 1 to 9, wherein the metal foil leading-in wire is a molybdenum foil.

Fig.1

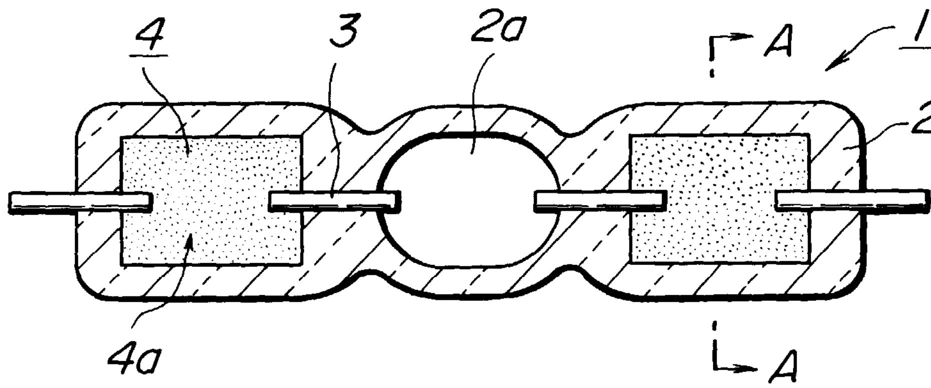

Fig.2

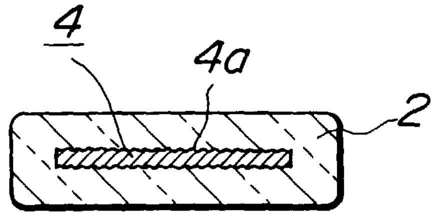

Fig.3
Prior Art

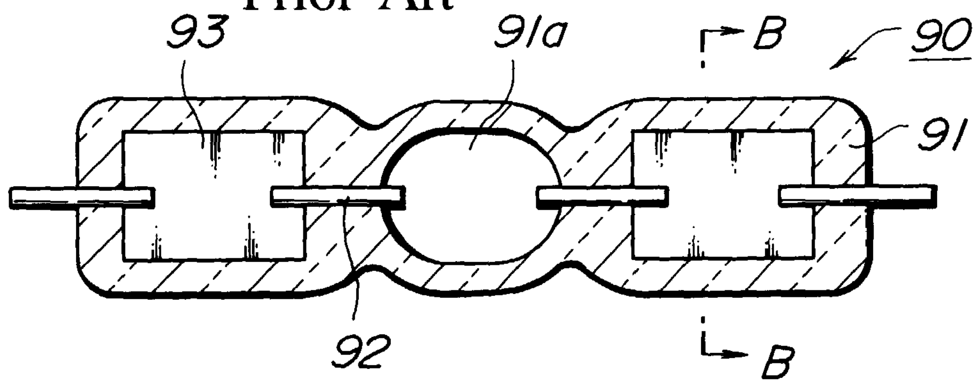

Fig.4
Prior Art