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

(11) EP 3 333 879 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
22.04.2020 Bulletin 2020/17

(51) Int Cl.:
H01J 61/82 *(2006.01)* ***H01J 61/12*** *(2006.01)*
H01J 61/34 *(2006.01)* ***H01J 61/073*** *(2006.01)*
H05B 41/42 *(2006.01)*

(21) Application number: **17186160.2**

(22) Date of filing: **14.08.2017**

(54) **AUTOMOBILE HEADLAMP**

KRAFTFAHRZEUGSCHEINWERFER

PHARE D'AUTOMOBILE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **06.12.2016 JP 2016236437**

(43) Date of publication of application:
13.06.2018 Bulletin 2018/24

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Description

FIELD

[0001] Embodiments described herein relate generally to a discharge lamp, a vehicle lighting device, and a vehicle lamp.

BACKGROUND

[0002] There is a discharge lamp including a light emitting portion having a discharge space in which a discharge medium is sealed on an inside thereof, and a pair of electrodes protruding into the discharge space and disposed to face each other at a predetermined distance.

[0003] Here, in general, a light source for low beam (beam for passing) and a light source for high beam (beam for driving) are provided in a headlamp for an automobile, and the low beam and the high beam are switched as necessary. For example, a discharge lamp is used as the light source for low beam and another discharge lamp or another type of lamp is used for the light source for high beam.

[0004] Although the low beam and the high beam are necessary for an operation of the automobile, since two light sources are necessary, a manufacturing cost of the headlamp is increased, and a size or design of the headlamp is limited.

[0005] For this reason, it is preferable to be able to cope with both the low beam and the high beam with one discharge lamp. Therefore, a discharge lamp is proposed in which a light emitting portion is moved in a predetermined direction so that the discharge lamp can cope with both the low beam and the high beam. Reference is made to, for instance, EP 2 420 407 A1. In addition, a discharge lamp including a magnetic field generating unit for applying a magnetic field including a magnetic force line component is also proposed.

[0006] However, in such a manner, a configuration of the discharge lamp becomes complicated.

[0007] Therefore, it is desired to develop a headlamp of automobile with a discharge lamp capable of coping with low beam and high beam with a simple configuration.

DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a schematic view illustrating a discharge lamp of a headlamp according to an embodiment.
FIG. 2 is a schematic view illustrating a vehicle lamp and a vehicle lighting device.
FIG. 3 is a block view of the vehicle lighting device.

DETAILED DESCRIPTION

[0009] In general, according to one embodiment, a discharge lamp includes a light emitting portion that has a discharge space in which a metal halide and inert gas are sealed on an inside thereof; and a pair of electrodes that protrudes to an inside of the discharge space and faces each other at a predetermined distance.

[0010] Electric power applied to the discharge lamp during a low beam is 24 W or more and 30 W or less, and electric power applied to the discharge lamp during a high beam is 32 W or more and 38 W or less. A thickness dimension of the electrode satisfies the following formula where the thickness dimension of the electrode is d (mm).

$0.24\ (\text{mm}) \leq d\ (\text{mm}) \leq 0.33\ (\text{mm})$

[0011] Hereinafter, embodiments will be described with reference to the drawings.

[0012] The discharge lamp according to the embodiments can be, for example, a High Intensity Discharge (HID) lamp used for a headlamp of an automobile. In addition, for example, if the discharge lamp is the HID lamp used for the headlamp of the automobile, so-called horizontal lighting can be performed.

[0013] According to the invention, the discharge lamp according to the embodiments is used for the headlamp of the automobile. However, the discharge lamp may be used for other purposes. According to the invention, the discharge lamp is the HID lamp of the headlamp of the automobile.

[0014] FIG. 1 is a schematic view illustrating a discharge lamp 100 according to an embodiment.

[0015] Moreover, in FIG. 1, if the discharge lamp 100 is attached to an automobile, a forward direction is a front end side, a rearward direction is a rear end side, an upward direction is an upper end side, and a downward direction is a lower end side.

[0016] As illustrated in FIG. 1, the discharge lamp 100 is provided with a burner 101 and a socket 102.

[0017] The burner 101 is provided with an outer tube 5, an inner tube 1, an electrode mount 3, a support wire 35, a sleeve 4, and a metal band 71.

[0018] The outer tube 5 is provided coaxially with the inner tube 1 on an outside of the inner tube 1. That is, the burner

101 has a double-tube structure configured of the outer tube 5 and the inner tube 1. The outer tube 5 is joined (welded) to the vicinity of a cylindrical portion 14 of the inner tube 1.

[0019] Gas is sealed in a closed space formed between the inner tube 1 and the outer tube 5. The sealed gas may be gas capable of performing dielectric barrier discharge.

[0020] Moreover, the sealed gas will be described below in detail.

[0021] It is preferable that the outer tube 5 is formed of a material having a thermal expansion coefficient close to a thermal expansion coefficient of a material of the inner tube 1 and having ultraviolet blocking properties. The outer tube 5 can be formed from, for example, quartz glass doped with an oxide such as titanium, cerium, or aluminum.

[0022] The inner tube 1 has a light emitting portion 11, a sealing portion 12, a boundary portion 13, and the cylindrical portion 14. The light emitting portion 11, the sealing portion 12, the boundary portion 13, and the cylindrical portion 14 can be integrally formed.

[0023] The inner tube 1 (light emitting portion 11, the sealing portion 12, the boundary portion 13, and the cylindrical portion 14) is formed of a material having translucency and heat resistance. The inner tube 1 can be formed of, for example, quartz glass or the like.

[0024] The light emitting portion 11 has a substantially elliptical outer shape. The light emitting portion 11 is provided in the vicinity of a center of the inner tube 1. A dimension (spherical length) of the light emitting portion 11 in an axial direction of the inner tube 1 can be, for example, substantially 8 mm. A dimension of the light emitting portion 11 in a direction orthogonal to the axial direction of the inner tube 1 can be, for example, substantially 6 mm.

[0025] A discharge space 111 is provided on an inside of the light emitting portion 11. A center portion of the discharge space 111 has a substantially cylindrical shape. Both end portions of the discharge space 111 have a substantially conical shape.

[0026] A discharge medium is sealed in the discharge space 111. The discharge medium contains a metal halide 2 and an inert gas.

[0027] In addition, from the viewpoint of environmental protection, the discharge medium is substantially free of mercury. Moreover, in the present specification, the phrase "substantially free of mercury" includes not only mercury but also mercury contained in an extent of impurities. For example, the discharge medium may contain mercury if it is less than 2 mg/cc in the discharge space 111.

[0028] The metal halide 2 can be, for example, a halide of scandium, a halide of indium, a halide of sodium, and a halide of zinc. Illustrative examples of the halogen include iodine. However, instead of iodine, bromine, chlorine, or the like can be used.

[0029] The inert gas sealed in the discharge space 111 may be, for example, xenon. In addition, besides xenon, neon, argon, krypton, or the like can be used, or a mixed gas of these can also be used. However, it is more preferable that the inert gas is xenon.

[0030] The sealing portion 12 has a form of a plate and is joined to both end portions of the light emitting portion 11. The sealing portion 12 can be formed, for example, by using a pinch seal method. In addition, the sealing portion 12 may be formed by a shrink seal method, and may have a cylindrical shape. The cylindrical portion 14 is joined to one sealing portion 12 via the boundary portion 13.

[0031] The boundary portion 13 and the cylindrical portion 14 are joined to an end portion of the sealing portion 12 on a side opposite to a light emitting portion 11 side.

[0032] The electrode mount 3 is provided on an inside of the sealing portion 12.

[0033] The electrode mount 3 has a metal foil 31, an electrode 32, a coil 33, and a lead wire 34. Two sets of the electrode mount 3 (metal foil 31, the electrode 32, the coil 33, and the lead wire 34) are provided.

[0034] The metal foil 31 is provided on the inside of the sealing portion 12. The metal foil 31 is joined to the vicinity of an end portion of the electrode 32 on a side opposite to the discharge space 111 side.

[0035] The metal foil 31 has a form of a thin plate and can be made of, for example, molybdenum, rhenium molybdenum, tungsten, rhenium tungsten, or the like.

[0036] The electrode 32 has a cylindrical shape.

[0037] One end portion of the electrode 32 protrudes into the discharge space 111. That is, one end of the electrode 32 is provided on the inside of the discharge space 111 and the other end is provided on the inside of the sealing portion 12. A pair of the electrodes 32 is provided so as to face each other at a predetermined distance. The other end of the electrode 32 is joined to the vicinity of an end portion of the metal foil 31 on the light emitting portion 11 side. Joining between the electrode 32 and the metal foil 31 can be performed by, for example, laser welding.

[0038] The electrode 32 can be formed of, for example, pure tungsten, doped tungsten, rhenium tungsten, or the like. The electrode 32 may contain thorium or may not contain thorium.

[0039] The coil 33 is provided to suppress occurrence of cracks in the sealing portion 12. The coil 33 can be formed from, for example, a metal wire made of doped tungsten. The coil 33 is provided on the inside of the sealing portion 12. The coil 33 is wound around an outside of the electrode 32. For example, a wire diameter of the coil 33 is substantially 30 μm to substantially 100 μm and a coil pitch can be 600% or less.

[0040] The lead wire 34 has a linear shape. A cross-sectional shape of the lead wire 34 can be, for example, circular. The lead wire 34 can be formed of, for example, molybdenum or the like. One end portion of the lead wire 34 is joined to the vicinity of an end portion of the metal foil 31 on a side opposite to the light emitting portion 11 side. Joining between the lead wire 34 and the metal foil 31 can be performed by laser welding. The other end of the lead wire 34 extends to the outside of the inner tube 1.

[0041] The support wire 35 has an L shape and is joined to an end portion of the lead wire 34 extending from a front end side of the discharge lamp 100. Joining between the support wire 35 and the lead wire 34 can be performed by laser welding. The support wire 35 can be formed of, for example, nickel.

[0042] The sleeve 4 covers a portion of the support wire 35 extending parallel to the inner tube 1. The sleeve 4 has, for example, a cylindrical shape. The sleeve 4 can be formed of, for example, ceramics.

[0043] The metal band 71 is fixed to the vicinity of an end portion of the outer tube 5 on a rear end side.

[0044] The socket 102 has a body portion 61, an attachment fitting 72, a bottom terminal 81, and a side terminal 82.

[0045] The body portion 61 is formed of an insulating material such as resin. A rear end side of the lead wire 34, a rear end side of the support wire 35, and a rear end side of the sleeve 4 are provided on an inside of the body portion 61.

[0046] The attachment fitting 72 is provided at an end portion of the body portion 61. The attachment fitting 72 is provided on a front end side of the body portion 61. The attachment fitting 72 protrudes from the body portion 61. The attachment fitting 72 holds the metal band 71. The metal band 71 is held by the attachment fitting 72 so that the burner 101 is held in the socket 102.

[0047] The bottom terminal 81 is provided on the inside of the body portion 61. The bottom terminal 81 is provided on a rear end side of the body portion 61. The bottom terminal 81 is formed of a conductive material. The bottom terminal 81 is electrically connected to the lead wire 34.

[0048] The side terminal 82 is provided at a side wall of the body portion 61. The side terminal 82 is provided on the rear end side of the body portion 61. The side terminal 82 is formed of a conductive material. The side terminal 82 is electrically connected to the support wire 35.

[0049] The bottom terminal 81 and the side terminal 82 are electrically connected to a lighting circuit 301. In this case, the bottom terminal 81 is electrically connected to a high voltage side of the lighting circuit 301. The side terminal 82 is electrically connected to a low voltage side of the lighting circuit 301.

[0050] If the discharge lamp 100 is used for the headlamp of the automobile, the discharge lamp 100 is attached such that a center axis (tube axis) thereof is in a substantially horizontal state and the support wire 35 is positioned on a substantially lower end side (downward). Moreover, turning on the discharge lamp 100 attached in such a direction is referred to as horizontal lighting.

[0051] Here, if one discharge lamp 100 can cope with both the low beam and the high beam, it is possible to reduce a manufacturing cost of the headlamp. In addition, it is possible to reduce the size of the headlamp, or to increase a degree of freedom of design of the headlamp.

[0052] In this case, if electric power applied to the discharge lamp 100 is changed, it is possible to cope with both the low beam and the high beam. However, if the applied electric power is changed, the temperature of the electrode 32 is likely to fall outside an appropriate range. In this case, since an arc spot becomes unstable even if the temperature of the electrode 32 is too high or too low, flickering occurs. When flickering occurs, it causes discomfort to a driver and other people.

[0053] In addition, furthermore, if the temperature of the electrode 32 is too high, the electrode 32 may suffer severe consumption, crack leakage is likely to occur in the sealing portion 12, and there is a concern that the service life of the discharge lamp 100 is shortened.

[0054] As a result of studies, the inventor found that if electric power (electric power during stable lighting) applied to the discharge lamp 100 during the low beam is 24 W or more and 30 W or less, and the thickness dimension (diameter dimension) d of the electrode 32 is set as follows, electric power (electric power during stable lighting) applied to the discharge lamp 100 during the high beam is 32 W or more and 38 W or less, it is possible to suppress the occurrence of the flickering and to suppress shortening of the service life thereof.

[0055] Table 1 is a table illustrating a relationship between the thickness dimension (diameter dimension) d of the electrode 32 and the occurrence of the flickering, and the service life.

Table 1

	Thickness dimension of electrode d (mm)				
	0.22	0.24	0.28	0.33	0.35
Flickering during low beam	○	○	○	○	X
Flickering during high beam	X	○	○	○	○

(continued)

	Thickness dimension of electrode d (mm)				
	0.22	0.24	0.28	0.33	0.35
Service life	X	○	○	○	○
Determination	X	○	○	○	X

[0056] Moreover, an internal volume (volume of the discharge space 111) of the light emitting portion 11 was 22 μL.

[0057] The inert gas sealed in the discharge space 111 was xenon.

[0058] A composition ratio of the metal halide 2 was ScI_3:NaI:ZnI_2:InBr=45wt%: 49wt%:4.9wt%:0.1wt%.

[0059] A weight of the metal halide 2 was 0.4 mg.

[0060] A material of the electrode 32 was tungsten.

[0061] An applied electric power during the low beam was 27 W.

[0062] An applied electric power during the high beam was 34 W.

[0063] Suppression of the occurrence of the flickering was evaluated by obtaining a fluctuation rate of illuminance. The illuminance was measured every 0.5 seconds from 5 minutes to 10 minutes. A case where the fluctuation rate of the illuminance was 3% or less was indicated by "O", and a case where the fluctuation rate of the illuminance exceeded 3% was indicated by "X".

[0064] In the evaluation of the service life, a case where the discharge lamp 100 was lit for 2,000 hours in a flashing mode of an EU 120 minute mode, and a crack leak did not occur in the sealing portion 12 was indicated by "O", and a case where the crack leak occurred in the sealing portion 12 was indicated by "X".

[0065] As can be seen from Table 1, if the thickness dimension (diameter dimension) d of the electrode 32 is set as the following formula, even if electric power applied to the discharge lamp 100 is changed, it is possible to suppress the occurrence of the flickering and to suppress shortening of the service life.

[0066] That is, the discharge lamp 100 capable of coping with the low beam and the high beam can be formed with a simple configuration.

$0.24\ (mm) \leq d\ (mm) \leq 0.33\ (mm)$

[0067] Moreover, in Table 1, although the applied electric power during the low beam was 27 W and the applied electric power during the high beam was 34 W, even if the applied electric power during the low beam is 24 W or more and 30 W or less, and the applied electric power during the high beam is 32 W or more and 38 W or less, it is possible to obtain the same effect.

[0068] Table 2 is a table illustrating a relationship between an amount of a change in a tube current during switching between the low beam and the high beam, and the occurrence of the flickering.

Table 2

Thickness dimension of electrode d (mm)	Conditions	Amount of change in tube current (A)			
		0.4	0.3	0.2	0.1
0.24	Flickering during low beam	○	○	○	○
	Flickering during high beam	X	○	○	○
0.28	Flickering during low beam	X	○	○	○
	Flickering during high beam	X	○	○	○
0.33	Flickering during low beam	X	○	○	○
	Flickering during high beam	○	○	○	○
Determination		X	○	○	○

[0069] Moreover, conditions and evaluation references of the evaluation test are the same as those of the case of Table 1.

[0070] As can be seen from Table 2, if the amount of the change in the tube current when switching between the low beam and the high beam is 0.3 A or less, the occurrence of the flickering can be suppressed even if the electric power applied to the discharge lamp 100 is changed.

[0071] That is, the discharge lamp 100 capable of coping with the low beam and the high beam can be formed with a simple configuration.

[0072] Moreover, if the thickness dimension of the electrode 32 is set to 0.24 (mm)≤d (mm)≤0.33 (mm), the electric power applied to the discharge lamp 100 during the low beam is set to 24 W or more and 30 W or less, and the electric power applied to the discharge lamp 100 during the high beam is set to 32 W or more and 38 W or less, the amount of the change in the tube current when switching between the low beam and the high beam can be 0.3 A or less.
[0073] Table 3 is a table illustrating a relationship between a cross-sectional area of a current, the occurrence of the flickering, and the service life.

Table 3

		Cross-sectional area of current I/S (A/mm^2)						
		6	8	12	14	16	18	20
Items	Flickering during low beam	X	○	○	○	○	○	○
	Flickering during high beam	○	○	○	○	○	○	X
	Service life	○	○	○	○	○	○	X
Determination		X	○	○	○	○	○	X

[0074] Moreover, conditions and evaluation references of the evaluation test are the same as those of the case of Table 1.
[0075] In Table 3, I(A) is a current applied to the discharge lamp 100, S (mm^2) is a cross-sectional area of the electrode 32, and I/S (A/mm^2) is a cross-sectional area of a current.
[0076] As can be seen from Table 3, if the following formula is satisfied, it is possible to suppress the occurrence of the flickering and to suppress shortening of the service life thereof even if electric power applied to the discharge lamp 100 is changed.
[0077] That is, the discharge lamp 100 capable of coping with the low beam and the high beam can be formed with a simple configuration.
8.0 (A/mm^2)≤I/S (A/mm^2)≤18.0 (A/mm^2)
[0078] Moreover, if the thickness dimension of the electrode 32 is 0.24 (mm) ≤d (mm) ≤0.33 (mm), electric power applied to the discharge lamp 100 during the low beam is 24 W or more and 30 W or less, and electric power applied to the discharge lamp 100 during the high beam is 32 W or more and 38 W or less, the cross-sectional area (I/S) of the current can be set so as to be in the range described above.
[0079] In addition, according to the findings obtained by the inventor, the arc spot can be stabilized if the distance (distance between the electrodes) L1 between tips of the pair of the electrodes 32 satisfies the following formula. Therefore, the occurrence of the flickering can be suppressed.
3.0 (mm)≤L1 (mm)≤3.6 (mm)
[0080] In addition, according to the findings obtained by the inventor, it is preferable that the gas sealed in the closed space formed between the inner tube 1 and the outer tube 5 is either nitrogen, argon, or a mixed gas of nitrogen and argon, and a sealing pressure of the gas is 0.1 atm or less at room temperature (25°C). In this way, it is possible to make the temperature of the light emitting portion 11 within an appropriate range. Therefore, it is possible to suppress the occurrence of the flickering and to suppress shortening of the service life thereof.
[0081] In addition, according to the findings obtained by the inventor, it is preferable that the gas sealed in the discharge space 111 is xenon and the sealing pressure of the gas is 10 atm or more and 15 atm or less at room temperature (25°C). In this way, the arc spot can be stabilized. Therefore, the occurrence of the flickering can be suppressed.
Vehicle Lamp and Vehicle Lighting Device
[0082] FIG. 2 is a schematic view illustrating a vehicle lamp 200 and a vehicle lighting device 300. FIG. 3 is a block view of the vehicle lighting device 300.
[0083] FIG. 2 illustrates a case where the discharge lamp 100 is attached such that the pair of the electrodes 32 provided in the discharge lamp 100 is horizontal. That is, a case of the discharge lamp 100 to be horizontal lighting is illustrated.
[0084] As illustrated in FIGS. 2 and 3, the vehicle lighting device 300 is provided with the discharge lamp 100, the lighting circuit 301, and a changeover switch 302.
[0085] As illustrated in FIG. 2, the vehicle lamp 200 is provided with the vehicle lighting device 300, a housing 202, a light shielding control plate 203, and a lens 204.
[0086] The housing 202 reflects the light irradiated from the discharge lamp 100 to the front end side. The housing 202 is formed of, for example, a metal having high reflectance. A space is provided on an inside of the housing 202 and an inner surface has a parabolic shape.

[0087] A front end side and a rear end side of the housing 202 are opened.

[0088] The discharge lamp 100 is attached to the housing 202. The socket 102 of the discharge lamp 100 is attached to the vicinity of the opening of the rear end side of the housing 202. The burner 101 of the discharge lamp 100 is positioned at the space on the inside of the housing 202.

[0089] That is, the housing 202 has a function of holding the discharge lamp 100 and a function of a reflector.

[0090] The light shielding control plate 203 is provided on the inside of the housing 202 and is provided on the front end side of the burner 101 and on a lower end side of the burner 101.

[0091] The light shielding control plate 203 is formed of a light shielding material such as a metal. The light shielding control plate 203 is provided to form a light distribution called a cut line. The light shielding control plate 203 is movable.

[0092] The lens 204 is provided so as to close the opening on the front end side of the housing 202. The lens 204 can be a convex lens. The lens 204 condenses the light directly incident from the discharge lamp 100 and the light reflected and incident by the housing 202 to form a desired light distribution.

[0093] The lighting circuit 301 is a circuit for starting of the discharge lamp 100 and maintaining the lighting.

[0094] As illustrated in FIG. 3, the lighting circuit 301 may include, for example, an igniter circuit 301a and a ballast circuit 301b.

[0095] A DC power source DS such as a battery and a switch SW are electrically connected to an input side of the lighting circuit 301. The discharge lamp 100 is electrically connected to an output side of the lighting circuit 301.

[0096] The igniter circuit 301a is composed of, for example, a transformer, a capacitor, a resistor, a semiconductor element, and the like. The igniter circuit 301a generates a high voltage pulse of substantially 30 kV and applies the high voltage pulse to the discharge lamp 100. Insulation breakdown occurs between the pair of electrodes 32 and electric discharge occurs by applying a high voltage pulse of substantially 30 kV to the discharge lamp 100. That is, the igniter circuit 301a starts the discharge lamp 100.

[0097] The ballast circuit 301b maintains the lighting of the discharge lamp 100 started by the igniter circuit 301a.

[0098] In addition, the ballast circuit 301b has a low beam ballast circuit and a high beam ballast circuit. Each of the low beam ballast circuit and the high beam ballast circuit has, for example, a DC/DC conversion circuit, a DC/AC conversion circuit, a current and voltage detection circuit, a control circuit, and the like. The low beam ballast circuit applies electric power of 24 W or more and 30 W or less to the discharge lamp 100 during stable lighting. The high beam ballast circuit applies electric power of 32 W or more and 38 W or less to the discharge lamp 100 during stable lighting.

[0099] The changeover switch 302 performs switching between the low beam and the high beam based on an input by a driver or the like. That is, the changeover switch 302 switches the low beam ballast circuit and high beam ballast circuit based on an input by the driver or the like. Therefore, predetermined electric power is supplied from the low beam ballast circuit or high beam ballast circuit switched by the changeover switch 302 to the discharge lamp 100.

[0100] As illustrated in FIGS. 2 and 3, the vehicle lighting device 300 has the discharge lamp 100 and an igniter circuit 301a incorporated in a case, and a ballast circuit 301b and a changeover switch 302 as other circuits are electrically connected to the igniter circuit 301a, but the configuration is not limited thereto.

[0101] For example, the vehicle lighting device 300 has the igniter circuit 301a and the ballast circuit 301b incorporated in one case, and the discharge lamp 100, and the changeover switch 302 as another circuit may be electrically connected to the ballast circuit 301b.

[0102] In addition, the vehicle lighting device 300 has the igniter circuit 301a, the ballast circuit 301b, and the changeover switch 302 incorporated in one case, and those may be electrically connected to the discharge lamp 100.

[0103] In addition, the vehicle lighting device 300 only has the discharge lamp 100 and the igniter circuit 301a, the ballast circuit 301b, and the changeover switch 302 as other circuits may be electrically connected to the discharge lamp 100.

[0104] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention as defined by the appended claims.

Claims

1. A headlamp of automobile (300), **characterized by** comprising:

a discharge lamp (100);
a lighting circuit (301) that is electrically connected to the discharge lamp (100) and has an igniter circuit (301a), a low beam ballast circuit (301b), and a high beam ballast circuit (301b); and
a changeover switch (302) that performs switching between the low beam ballast circuit (301b) and the high beam ballast circuit (301b);
the discharge lamp (100) comprising:

a light emitting portion (11) that has a discharge space (111) in which a metal halide and inert gas are sealed on an inside thereof; and

a pair of electrodes (32) that protrudes to an inside of the discharge space (111) and faces each other at a predetermined distance,

electric power applied to the discharge lamp (100) during a low beam is 24 W or more and 30 W or less, and electric power applied to the discharge lamp (100) during a high beam is 32 W or more and 38 W or less, and

an amount of a change in a tube current when performing switching between the low beam and the high beam is 0.3 A or less,

the following formula is satisfied where a thickness dimension of the electrode (32) is d in mm: $0.24 \text{ mm} \leq d \leq 0.33 \text{ mm}$.

2. The headlamp (300) according to claim 1,
wherein when the current applied to the discharge lamp (100) is I in A and a cross-sectional area of the electrode (32) is S in mm^2, the following formula is satisfied. $8.0 \text{ A/mm}^2 \leq I/S \leq 18.0 \text{ A/mm}^2$.

3. The headlamp (300) according to claim 1 or 2, further comprising:
a housing (202) to which the discharge lamp (100) is attached.

Patentansprüche

1. Scheinwerfer für ein Kraftfahrzeug (300), **dadurch gekennzeichnet, dass** er Folgendes umfasst:

eine Entladungslampe (100);

eine Beleuchtungsschaltung (301), die elektrisch mit der Entladungslampe (100) verbunden ist und eine Zündschaltung (301a), eine Abblendlicht-Vorschaltschaltung (301b) und eine Fernlicht-Vorschaltschaltung (301b) aufweist; und

einen Umschalter (302), der das Umschalten zwischen der Abblendlicht-Vorschaltschaltung (301b) und der Fernlicht-Vorschaltschaltung (301b) durchführt;

die Entladungslampe (100) umfassend:

einen lichtemittierenden Abschnitt (11), der einen Entladungsraum (111) aufweist, in dem ein Metallhalogenid und ein Inertgas an einer Innenseite davon abgedichtet sind; und

ein Elektrodenpaar (32), das in das Innere des Entladungsraums (111) hineinragt und sich in einem vorbestimmten Abstand gegenüberliegt,

die elektrische Leistung, die während eines Abblendlichts an die Entladungslampe (100) angelegt wird, 24 W oder mehr und 30 W oder weniger beträgt, und die elektrische Leistung, die während eines Fernlichts an die Entladungslampe (100) angelegt wird, 32 W oder mehr und 38 W oder weniger beträgt, und

eine Änderung des Röhrenstroms beim Umschalten zwischen Abblend- und Fernlicht 0,3 A oder weniger beträgt,

die folgende Formel erfüllt ist, wenn die Dickenabmessung der Elektrode (32) d in mm ist:
$0{,}24 \text{ mm} \leq d \leq 0{,}33 \text{ mm}$

2. Scheinwerfer (300) nach Anspruch 1,
wobei, wenn der an die Entladungslampe (100) angelegte Strom I in A und eine Querschnittsfläche der Elektrode (32) S in mm^2 ist, die folgende Formel erfüllt ist:
$8{,}0 \text{ A/mm}^2 \leq I/S \leq 18{,}0 \text{ A/mm}^2$

3. Scheinwerfer (300) nach Anspruch 1 oder 2, ferner umfassend:
ein Gehäuse (202), an dem die Entladungslampe (100) befestigt ist.

Revendications

1. Phare d'automobile (300), **caractérisé en ce qu'**il comprend :

une lampe à décharge (100) ;

un circuit d'éclairage (301) qui est connecté électriquement à la lampe à décharge (100) et comporte un circuit d'allumage (301a), un circuit de ballast de feu de croisement (301b), et un circuit de ballast de feu de route (301b) ; et
un commutateur (302) qui met en œuvre une commutation entre le circuit de ballast de feu de croisement (301b) et le circuit de ballast de feu de route (301b) ;
la lampe à décharge (100) comprenant :

une portion d'émission de lumière (11) qui comporte un espace de décharge (111) dans lequel sont scellés un halogénure métallique et un gaz inerte ; et
une paire d'électrodes (32) qui ressortent à l'intérieur de l'espace de décharge (111) et qui se font face à une distance prédéterminée,
dans lequel l'énergie électrique appliquée à la lampe à décharge (100) pour un faisceau de croisement est supérieure ou égale à 24 W et inférieure ou égale à 30 W, et l'énergie électrique appliquée à la lampe à décharge (100) pour un faisceau de route est supérieure ou égale à 32 W et inférieure ou égale à 38 W, et la variation de courant de tube lors de la mise en œuvre d'une commutation entre le faisceau de croisement et le faisceau de route est inférieure ou égale à 0,3 A,
la formule suivante étant satisfaite, où la dimension de l'épaisseur de l'électrode (32) est d en mm :
$0{,}24 \text{ mm} \leq d \leq 0{,}33 \text{ mm}$.

2. Phare (300) selon la revendication 1,
dans lequel, quand le courant appliqué à la lampe à décharge (100) est I en A et la section transversale de l'électrode (32) est S en mm^2, la formule suivante est satisfaite :
$8{,}0 \text{ A/mm}^2 \leq I/S \leq 18{,}0 \text{ A/mm}^2$.

3. Phare (300) selon la revendication 1 ou 2, comprenant en outre :
un boîtier (202) sur lequel est montée la lampe à décharge (100).

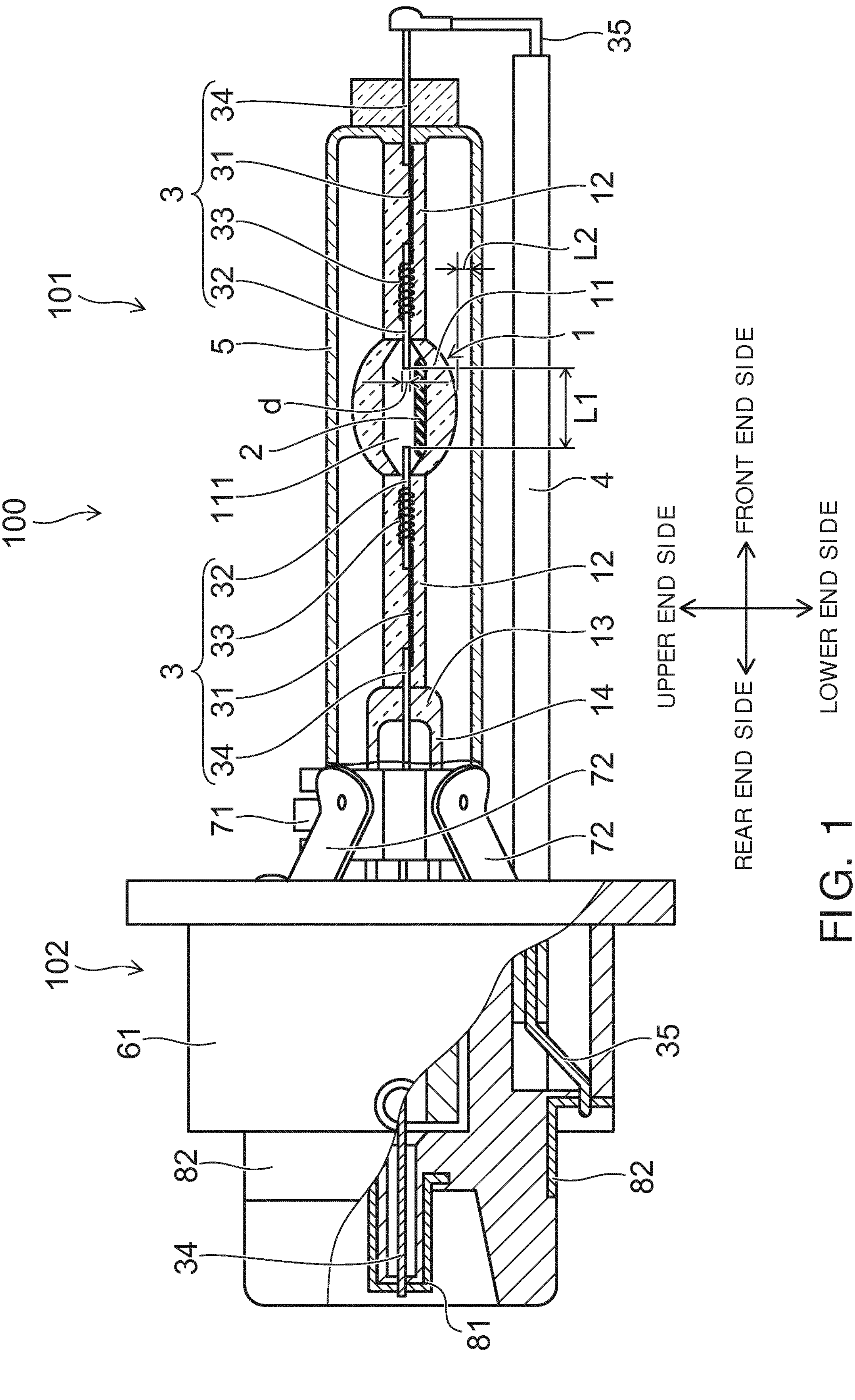
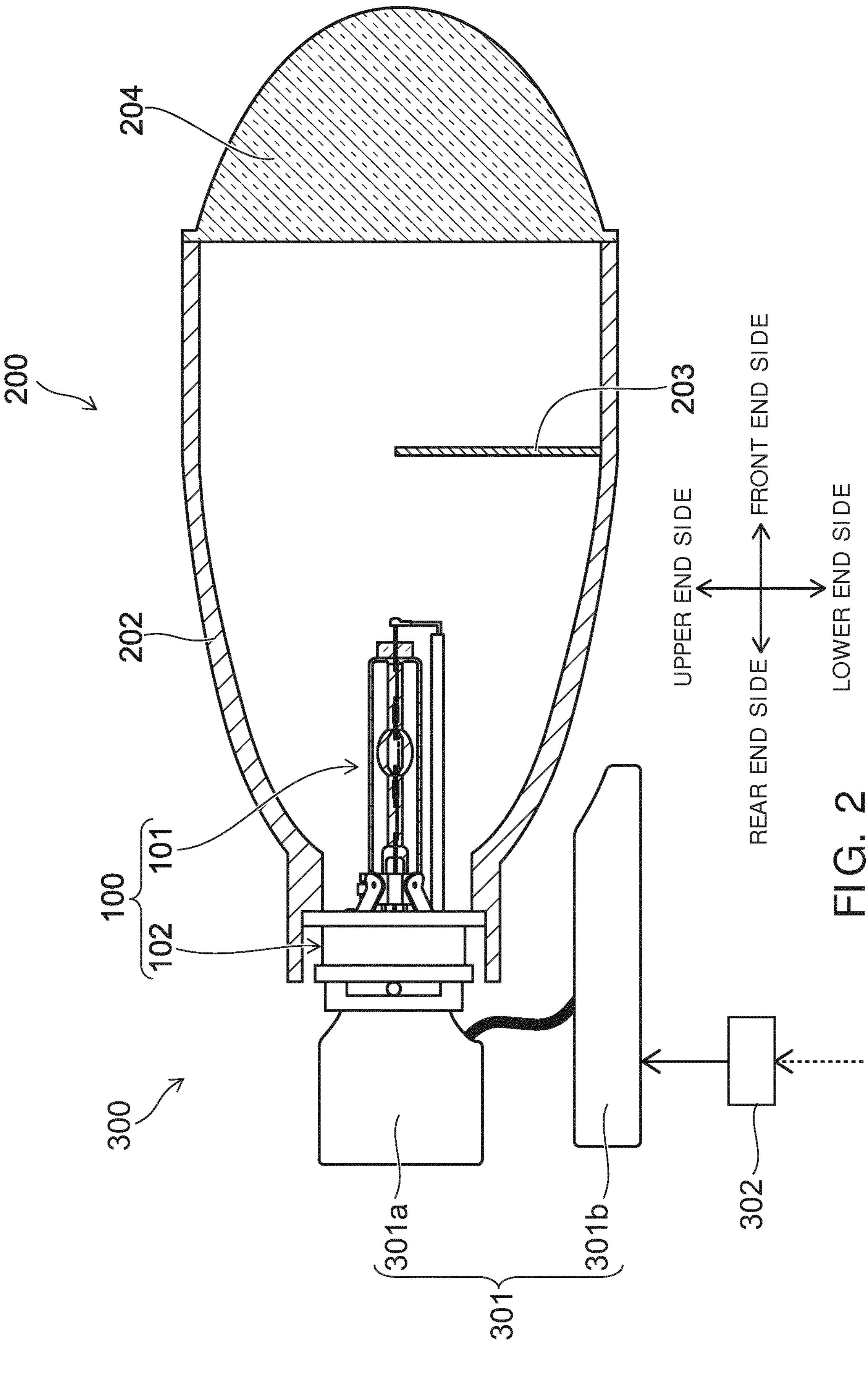

35
34
31
33
32
3
12
L2
101
11
1
5
d
L1
2
111
100
4
FRONT END SIDE
UPPER END SIDE
LOWER END SIDE
REAR END SIDE
32
33
31
34
3
12
13
14
72
71
72
102
61
35
82
82
34
81

FIG. 1



204
200
203
202
101
100
102
300
301a
301b
301
302
UPPER END SIDE
FRONT END SIDE
REAR END SIDE
LOWER END SIDE

FIG. 2

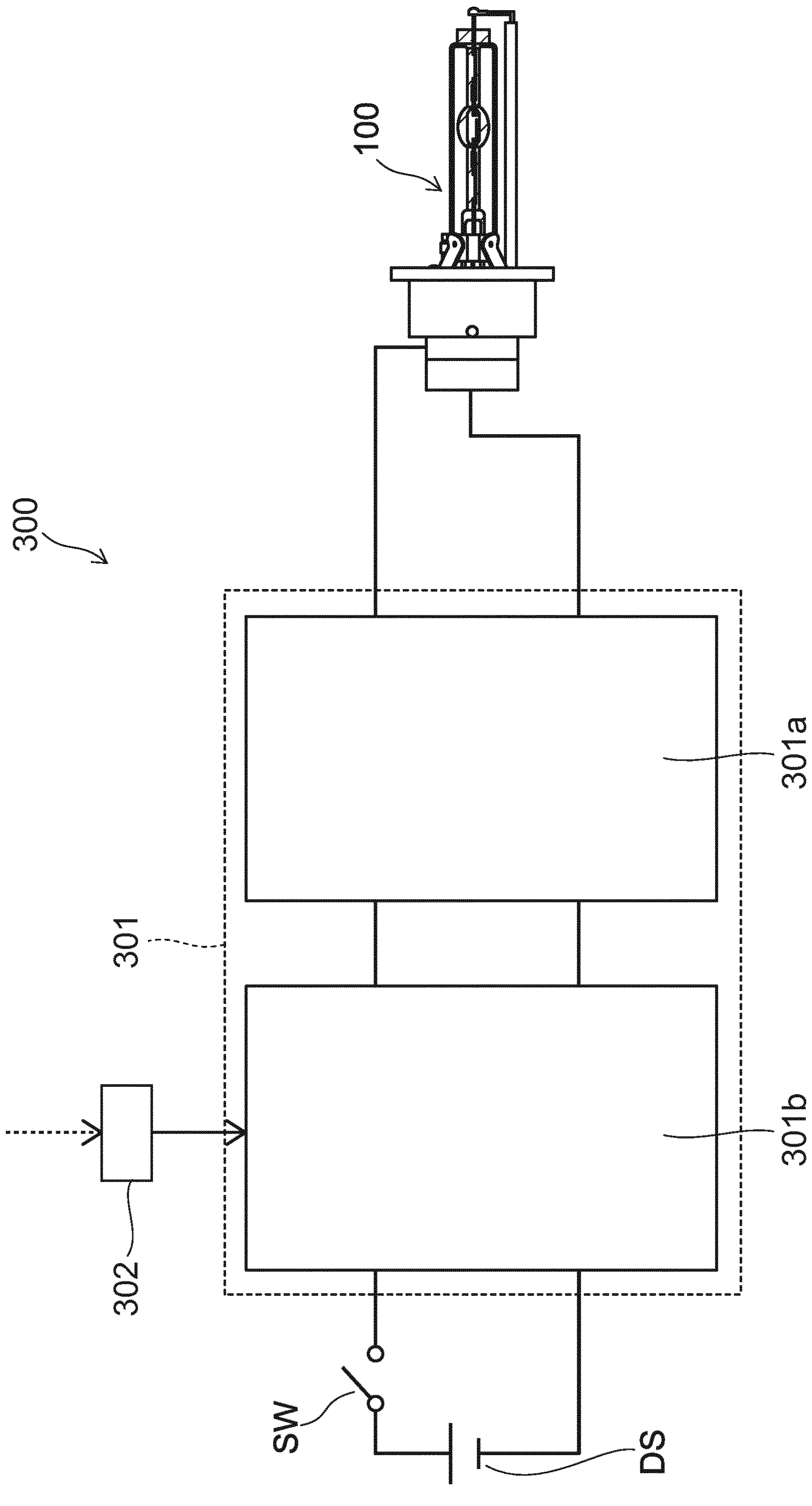


FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2420407 A1 **[0005]**