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(54) Double-end type metal halide bulb with low power consumption

Zweiseitig gesockelte Metallhalogenidlampe niedriger Leistung

Lampe à halogénure métallique à double culot à basse puissance

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a double end type metal halide bulb or lamp with low power consumption for use in automotive lighting, and more particularly to a composition of the metal halide bulb or lamp capable of providing sufficient light emitting efficiency in spite of a small input power of less than 35 W. The shape or diameter of the electrodes are adjusted in order to keep a temperature within a discharge chamber in a rated power range of 20-30 W, thereby obviating or preventing the evaporation of any amount of the metal halide and also preventing the strength of the metal spectrum from decreasing.

Discussion of the Related Art

[0002] Metal halide bulbs or lamps are used in various fields including illumination in sports facilities, because of their characteristics such as high color rendering property and high efficiency. In recent years, energy saving is becoming more important, and it is expected to further improve the efficiency of the metal halide lamps. Specifically, low power consumption and size reduction are major subjects when developing new models.

[0003] One of the most popular usages of a metal halide bulb or lamp is in endoscopes. The metal halide lamp in an endoscope operates with 21 W having arc length 1.2 mm, resulting in high incidental efficiency to an optical fiber. In the automotive lighting industry, 35 W metal halide bulbs have started to prevail, and are used in some automobile models in Europe and Japan. In Europe, standards for 35 W metal halide bulbs for use in automobiles are on the way to be established, and in Japan discussions for establishment of standards will start in the near future.

[0004] Fig. 4 illustrates the spectrum of the metal halide composition included in these low wattage metal halide bulbs or lamps. The major element of the metal halide is ScI_3-NaI. The composition having ScI_3-NaI as a major element of the metal halide composition enables the metal halide lamp to provide high radiation efficiency in visible wavelengths and also high efficiency, as compared with the metal halide composition of Na-TI-In, or Dy-TI-(In).

[0005] In recent years, a metal halide bulb or lamp having a ScI_3-NaI composition with an efficiency of 901 m/W has been developed as a result of the study of the shape of a glass envelope, the structure of the sealed end of the glass envelope, and the composition ratio of the metal halide.

[0006] This double end type metal halide lamp with low power consumption has a relatively short arc length, is substantially a dot light source, and a large amount of light is obtained. Specifically, the 35 W metal halide bulb for use in automobiles is required to have instant lumen output, and a rare gas is sealed in said bulb by applying predetermined pressure for enabling a very high, i. e. excessive current flow at start-up of the metal halide lamp.

[0007] Fig. 5 illustrates such a conventional double end type metal halide lamp with low power consumption which is optimally designed in terms of thermal capacity for obtaining a sufficient temperature within a glass envelope in order to start and keep the evaporation of metal halide therein. The dimensions of the glass envelope are as follows. The thickness t of the glass envelope at a maximum external diameter portion 62 is more than 1.5 mm (t > 1.5 mm); the diameter ϕ a of an arc chamber 66 is more than 2.6 mm (ϕa > 2.6 mm); in the arc chamber 66, a distance d between a tip portion 65 of an electrode 69 and a wall 67 of the arc chamber 66 is equal to or more than around 1.0 mm (d $\geq$ 1.0 mm).

[0008] Fig. 6(a) illustrates an enlarged cross sectional view Sg of the first neck portion 63 and the second neck portion 64 of the glass envelope made of quartz glass. Fig. 6(b) illustrates an enlarged cross sectional view S of the maximum external diameter portion 62 along a surface perpendicular to the longitudinal axis of the glass envelope. The enlargement ratio between the Sg and S is around 0.26 (Sg/S = 0.26).

[0009] The volume Vg of the glass envelope at the arc chamber portion 61 having a length l between the first neck portion 63 and the second neck portion 64, the volume Vs_1 of the glass envelope at an adjacent portion extending the length l from the first neck portion 63 toward a nearer end of the glass envelope, and the volume Vs_2 of the glass envelope extending the length l from the second neck portion 64 toward the nearer end of the glass envelope, have the following relationship: Vs_1=Vs_2=73.7 mm^3 and Vg=95.8 mm^3.

[0010] The pair of electrodes 69 is substantially a cylinder, respectively, and its diameter ϕ is equal to or more than 0.25 mm. The electrode tip portion 65 has substantially the same diameter as the remaining portion of the electrode 69. The pair of electrodes 69, respectively, have electrical connections to a molybdenum foil, whose end has a shape like a knife blade or a wedge, for obtaining predetermined air-tightness and avoiding excessive stress concentration; said foil having the following dimensions: thickness 20-28 μm, width 1.5-2.0 mm, and length 6-8 mm.

[0011] As described above, on designing of the 35 W automotive metal halide lamp, it is sufficient to consider just the entire shape and end portion structure of the glass envelope for obtaining sufficient temperature to start and keep the evaporation of metal halide within the glass envelope, and it is not required to determine in detail the entire shape or diameter of the electrode. However, when designing the ScI_3-NaI metal halide lamp with a power consumption of less than 35 W, it is required to determine more specifically the electrode structure, because light color shifts to blue due to low light emitting efficiency. As the input power is small, the evaporation amount of metal halide is also small.

[0012] US-A-5 083 059 discloses a low-wattage (5-30 watts) metal-halide discharge lamp having a tube of the double ended type that forms a bulb or envelope, a pair of electrodes, e.g., an anode and a cathode, which penetrate into an arc chamber inside the envelope, and a suitable amount of mercury plus one or more metal halide salts. The electrodes are each formed of a refractory metal, i.e., tungsten wire, extending through the respective necks into the arc chamber. The electrodes are of a composite design i.e., in the form of a club, with a lead-in wire of small diameter supported in the associated neck, and a post member of greater diameter supported on the lead-end wire. The post members are supported of contact with the necks and also out of contact with the bulb wall. The larger size of the post member allows heat at the tip to diffuse back into the post member, so that the metal tip will not evaporate. The narrow lead-in wire keeps most of the heat in the bulb, so that flow of heat out of the neck portions is limited. The anode has a lead-in tungsten wire shank that is supported in the neck and extends somewhat into the chamber where a tungsten post portion is butt-welded onto it. The lead-in wire typically has a diameter of 0.18 mm (0.007 inches), and the post portion typically has a diameter of 0.36 mm (0.014 inches). The post portion has a conic tip which forms a central point, with a flare angle in the range of 60 degrees to 120 degrees. The cathode similarly has a tungsten lead-in wire that extends in the shank and is supported in the neck. The wire extends somewhat out into the chamber and a post portion is butt-welded onto it. The wire is typically of 0.18 mm (0.007 inches) diameter while the post portion can be of 0.28 mm (0.011 inches) diameter. The cathode post portion has a pointed, conic tip with a taper angle on the order of 30 degrees to 45 degrees.

[0013] US-A-5 420 477 discloses a low power metal halide discharge lamp having two elongated electrodes fabricated of a doped tungsten each extending axially through a respective neck of a bulb into an arc chamber. Each of electrode comprises a lead-in wire having a diameter ranging between about 0.08 to 0.46 mm (0.003 to 0.018 inches) that enters the arc chamber. A post member is mounted on the lead-in wire, out of contact with the associated neck, and is preferably welded to the lead-in. The post member has a flat distal surface for transferring heat to vapors in said arc chamber. It is larger in diameter than its associated lead-in wire, and has a diameter in a range of 0.13 to 1.02 mm (0.005 to 0.040 inches). The flat distal surfaces of the two post members face one another in spaced apart relationship, the space therebetween forming an arc gap.

[0014] US-A-5 017 839 discloses a discharge lamp that includes a fill of xenon, at a cold fill pressure of at least 3 bar, in addition to mercury and a metal halide; the discharge vessel is, at least in part, coated or doped so that invisible radiation is reflected into the lamp, or absorbed, while visible radiation is being transmitted by the discharge vessel. The shafts of the electrodes are thin, of only about 0.3 mm diameter, and the electrodes facing each other are part-spherical or rounded. The lamp is operated in combination with a lamp power supply which has the characteristics of being capable of supplying between 5 to 10 times normal operating current of the lamp under starting conditions.

[0015] US-A-4 594 529 discloses a gas discharge lamp comprising an ionizable filling of rare gas, mercury, and metal iodide, the quantity of mercury being dependent upon the inner diameter D of the lamp envelope, the distance d between the tips of the electrodes, and the distance I over which the electrodes project into the lamp envelope. The values of D, d, I and the wall thickness t of the lamp envelope lie within indicated limits.

[0016] The conventional metal halide lamp with low power consumption has the following problems. On designing a metal halide lamp with a power consumption less than 35 W, it is impossible to achieve sufficient a temperature in an arc chamber 66 by downsizing the scale of designing parameters of the parameters for 35 W bulbs. When each of the designing parameters is just downsized, the evaporation amount of the metal halide is insufficient such that the light emitting efficiency decreases and the light color shifts to blue. The aforementioned metal halide lamp with an operating power 21 W has overcome the light emitting efficiency problem to the extent that it can be used as an endoscope. However, designing parameters are different for uses between endoscope and automobile. Since the endoscope is not required to have instant lumen output property, the metal halide lamp in 21 W has not yet overcome the standards of start-up properties for use in automobiles.

SUMMARY OF THE INVENTION

[0017] The present invention is directed to an automobile headlight that substantially obviates one or more of the above problems due to the limitations and disadvantages of the related art.

[0018] It is an object of the invention to provide a double end type Scl_3-Nal metal halide lamp for use in automobile with rated power consumption smaller than 35 W, more specifically 20-30 W, being capable of an instant lumen output.

[0019] The above object is achieved by a double end type metal halide bulb or lamp as set forth in claim 1. Preferred embodiments of the present invention may be gathered from the dependent claims. More specifically, the object may be achieved by sealing Xenon gas under high pressure and applying excessive current at start-up of the metal halide lamp, and by providing an electrode structure capable of enduring excessive current at start-up of the metal halide lamp. The electrode structure is achieved by adjusting the designing parameters of electrode such as the diameter or entire shape, for mitigating thermal emission from electrode tip portions such that the temperature in the glass envelope is maintained.

Thereby low light-emitting efficiency due to low power input and light color shift to blue are prevented.

[0020] The double end type ScI_3-NaI metal halide lamp with rated power consumption smaller than 35W, more specifically 20-30 W, of the present invention comprises a pair of electrodes whose diameter ϕn is equal to or less than 0.25 mm ($\phi n \leq 0.25$ mm), and the diameter ϕ P of the electrode tip portion is equal to or larger than the diameter ϕ S of the remaining electrode portion ($\phi P \geq \phi S$).

[0021] The electrode tip portion is spherical or cylindrical, and the cross section area of the electrode increases as a cross section moves toward the tip portion for mitigating thermal emission from the electrode tip portion and preventing low light emission efficiency due to small input power. The arc chamber is substantially a sphere, ellipsoid, or any similar shape, and comprises the pair of electrodes, mercury, rare gas, and at least one kind of metal halide sealed therein. Since a rare gas, more specifically Xenon gas, is sealed within an arc chamber under high pressure, when excessive current, is applied instant lumen output is achieved.

[0022] Additional objects and advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

[0023] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The accompanying drawings, which are incorporated in and which constitute a part of this specification, illustrate several embodiments of the invention and together with the description, serve to explain the principles of the invention.

[0025] Fig. 1 illustrates a front view and cross sectional views of a first preferred embodiment of the present invention.

[0026] Fig. 2 (a) illustrates an electrode structure of the first preferred embodiment of the present invention.

[0027] Fig. 2 (b) illustrates an electrode structure of the second preferred embodiment of the present invention.

[0028] Fig. 2 (c) illustrates an electrode structure of the third preferred embodiment of the present invention.

[0029] Fig. 2 (d) illustrates an electrode structure of the fourth preferred embodiment of the present invention.

[0030] Fig. 3 is a graph showing light emitting efficiency as a function of power in comparison between the double end type metal halide lamp with low power consumption of the present invention and a conventional one.

[0031] Fig. 4 illustrates spectrum distribution of a ScI_3-NaI metal halide lamp.

[0032] Fig. 5 illustrates a front view of a conventional double end type metal halide lamp with low power consumption.

[0033] Fig. 6 (a) illustrates an enlarged cross sectional view of the first and second neck portions of the glass envelope along the A-A line in Fig. 5.

[0034] Fig. 6 (b) illustrates an enlarged cross sectional view along the B-B line in Fig. 5 which is perpendicular to the longitudinal axis of the glass envelope and passes through the glass envelope at a portion having the maximum external diameter.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0035] Reference will now be made in detail to the preferred embodiments of the present invention. Whenever possible, the same references numbers will be used throughout the drawings to refer to the same or like parts.

[0036] Fig. 1 illustrates a front view and cross sectional views of the first preferred embodiment of the present invention. The double end type metal halide bulb or lamp with low power consumption being operated with a power of less than 35 W comprises a glass envelope 100, an arc chamber 6, an electrode structure comprising molybdenum foils 21 and a pair of electrodes 20. The glass envelope 100 comprises an arc chamber portion 1 surrounding the arc chamber 6 and at least one sealed portion 8 adjacent to the arc chamber portion 1. The length q of the sealed portion is shown in Fig. 1. The entire shape and end structure of the glass envelope is adjusted as described in Japanese patent application No. HEI 10-195647. Detailed description about how to determine dimensions of the glass envelope will be provided later.

[0037] Figs. 2 (a)-(d) illustrate electrode structures of the first to fourth preferred embodiments of the present invention. The electrode material of the present invention is tungsten (including W-1.7% ThO_2). The first electrode structure in Fig. 2(a) comprises a molybdenum foil 21 and a first or second electrode 20 which is electrically connected to the molybdenum foil 21 and is projected within arc chamber 6. A diameter ϕ n of the first or second electrode 20 is equal to or less than 0.25 mm ($\phi n \leq 0.25$), thereby mitigating thermal emission from the electrode 20 and maintaining the temperature in the glass envelope. Tip portions 23 of the electrodes 20 have substantially the same diameter as the remaining portions 22 of the electrodes 20.

[0038] The second electrode structure in Fig. 2(b) comprises a molybdenum foil 21 and a first or second electrode 20 which is electrically connected to the molybdenum foil 21 and is projected within an arc chamber 6. The electrode 20 comprises a spherical electrode tip portion 23 and remaining electrode portion 22. A diameter ϕ S of the remaining electrode portion 22 is equal to or smaller than the diameter ϕ P of the spherical electrode tip portion 23, and the diameter ϕ P of the spherical electrode tip portion 23 is equal to or less than 0.25 mm ($\phi S \leq \phi P \leq$

0.25 mm). Since the cross section area of the spherical electrode tip portion 23 is enlarged enabling the mitigation of thermal emission from the electrode tip portion 23 to the extent of maintaining evaporation of metal halide, sufficient light-emitting efficiency is achieved in spite of small input power.

[0039] The third electrode structure in Fig. 2(c) comprises a molybdenum foil 21 and a first or second electrode 20 which is electrically connected to the molybdenum foil 21 and is projected within an arc chamber 6. In this embodiment, the shape of the electrode tip portion 23 is a cylinder. The electrode 20 comprises said cylindrical electrode tip portion 23 and remaining electrode portion 22. A diameter ϕ Y of the remaining electrode portion 22 is equal to or smaller than the diameter ϕ X of the cylindrical electrode tip portion 23, and the diameter ϕ X of the cylindrical electrode tip portion 23 is equal to or smaller than 0.25 mm ($\phi Y \leq \phi X \leq 0.25$ mm). The cross section area of the cylindrical electrode tip portion 23 is further enlarged as compared with the second preferred embodiment. The third electrode structure is also able to mitigate thermal emission from the electrode 20 such that evaporation of metal halide is maintained. Accordingly, it is prevented to decrease light-emitting efficiency even though input power decreases.

[0040] The fourth electrode structure in Fig. 2(d) comprises a molybdenum foil 21 and a first or second electrode 20 which is electrically connected to the molybdenum foil 21 and is projected within an arc chamber 6. In this embodiment, the cross section area of the electrode 20 increases as a cross section moves toward the projecting end of the electrode 20. A diameter ϕ K of the projecting end of the electrode 20 is equal to or smaller than 0.25 mm ($\phi K \leq 0.25$ mm). The fourth electrode structure is also able to mitigate thermal emission from the electrode 20, and it is prevented from decreasing the light-emitting efficiency even though input power decreases.

[0041] In all the preferred embodiments described above, the entire shape and end structure of the glass envelope is adjusted as described in the Japanese patent Application No. 10-195647. Such preferred dimensions of the glass envelope are briefly explained as follows based on the metal halide lamp in Fig. 1.

[0042] The thickness t at a portion 2 having the maximum external diameter of the glass envelope is equal to or smaller than 1.5 mm ($t \leq 1.5$ mm). The maximum internal diameter of the arc chamber ϕ a is equal to or smaller than 2.6 mm ($\phi a \leq 2.6$ mm). The thickness t and the maximum internal diameter ϕ a are determined for the purpose of maintaining the temperature within the glass envelope for achieving sufficient light emitting efficiency in spite of small input power.

[0043] The distance d between an electrode tip portion 5 and a wall 7 of the arc chamber 6 is 0.6-1.3 mm (0.6 mm $\leq d \leq$ 1.3 mm). The maximum value 1.3 mm is determined for the purpose of maintaining temperature in the glass envelope and achieving sufficient light emitting efficiency in spite of small input power. The minimum value 0.6 mm is determined for preventing occurrence of a non-stabilized arc which may cause a sudden turn-off of the metal halide lamp.

[0044] According to the present invention, the ratio of the cross section area is adjusted as follows: the cross section area Sg of the first neck portion 3 or the second neck portion 4 is less than the cross section area S which is perpendicular to the longitudinal axis of the glass envelope and passes the maximum external diameter portion 2 ($Sg/S \leq 0.25$); preferable Sg/S values are within a range from equal to or more than 0.15 up to equal to or less than 0.25 ($0.15 \leq Sg/S \leq 0.25$), the optimized Sg/S value is around 0.2 ($Sg/S = 0.2$). These values are determined such that thermal emission from the arc chamber portion 1 of the glass envelope 100 is mitigated and the temperature in arc chamber portion 1 is maintained, thereby it is able to achieve sufficient light emitting efficiency in spite of small input power.

[0045] The volumes of the glass envelope 100 at the arc chamber portion 1 surrounding the arc chamber 6, and sealed portions 8 are determined as follows. The volume Vg of the arc chamber portion 1 having a length l between the first neck portion 3 and the second neck portion 4, the volume Vs_1 of the sealed portion 8 extending the length l from the first neck portion 3 toward a nearer end of the glass envelope 100, and the volume Vs_2 of the sealed portion 8 extending the length l from the second neck portion 4 toward a nearer end of the glass envelope 100, have the following relationship: $0.4Vg < Vs_1$, and $Vs_2 < 0.9Vg$. These values are determined such that thermal emission from the arc chamber portion 1 of the glass envelope is mitigated and the temperature within the arc chamber portion 1 is maintained, thereby sufficient light emitting efficiency is achieved in spite of small input power. The value of 0.4Vg is determined for preventing excessive thermal emission from the arc chamber portion 1 of the glass envelope.

[0046] The above-identified double end type metal halide lamp with low power consumption comprises a spherical or elliptic arc chamber 6 which includes a pair of electrodes 20, mercury, rare gas, and at least one kind of metal halide. The metal halides ScI_3 and NaI are sealed within the arc chamber 6 with a ratio from 3:1 to 1:8 (ScI_3: NaI = 3:1-1:8) in weight. The rare gas, Xenon gas, is also sealed in the arc chamber 6 under high pressure enabling an excessive current flow at the start-up of the bulb or lamp. The excessive current flow is required for instant lumen output which is essential for use in automobiles.

[0047] As described in the specification of the Japanese Patent Application No. 10-195647, the adjustments of the glass envelope described above are sufficiently effective when each adjustment is individually made. However, combination of each adjustment makes it more effective.

[0048] The conventional 35 W metal halide lamp is able to provide high temperatures to the extent of enabling sufficient evaporation of the metal halide. However, on designing a metal halide lamp with a smaller input power consumption than 35 W, it is essential to adjust e. g. the entire shape or diameter of the electrode structure because, without such adjustments, light emitting efficiency decreases when the input power is smaller than 35 W, and the light color may shift to blue.

[0049] By adjusting not only the structure of the glass envelope, such as the entire shape, or the shape of the end portions, but also the electrode structure, thermal emission from the electrode tip portion is mitigated, and the temperature of the glass envelope is maintained. Thereby sufficient light emitting efficiency is achieved in spite of small input power. This adjustment is highly effective for metal halide lamps whose power consumption is smaller than 35 W, specifically 20-30 W.

[0050] Fig. 3 is a graph showing light-emitting efficiency of the metal halide lamp with low power consumption as a comparison between the preferred embodiment of the present invention in a solid line and a conventional 35 W metal halide lamp in a broken line. In the preferred embodiment, an electrode 20 has a diameter smaller than 0.25 mm, and the electrode tip portion 23 has larger diameter than the remaining electrode portions 22. Additionally, the arc chamber portion 1 and sealed end of the arc chamber portion 1 are adjusted as described in the Japanese patent application No. 10-195647. As shown in this graph, the preferred embodiment of the present invention achieved light emitting efficiency of 60-90 lm/W in spite of small input power. The operational advantages of the metal halide lamp according to the preferred embodiment of the present invention will now be described. First, even though the power consumption of the metal halide lamp is less than 35 W, the arc chamber portion is maintained in a sufficiently high temperature for metal halide evaporation. Therefore, although the power consumption decreases, light emitting efficiency does not decrease very much and light color shift to blue is prevented. Second, instant lumen output is achieved in spite of a small input power of less than 35 W, specifically in the range of 20-30 W. This is achieved by adjusting the electrode shape and structure, by sealing ScI_3 and NaI in the arc chamber, and by applying an excessive current at start-up of the lamp. The combination of these parameters is able to provide more effective metal halide lamps.

Claims

1. A double end type metal halide bulb or lamp being operated at a rated power less than 35 W comprising:

    a glass envelope (100) having an arc chamber (6),
    at least one kind of metal halide included in the arc chamber (6),
    said glass envelope comprising an arc chamber portion (1) surrounding the arc chamber (6), and sealed portions (8) adjacent to the arc chamber portion (1) and separated from the arc chamber portion (1) by neck portions (3, 4),
    a first electrode (20) partly projecting into the arc chamber (6), and
    a second electrode (20) partly projecting into the arc chamber (6),
    the maximum diameter ϕ n of the first and second electrodes (20) is equal to or smaller than 0.25 mm;

    characterized in that
    a ratio of the cross sectional area Sg of the first neck portion (3) or the second neck portion (4) to the cross sectional area S which is perpendicular to the longitudinal axis of the glass envelope and passes through the maximum external diameter portion (2) of said arc chamber portion (1) is equal to or less than 0.25, or

    $$Sg/S \leq 0.25.$$

2. A double end type metal halide lamp according to claim 1, **characterized in that** the volume Vg of the arc chamber portion (1) having a length l between the first neck portion (3) and the second neck portion (4), the volume Vs_1 of the sealed portion (8) extending the length l from the first neck portion (3) toward a nearer end of the glass envelope (100), and the volume Vs_2 of the sealed portion (8) extending the length l from the second neck portion (4) toward a nearer end of the glass envelope (100), have the following relationships:

    $$0.4Vg < Vs_1,$$

    and

    $$Vs_2 < 0.9Vg.$$

3. A double end type metal halide lamp according to claim 1 or 2, **characterized in that** a diameter ϕ P of the electrode tip portion (5, 23) projecting into the arc chamber (6) is equal to or larger than a diameter ϕ S of the remaining electrode portion (22).

4. A double end type metal halide lamp according to claim 1 or 2, **characterized in that** the electrode tip portion (5, 23) projecting into the arc chamber (6) is spherical.

5. A double end type metal halide lamp according to claim 1 or 2, **characterized in that** the electrode tip

portion (5, 23) projecting into the arc chamber (6) is a cylinder.

6. A double end type metal halide lamp according to claim 1 or 2, **characterized in that** the cross section areas of the first and second electrodes (20) increase as the cross section moves toward a projecting end (5, 23) of the electrode (20).

7. A double end type metal halide lamp according to any of the preceding claims, **characterized in that** the metal halide included in the arc chamber (6) comprises ScI_3 and NaI.

8. A double end type metal halide lamp according to any of the preceding claims, **characterized in that** a rated power range of the metal halide lamp is 20-30 W.

9. A double end type metal halide lamp according to claim 7 and 8, **characterized in that** instant lumen output is achieved by sealing rare gas at high pressure and applying excessive current at start-up of the lamp.

Patentansprüche

1. Zweiseitig gesockelte Halogenmetalldampfbirne oder -lampe, die bei einer Nennleistung von weniger als 35 W betrieben wird, aufweisend:

einen Glaskolben (100) mit einer Brennkammer (6),
zumindest eine Art von Metallhalogenid, das in der Brennkammer (6) enthalten ist,

wobei der Glaskolben einen Brennkammerteil (1) aufweist, der die Brennkammer (6) umgibt, und abgedichtete Teile (8), die benachbart zum Brennkammerteil (1) angeordnet und vom Brennkammerteil (1) mittels Einschnürungsteilen (3, 4) getrennt sind,
eine erste Elektrode (20), die teilweise in die Brennkammer (6) hineinragt, und
eine zweite Elektrode (20), die teilweise in die Brennkammer (6) hineinragt, wobei der maximale Durchmesser Φ n der ersten und der zweiten Elektrode (20) gleich oder kleiner als 0,25 mm ist;
dadurch gekennzeichnet, dass
ein Verhältnis der Querschnittsfläche Sg des ersten Halsteils (3) oder des zweiten Halsteils (4) zur Querschnittsfläche S, welche senkrecht zur Längsachse des Glaskolbens liegt und durch den maximalen Außendurchmesserteil (2) des Brennkammerteils (1) läuft, gleich oder kleiner als 0,25 ist, oder

$$Sg/S \leq 0{,}25.$$

2. Zweiseitig gesockelte Halogenmetalldampflampe nach Anspruch 1, **dadurch gekennzeichnet, dass** das Volumen Vg des Brennkammerteils (1) mit einer Länge l zwischen dem ersten Einschnürungsteil (3) und dem zweiten Einschnürungsteil (4), das Volumen Vs_1 des abgedichteten Teils (8), der sich die Länge l vom ersten Einschnürungsteil (3) in Richtung eines näheren Endes des Glaskolbens (100) erstreckt, und das Volumen V_{S2} des abgedichteten Teils (8), der sich die Länge l vom zweiten Einschnürungsteil (4) in Richtung eines näheren Endes des Glaskolbens (100) erstreckt, die folgenden Beziehungen aufweisen:

$$0{,}4\ Vg < Vs_1,$$

und

$$Vs_2 < 0{,}9\ Vg.$$

3. Zweiseitig gesockelte Halogenmetalldampflampe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** ein Durchmesser Φ P des Elektrodenspitzenteils (5, 23), der in die Brennkammer (6) hineinragt, gleich oder größer als ein Durchmesser ϕ S des restlichen Elektrodenteils (22) ist.

4. Zweiseitig gesockelte Halogenmetalldampflampe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Eledtrodenspitzenteil (5, 23), der in die Brennkammer (6) hineinragt, sphärisch ist.

5. Zweiseitig gesockelte Halogenmetalldampflampe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Elektrodenspitzenteil (5, 23), der in die Brennkammer (6) hineinragt, ein Zylinder ist.

6. Zweiseitig gesockelte Halogenmetalldampflampe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Querschnittsflächen der ersten und der zweiten Elektrode (20) sich vergrößern, je weiter sich der Querschnitt auf ein hervorstehendes Ende (5, 23) der Elektrode (20) zubewegt.

7. Zweiseitig gesockelte Halogenmetalldampflampe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das in der Brennkammer (6) enthaltende Metallhalogenid ScI_3 und NaI aufweist.

8. Zweiseitig gesockelte Halogenmetalldampflampe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** ein Nennleistungsbereich der Halogenmetalldampflampe 20 - 30 W beträgt.

9. Zweiseitig gesockelte Halogenmetalldampflampe nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** eine augenblickliche Lichtstromausgabe mittels Abdichtens von Edelgas bei hohem Druck und Anlegens eines überhohen Stroms bei Inbetriebnahme der Lampe erreicht wird.

Revendications

1. Ampoule ou lampe à halogénure métallique de type à double culot actionnée à une puissance nominale inférieure à 35 W, comprenant :

   une enveloppe de verre (100) comportant une chambre d'arc (6),
   au moins une sorte d'halogénure métallique inclus dans la chambre d'arc (6),
   l'enveloppe de verre comprenant une partie de chambre d'arc (1) entourant la chambre d'arc (6), et des parties étanches (8) adjacentes à la partie de chambre d'arc (1) et séparées de la partie de chambre d'arc (1) par des parties de col (3, 4),
   une première électrode (20) faisant partiellement saillie dans la chambre d'arc (6), et une deuxième électrode (20) faisant partiellement saillie dans la chambre d'arc (6), le diamètre maximum ϕn des première et deuxième électrodes (20) étant inférieur ou égal à 0,25 mm ;

   caractérisée en ce que le rapport entre la section transversale Sg de la première partie de col (3) ou de la deuxième partie de col (4) et la section transversale (S) qui est perpendiculaire à l'axe longitudinal de l'enveloppe de verre et qui passe par une partie de diamètre externe maximum (2) de la partie de chambre d'arc (1) est inférieur ou égal à 0,25, ou

$$Sg/S \leq 0,25.$$

2. Lampe à halogénure métallique de type à double culot selon la revendication 1, **caractérisée en ce que** le volume Vg de la partie de chambre d'arc (1) ayant une longueur 1 entre la première partie de col (3) et la deuxième partie de col (4), le volume V_{s1} de la partie étanche (8) s'étendant sur la longueur 1 entre la première partie de col (3) et une extrémité plus proche de l'enveloppe de verre (100), et le volume V_{s2} de la partie étanche (8) s'étendant sur la longueur 1 entre la deuxième partie de col (4) et une extrémité plus proche de l'enveloppe de verre (100), ont les relations suivantes :

$$0,4\ Vg < V_{s1},$$

et

$$V_{s2} < 0,9\ Vg.$$

3. Lampe à halogénure métallique de type à double culot selon la revendication 1 ou 2, **caractérisée en ce que** le diamètre ϕP de la partie de pointe d'électrode (5, 23) faisant saillie dans la chambre d'arc (6) est égal ou supérieur au diamètre ϕS de la partie d'électrode restante (22).

4. Lampe à halogénure métallique de type à double culot selon la revendication 1 ou 2, **caractérisée en ce que** la partie de pointe d'électrode (5, 23) faisant saillie dans la chambre d'arc (6) est sphérique.

5. Lampe à halogénure métallique de type à double culot selon la revendication 1 ou 2, **caractérisée en ce que** la partie de pointe d'électrode (5, 23) faisant saillie dans la chambre d'arc (6) est un cylindre.

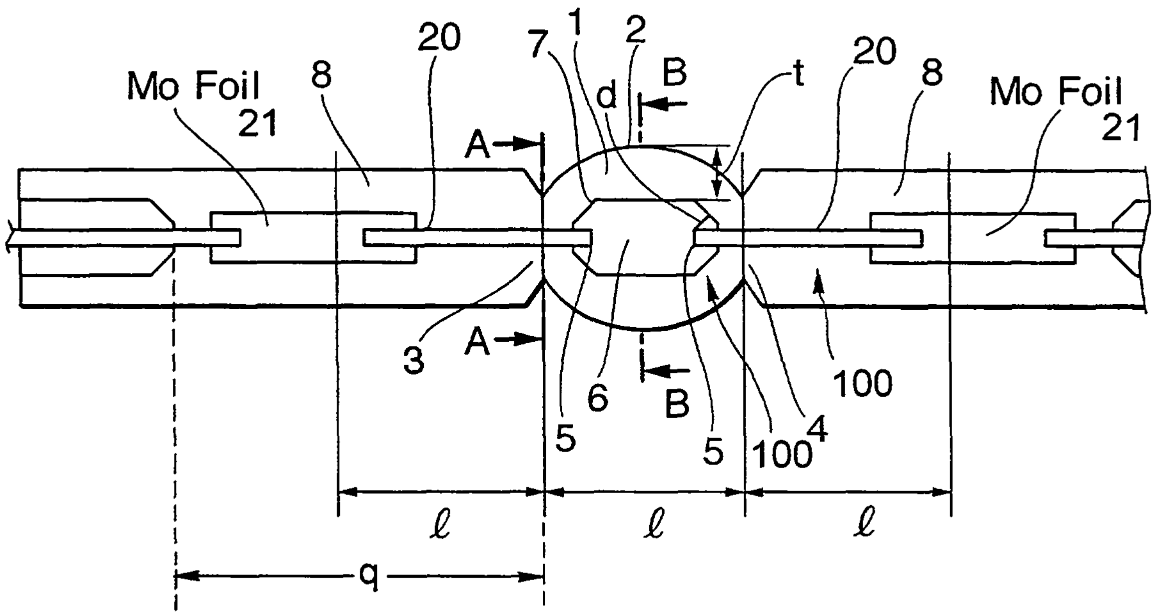
6. Lampe à halogénure métallique de type à double culot selon la revendication 1 ou 2, **caractérisée en ce que** les sections transversales des première et deuxième électrodes (20) augmentent lorsque la section transversale se déplace vers une extrémité saillante (5, 23) de l'électrode (20).

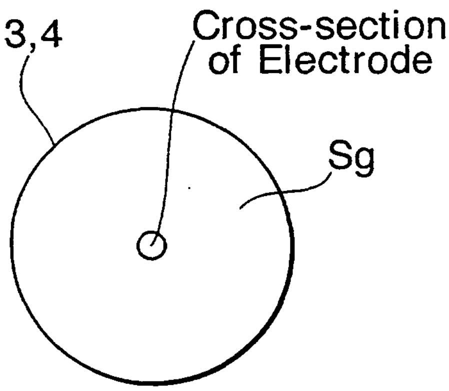
7. Lampe à halogénure métallique de type à double culot selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'halogénure métallique inclus dans la chambre d'arc (6) comprend ScI_3 et NaI.

8. Lampe à halogénure métallique de type à double culot selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la plage de puissance nominale de la lampe à halogénure métallique est comprise entre 20 et 30 W.

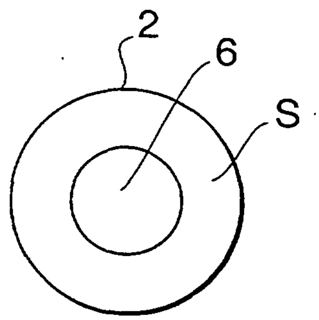
9. Lampe à halogénure métallique de type à double culot selon les revendications 7 et 8, **caractérisée en ce que** l'intensité lumineuse instantanée est obtenue en enfermant de façon étanche un gaz rare à haute pression et en appliquant un courant en excès au démarrage de la lampe.

FIG. 1





Along A-A line



Along B-B line

FIG.2(a)

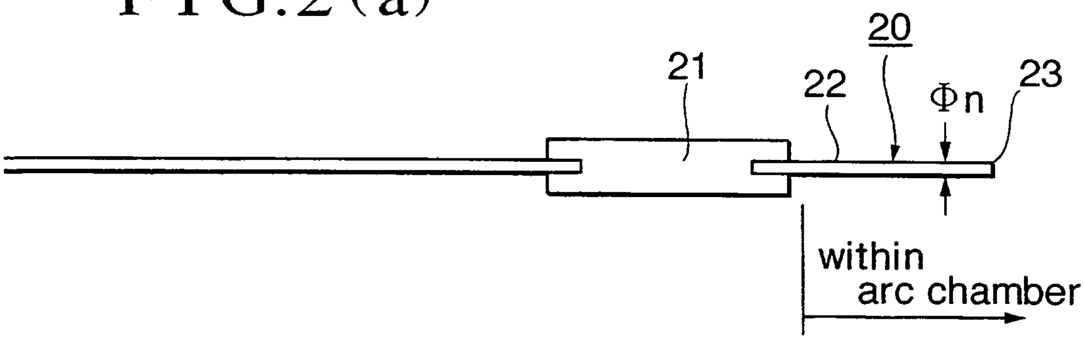


FIG.2(b)

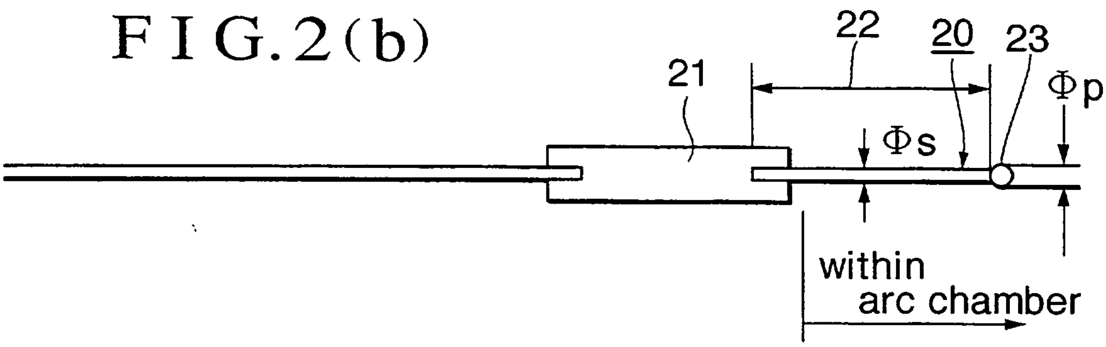


FIG.2(c)

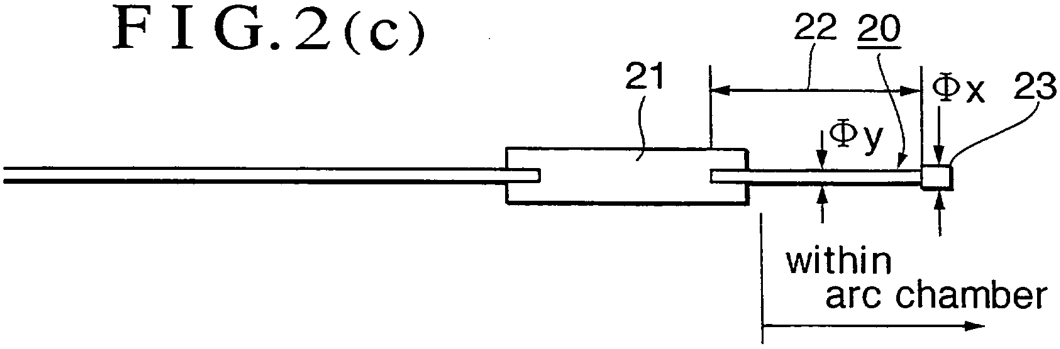
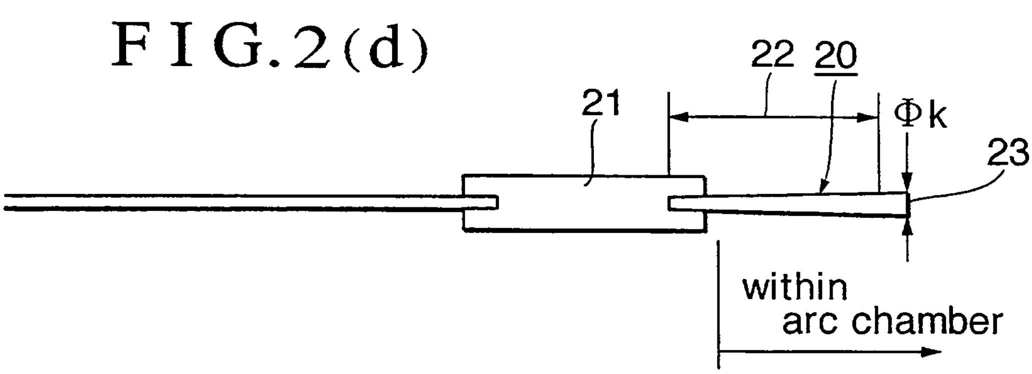
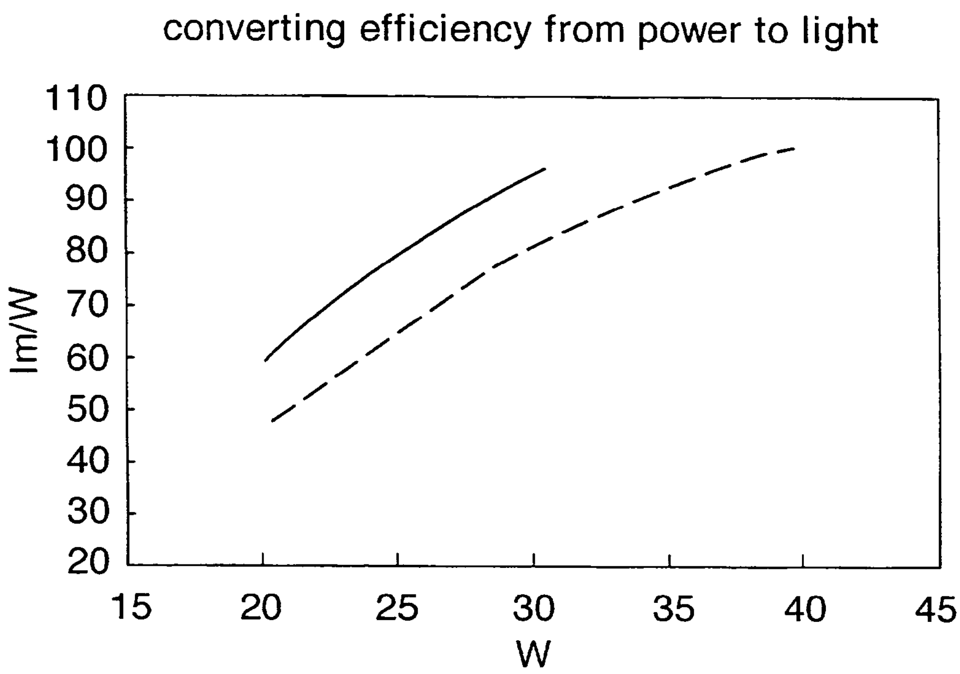


FIG.2(d)



F I G. 3


converting efficiency from power to light
110
100
90
80
70
60
50
40
30
20
lm/W
15
20
25
30
35
40
45
W

F I G. 4

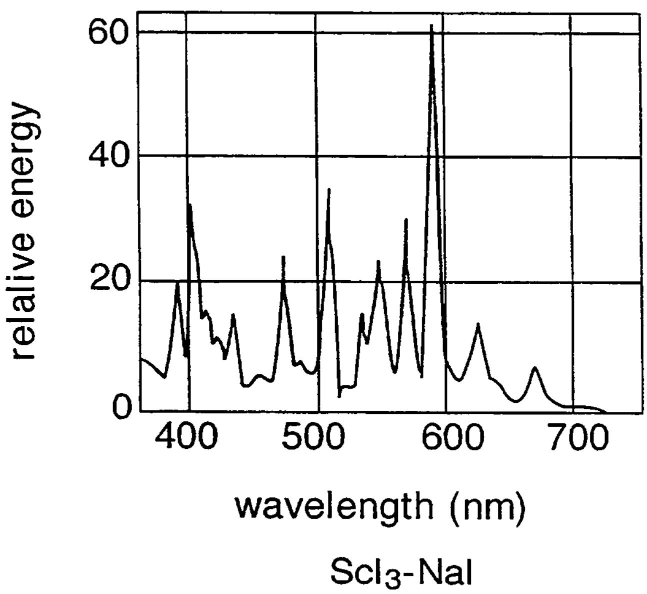

60
40
20
0
relalive energy
400
500
600
700
wavelength (nm)
ScI3-NaI

FIG. 5

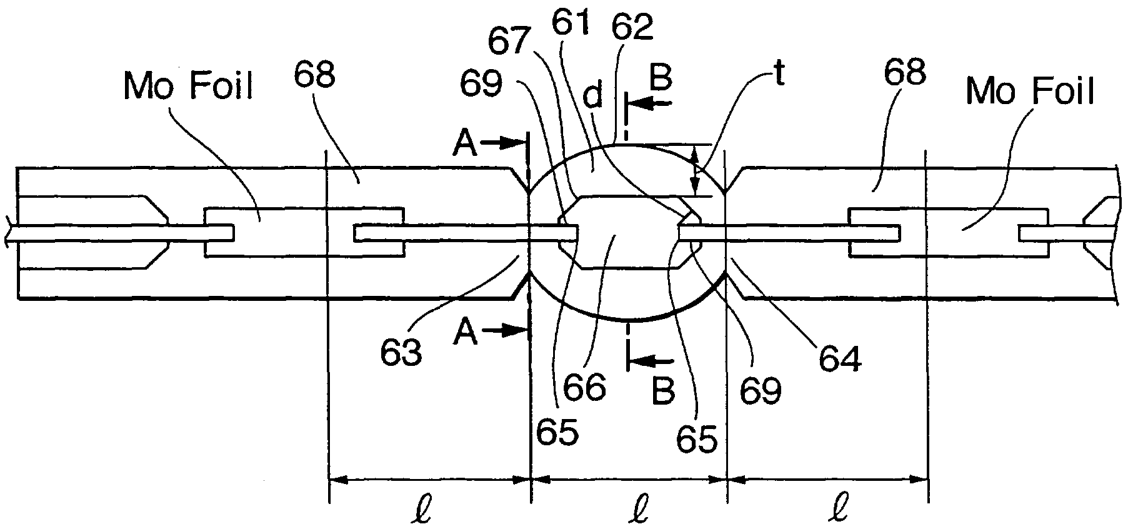


FIG. 6(a)

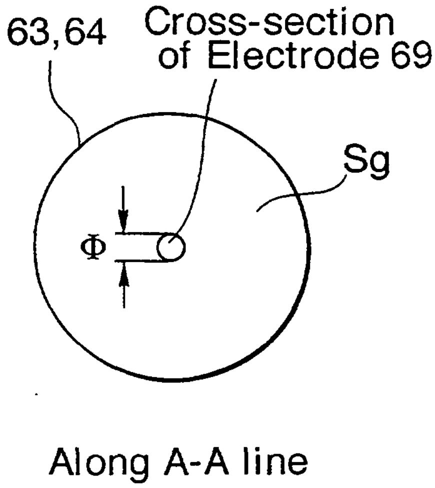
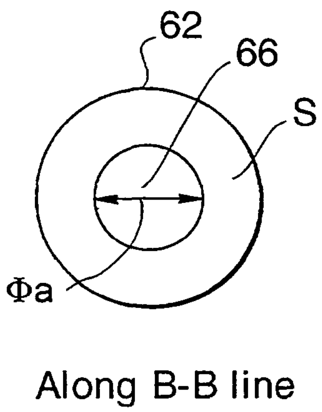


FIG. 6(b)



REFERENCES CITED IN THE DESCRIPTION

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