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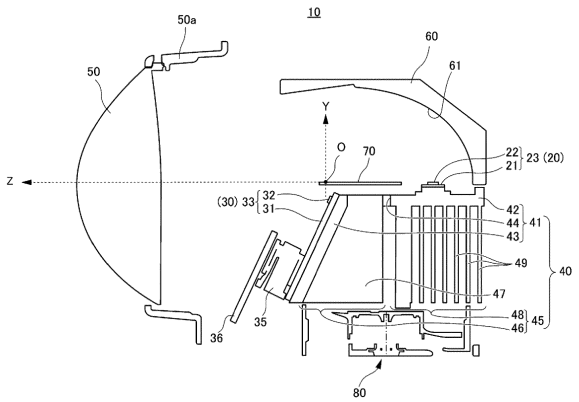
(54) **VEHICLE LAMP**

(57) In order to provide a vehicle lamp that has greater cooling efficiency and comprises a first light source unit having a semiconductor-type first light-emitting chip and a second light source unit having a semiconductor-type second light-emitting chip, this vehicle lamp comprises a first light source unit which has a semiconductor-type first light-emitting chip, a second light source unit which is disposed further forward than the first light source unit and which has a semiconductor-type second light-emitting chip, and a heat sink. The heat sink is provided with a base part, and a fin part which has heat releasing fins disposed on a rear surface side of the base part. The base part is provided with a horizontal section on which the first light source unit is disposed, an inclined section which extends downward from the front of the horizontal section and on which the second light source unit is disposed, and an opening which is provided between the first light source unit and the second light source unit and through which gas can travel. The fin part is provided with a vertical fin section in which a plurality of vertical fins which extend back from the rear surface of the inclined section are arranged in the horizontal direction. The opening is provided so as to include a position corresponding to the vertical fin section.

FIG. 3



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Description

TECHNICAL FIELD

[0001] The present invention relates to a vehicular light.

BACKGROUND ART

[0002] Patent Literature 1 discloses a vehicular light including a light unit capable of forming both a low beam light distribution pattern and a high beam light distribution pattern. The disclosed vehicular light allows the variable high beam (adaptive driving beam) control, in which a plurality of light emitting chips are used to change a high beam light distribution pattern according to the position of a preceding vehicle or an oncoming vehicle.

CITATION LIST

PATENT LITERATURE

[0003] Patent Literature 1: JP 2016-039020 A

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] In recent years, semiconductor light sources such as LEDs are of a higher power. Such semiconductor light sources including LEDs are increasingly used as a light source for a vehicular light, as also seen from Patent Literature 1.

[0005] A light emitting chip as a semiconductor light source such as an LED, however, is reduced in luminous efficiency at higher temperatures. Consequently, the luminous efficiency may be decreased if light emitting chips each generating heat are used in a large number, as is the case with Patent Literature 1.

[0006] The present invention has been made in view of such circumstances, with an object thereof having been to provide a vehicular light that includes a first light source unit having a first semiconductor light emitting chip and a second light source unit having a second semiconductor light emitting chip and is improved in cooling efficiency.

MEANS FOR SOLVING THE PROBLEM

[0007] In order to achieve the above object, the present invention will be understood by the following configurations.

(1) A vehicular light of the present invention includes: a first light source unit including a first light emitting chip of a semiconductor type configured to emit light for low beam light distribution; a second light source unit located ahead of the first light source unit and including a second light emitting chip of a semiconductor type configured to emit light for high beam light distribution; and a heat sink having the first light source unit and the second light source unit arranged thereon. The heat sink includes: a base section where the first light source unit and the second light source unit are positioned; and a finned section with heat dissipating fins provided on a rear face side of the base section. The base section has: a horizontal portion having the first light source unit located therein; an inclined portion obliquely extending forward and downward from a front of the horizontal portion and having the second light source unit located therein; and an opening provided at a position between the first light source unit and the second light source unit and allowing gas to flow through from a rear face side toward a front face side. The finned section includes a longitudinal fin section with a plurality of longitudinal fins each extending from a rear face of the inclined portion backward to a position in the horizontal portion that is ahead of the first light source unit, and aligned with one another in a horizontal direction. The opening is so provided as to include a position corresponding to the longitudinal fin section.

(2) In the configuration of (1) above, the second light source unit includes a second substrate positioned in the inclined portion of the base section, and the second light emitting chip provided on the second substrate. At least part of the second substrate is provided with a substrate opening allowing gas to flow through from a rear face side toward a front face side. The inclined portion of the base section is provided with an opening allowing gas to flow through from a rear face side toward a front face side, at a position corresponding to the substrate opening of the second substrate.

(3) In the configuration of (1) or (2) above, the finned section includes a lateral fin section provided behind the longitudinal fin section and having a plurality of lateral fins each extending from the horizontal portion downward and aligned with one another in a longitudinal direction.

(4) In the configuration of (3) above, the opening is provided in the horizontal portion at a position ahead of the lateral fin section.

(5) In the configuration of any one of (1) through (4) above, at least a backward inner face of the opening is forwardly inclined from a bottom toward a top.

(6) In the configuration of any one of (1) through (5) above, a lens located ahead of the first light source unit and the second light source unit; a reflector positioned on the horizontal portion and having a shape

forwardly opened to cover the first light source unit in a semi-domed manner; and a shade configured to partially block light from the first light source unit that is reflected by the reflector so as to form a cutoff line of a low beam light distribution pattern are included. The shade is positioned above the opening so as to guide at least part of gas flowing out through the opening toward the lens.

(7) In the configuration of any one of (1) through (6) above, the opening is so provided as to reach part of the inclined portion.

(8) In the configuration of any one of (1) through (7) above, a cooling fan located lower than the finned section and configured to blow gas toward the base section is included.

EFFECT OF THE INVENTION

[0008] According to the present invention, the vehicular light, which includes a first light source unit having a first semiconductor light emitting chip and a second light source unit having a second semiconductor light emitting chip and is improved in cooling efficiency, is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a plan view of a vehicle equipped with a vehicular light according to a first embodiment of the present invention.
FIG. 2 is a front elevation of a light unit of the first embodiment of the present invention as viewed from forward.
FIG. 3 is a vertical cross section along the lens optical axis of the light unit of the first embodiment of the present invention.
FIG. 4 is a perspective view chiefly showing a heat sink of the first embodiment of the present invention from above.
FIG. 5 is a diagram illustrating a modification of the heat sink of the first embodiment of the present invention.
FIG. 6 is a front elevation of a light unit of a second embodiment of the present invention as viewed from forward.

MODE FOR CARRYING OUT THE INVENTION

[0010] In the following, modes for carrying out the present invention (hereafter referred to simply as "embodiments") will be described in detail with reference to the accompanying drawings.
[0011] Over the entire description on the embodiments, like elements will be denoted by like numerals.
[0012] In the embodiments and drawings, the terms "forward" and "backward" indicate "the moving-forward direction" and "the moving -backward direction" of a vehicle 102, respectively, and the terms "above," "below," left" and "right" each indicate the direction as viewed by a driver in the vehicle 102 unless otherwise specified.

(First Embodiment)

[0013] A vehicular light according to a first embodiment of the present invention is each of vehicular front lights (101R and 101L) provided on the right and left sides at the front of the vehicle 102 as shown in FIG. 1, respectively, and is hereafter referred to simply as a "vehicular light."
[0014] The following description on a light unit 10 is chiefly made with respect to the vehicular light on the right side of the vehicle, while the description will be common to the vehicular lights on the right and left sides unless otherwise specified.
[0015] The vehicular light of this embodiment includes a housing (not shown) that is opened toward the front side of the vehicle and an outer lens (not shown) that is so attached to the housing as to cover the opening of the housing, and the light unit 10 (see FIGS. 2 and 3) and the like are arranged in a light chamber formed by the housing and the outer lens.

(Light Unit 10)

[0016] FIG. 2 is a front elevation of the light unit 10 as viewed from forward, FIG. 3 is a vertical cross section along the lens optical axis Z of the light unit 10, and FIG. 4 is a perspective view chiefly showing a heat sink 40 from above.
[0017] In FIGS. 2 and 3, an axis Y represents the vertical axis passing through the backward focal point O of a lens 50.
[0018] The lens 50 is omitted from FIG. 2 so that the inside may clearly be illustrated.
[0019] As shown in FIG. 3, the light unit 10 of this embodiment includes a first light source unit 20, a second light source unit 30, the heat sink 40, the lens 50, a reflector 60, a shade 70, and a cooling fan 80.

(First Light Source Unit 20)

[0020] The first light source unit 20 is the light source unit for emitting light for low beam light distribution, which, in this embodiment, is composed of a single first light source 23 including a single first substrate 21 and a single first semiconductor light emitting chip 22 emitting light for low beam light distribution that is mounted on the first substrate 21.
[0021] The first light source unit 20 may also be composed of a plurality of first light sources 23.
[0022] In addition, the first light source 23 to be used for the first light source unit 20 may have such a configuration that a plurality of first light emitting chips 22 are

mounted on the single first substrate 21.

[0023] In this embodiment, an LED chip as a semiconductor light emitting chip is used for the first light emitting chip 22. The first light emitting chip 22, however, does not need to be limited to the LED chip but may be an LD chip (laser diode chip) as a semiconductor light emitting chip.

(Second Light Source Unit 30)

[0024] The second light source unit 30 is the light source unit emitting light for high beam light distribution, which, in this embodiment, is composed of a single second light source 33 (see FIG. 3) including a single second substrate 31 and a plurality of second semiconductor light emitting chips 32 emitting light for high beam light distribution that are aligned with one another in the horizontal direction on the second substrate 31 (see FIG. 3), as shown in FIGS 2 and 3. On the second substrate 31, a feeding connector 35 to be connected with an external connector is mounted for power feeding.

[0025] The second light source unit 30 may also have such a configuration that a plurality of second light sources 33 each having a single second light emitting chip 32 mounted on a single second substrate 31 are aligned with one another in the horizontal direction.

[0026] In this embodiment, a cover 36 covering the feeding connector 35 in order to make the feeding connector 35 invisible from the outside is also arranged on the second substrate 31.

The cover 36 may be provided in a base section 41 (an inclined portion 43 described later, for instance) of the heat sink 40.

[0027] In the light unit 10 of this embodiment, the variable high beam (adaptive driving beam) control is carried out by controlling the turning on and off of the second light emitting chips 32 according to the position of a preceding vehicle or an oncoming vehicle to thereby suppress the generation of glare to the preceding vehicle or the oncoming vehicle.

[0028] In this embodiment, an LED chip as a semiconductor light emitting chip is used for each second light emitting chip 32, as is the case with the first light emitting chip 22. The second light emitting chips 32, however, do not need to be limited to the LED chips but may each be an LD chip (laser diode chip) as a semiconductor light emitting chip.

[0029] In this embodiment, the vehicular light is illustrated as a vehicular light on the right side and, as such, has four second light emitting chips 32 positioned on the left side (outside of the vehicle) and seven second light emitting chips 32 positioned on the right side (inside of the vehicle) with respect to the axis Y as a vertical axis passing through the backward focal point O of the lens 50 when the light unit 10 is viewed from forward in the front vision, as shown in FIG. 2. In a vehicular light on the left side, on the contrary, four second light emitting chips 32 may be positioned on the right side and seven second light emitting chips 32 may be positioned on the left side with respect to the axis Y.

[0030] If the inside and the outside of the vehicle 102 are to be used as a reference, it should be noted that the inside and the outside of the vehicle are reversed between a vehicular light on the right side and a vehicular light on the left side.

[0031] In a vehicular light on the left side, the left side in the front vision corresponds to the inside of the vehicle and the right side corresponds to the outside. Consequently, if the inside and the outside of the vehicle are used as a reference, the second light emitting chips 32 on the right and left sides with respect to the axis Y are the same in number between vehicular lights on the right and left sides.

[0032] The number of the second light emitting chips 32 does not need to be limited to eleven but may appropriately be changed in consideration of the horizontal light distribution range of the high beam light distribution pattern to be formed and the variable high beam (adaptive driving beam) control.

(Heat Sink 40)

[0033] The heat sink 40 includes a base section 41 where the first light source unit 20 (see FIG. 3) and the second light source unit 30 (see FIG. 3) are positioned, and a finned section 45 with a plurality of heat dissipating fins (longitudinal fins 47 and lateral fins 49), as shown in FIGS. 3 and 4.

[0034] The heat sink 40 is preferably formed of a metallic or plastic material having a high thermal conductivity. In this embodiment, the heat sink 40 as used is an aluminum die-cast heat sink.

[0035] The base section 41 has a horizontal portion 42 having the first light source unit 20 located therein, an inclined portion 43 obliquely extending forward and downward from the front of the horizontal portion 42 and having the second light source unit 30 located therein, and an opening 44 provided at a position between the first light source unit 20 and the second light source unit 30, which opening communicates the rear face side and the front face side of the base section 41 with each other.

[0036] On the other hand, the finned section 45 includes a longitudinal fin section 46 with a plurality of longitudinal fins 47 each extending from a rear face of the inclined portion 43 backward to a position in the horizontal portion 42 that is ahead of the first light source unit 20, and aligned with one another in the horizontal direction, and a lateral fin section 48 provided behind the longitudinal fin section 46 and having a plurality of lateral fins 49 each extending from a rear face of the horizontal portion 42 downward and aligned with one another in a longitudinal direction.

(Lens 50)

[0037] The lens 50 is a component for forwardly pro-

jecting the light from the first light source unit 20 and the second light source unit 30 while controlling the light distribution so that a specified light distribution pattern may be formed, and is attached to the heat sink 40 through a lens holder 50a (see FIGS. 2 and 3).

[0038] The material to be used to form the lens 50 does not need to be particularly limited but may be a transparent glass or resin. From the viewpoint of a good formability, the lens 50 is preferably formed of a transparent resin.

[0039] As an example, the acrylic resin, which has a refractive index less dependent on wavelength and whose spectral blue color is ready to suppress, is suitable for use.

[0040] If many light emitting chips (the first light emitting chip 22 and the second light emitting chips 32) are used as is the case with this embodiment and, accordingly, it is desirable to give priority to the heat resistance, a resin excellent in heat resistance, such as a polycarbonate resin, may be used for the lens 50.

[0041] The reflector 60 is positioned on the horizontal portion 42 of the base section 41 and has a shape forwardly opened to cover the first light source unit 20 in a semi-domed manner.

[0042] The reflector 60 has a face on the first light source unit 20 side formed into a reflecting face 61, and reflects the light emitted upward in the vertical direction from the first light emitting chip 22 of the first light source unit 20 toward the lens 50.

[0043] The reflecting face 61 has a curved face shape constituting part of an ellipse, and is so formed as to have two focal points, a first focal point and a second focal point.

[0044] The reflector 60 is positioned on the horizontal portion 42 so that the first focal point thereof may be located at the backward focal point O of the lens 50 or in the vicinity of the backward focal point O and the second focal point thereof may be located at the emission center of the first light emitting chip 22 or in the vicinity of the emission center.

(Shade 70)

[0045] The shade 70 partially blocks the light as emitted from the first light emitting chip 22 of the first light source unit 20 and reflected by the reflector 60 to form a cutoff line of a low beam light distribution pattern.

[0046] For this purpose, an edge 71 at the front of the shade 70 is formed in a shape according to the cutoff line, as shown in FIG. 2.

[0047] The shade 70 is positioned on the horizontal portion 42 of the heat sink 40 so that a portion constituting an upper end of an oblique cutoff line of the edge 71 may be located in the vicinity of the backward focal point O of the lens 50.

[0048] In this embodiment, the shade 70 is positioned on the horizontal portion 42 so that the backward focal point O of the lens 50 may be located at a position about 1.0 mm back from the edge 71, as shown in FIG. 3.

[0049] As also shown in FIG. 3, the shade 70 is positioned on the horizontal portion 42 so that it may be located above the opening 44 as provided in the horizontal portion 42 of the heat sink 40 with some distance from the opening 44.

(Cooling Fan 80)

[0050] The cooling fan 80 is a component for forcibly blowing gas such as air to the finned section 45 of the heat sink 40 so as to promote the cooling of the heat sink 40.

[0051] Specifically, as shown in FIG. 4, attachment legs 41a for the attachment of the cooling fan 80 extend from the base section 41 of the heat sink 40 to the lower side of the finned section 45, and the cooling fan 80, as being attached to the attachment legs 41a as such, is positioned below the finned section 45 so that a gas outlet may be opposite to the finned section 45.

[0052] While only two attachment legs 41a at the back are visible in FIG. 4, another two attachment legs 41a are provided at the front, that is to say, the cooling fan 80 is actually attached to the four attachment legs 41a.

[0053] The light unit 10 having the configuration as above is described in more detail while explaining the flow of gas such as air from the cooling fan 80 and the like.

[0054] When the cooling fan 80 is driven, gas such as air is to be blown to the finned section 45.

[0055] Specifically, as seen from FIG. 3, the cooling fan 80 is so arranged as to blow the wind to both the longitudinal fin section 46 and the lateral fin section 48, that is to say, part of the wind as generated by the cooling fan 80 is blown toward the lateral fin section 48.

[0056] The wind as blown to the lateral fin section 48 flows upward passing through between the lateral fins 49 aligned with one another in the longitudinal direction to take heat from the lateral fins 49, and strikes the rear face side of the region of the horizontal portion 42 where the first light source unit 20 is located.

[0057] The wind as prevented by the rear face of the horizontal portion 42 from flowing upward further flows along the rear face of the horizontal portion 42 in the horizontal direction while taking heat from the horizontal portion 42, and is laterally discharged out of the heat sink 40.

[0058] In order not to inhibit the flow of the gas (such as air) from the cooling fan 80, it is important that the wind be discharged efficiently from the heat sink 40.

[0059] In recent years, however, downsizing, in particular downsizing in the longitudinal direction has been required of vehicular lights.

[0060] Consequently, housing walls forming the light chamber tend to be closer to the back of the light unit 10, so that it is not possible to efficiently discharge the wind if the lateral fins 49 of the lateral fin section 48 are formed as longitudinal fins to discharge the wind backward.

[0061] In contrast, the wind will be discharged with no

inhibition by realizing the back of the heat sink 40 as the lateral fin section 48 having the lateral fins 49 aligned with one another in the longitudinal direction, as is the case with this embodiment, because a space for discharging the wind is obtainable in the lateral direction.

[0062] The flow of the wind between the lateral fins 49 is thus improved, which allows an efficient cooling of the first light source unit 20.

[0063] As described before, the front of the heat sink 40 is realized as the longitudinal fin section 46 having the longitudinal fins 47 aligned with one another in the horizontal direction (lateral direction).

[0064] The longitudinal fin section 46 is formed by making the longitudinal fins 47 extend backward from the rear face of the inclined portion 43 which obliquely extends forward and downward from the front of the horizontal portion 42.

[0065] Consequently, part of the wind as blown to the longitudinal fin section 46 flows under no disturbance by the fins along a backward inclination of the rear face of the inclined portion 43 from the bottom toward the top, while coming into contact with the rear face of the inclined portion 43.

[0066] It should be noted that the wind cannot flow upward if the provided fins are lateral fins because the lateral fins will guide the wind to a lateral outside.

[0067] Particularly since the rear face of the inclined portion 43 is not a vertical face but is inclined, the wind efficiently comes into contact with the rear face, leading to an excellent heat dissipation efficiency.

[0068] In the horizontal portion 42 of the base section 41, the opening 44 allowing gas to flow through from a rear face side toward a front face side is so provided as to include a position corresponding to the longitudinal fin section 46, as shown in FIGS. 3 and 4. Consequently, the part of the wind that flows upward in the longitudinal fin section 46 should flow out to the upper side of the heat sink 40 through the opening 44.

[0069] As described before, the opening 44 is provided at a position between the first light source unit 20 and the second light source unit 30. The wind flowing out through the opening 44 is to be blown to the region which is prone to be of a high temperature due to the combination of heats of the light source units (the first light source unit 20 and the second light source units 30), which leads to a high cooling efficiency.

[0070] Since a gap is formed between the longitudinal fins 47 on one hand and the lateral fin section 48 on the other, even a gas that flows between the longitudinal fins 47 in a region of the longitudinal fin section 46 not included in the opening 44 flows out through the gap between the longitudinal fins 47 and the lateral fin section 48 laterally in the horizontal direction under no inhibition, that is to say, the flow of the wind is in no way stagnated.

[0071] In this embodiment, the shade 70 is provided above the opening 44, as shown in FIG. 3. As a result, the gas which is so blown out from the cooling fan 80 as to flow upward is induced by the shade 70 to flow in the horizontal direction (rightward and leftward directions in FIG. 3). In other words, at least part of gas flowing out through the opening 44 is guided toward the lens 50 and the second light source unit 30, while at least another part of gas flowing out through the opening 44 is guided toward the first light source unit 20.

[0072] It is thus possible to cool not only the first light source unit 20 and the second light source unit 30 but the lens 50 which is prone to be hot due to radiant heat.

[0073] The shade 70, however, does not necessarily need to be located above the opening 44.

[0074] If the second light source unit 30 is positioned at a lower level and the opening 44 is so provided as to reach an upper region of the inclined portion 43, for instance, part of gas flowing out through the opening 44 will be allowed to flow forward. It is therefore possible to provide the opening 44 so that it may reach an upper region of the inclined portion 43 instead of positioning the shade 70 above the opening 44.

[0075] It is also possible to position the shade 70 above the opening 44 and, at the same time, provide the opening 44 so that it may reach an upper region of the inclined portion 43.

[0076] If the gas flowing out through the opening 44 is allowed to flow forward as described above, an additional gas flow will occur in the vicinity of the second light source unit 30 and the second light source unit 30 will be cooled much more efficiently.

[0077] As seen from FIG. 3, the longitudinal fin section 46 is caused by the inclined portion 43 to be wider on the cooling fan 80 side and narrower toward the top. As a consequence, the wind from the cooling fan 80 is efficiently accepted to make the wind flow upward at flow rates increased toward the top and, accordingly, is ready to blow out vigorously from the opening 44.

[0078] On the basis of the above configuration, the wind is efficiently blown toward the lens 50 and the first light source unit 20, and the gas as blown toward the lens 50 flows spreadably toward the second light source unit 30 according to the fact that the shade 70 extends even above the second light source unit 30 and, in association with that, the gas flow is no more prevented by the horizontal portion 42 on the front side of the shade 70, to thereby efficiently cool the second light source unit 30.

[0079] The gas flow toward the first light source unit 20 will be reduced if the gas flowing out through the opening 44 is caused to flow forward. In this regard, the quantity of heat generated by the second light source unit 30 will be increased if the second light source unit 30 is provided with more light emitting chips than the first light source unit 20, as is the case with this embodiment. Therefore, it is preferable in view of the overall cooling efficiency to cause the gas flowing out through the opening 44 to flow forward.

(Modification of Heat Sink 40)

[0080] Next, a modification of the heat sink 40 is de-

scribed with reference to FIG. 5.

FIG. 5 is a vertical cross section of a modification of the heat sink 40 that corresponds to FIG. 3.

[0081] The modification of the heat sink 40 as shown in FIG. 5 has a basic configuration similar to that of the heat sink 40 as described above, so that the differences therebetween are chiefly described below.

[0082] In the modification as shown in FIG. 5, the gas such as air which flows out through the opening 44 upward is made to readily flow forward by improving the shape of an inner face 44a of the opening 44.

[0083] Specifically, the opening 44 is formed so that a backward inner face 44a may forwardly be inclined from the bottom toward the top, that is to say, gas passing through the opening 44 may forwardly be guided.

[0084] With such configuration, the gas flowing out through the opening 44 is allowed to flow forward even if the shade 70 is not positioned above the opening 44.

[0085] In the modification as shown in FIG. 5, the gas flowing out through the opening 44 is allowed to flow forward by forwardly inclining a portion ranging from the forwardmost part of the lateral fin section 48 to the inner face 44a of the opening 44. It, however, may be adequate that at least the inner face 44a which constitutes the opening 44 at the back of the horizontal portion 42 of the base section 41 is composed of an inclined face forwardly inclined toward the top.

(Second Embodiment)

[0086] Next, a light unit 10 of a second embodiment of the present invention is described with reference to FIG. 6.

[0087] FIG. 6 is a front elevation of the light unit 10 of the second embodiment as viewed from forward.

[0088] In FIG. 6, the illustration of the lens 50 is omitted as in FIG. 2. The lens 50 is attached to the lens holder 50a in the same manner as shown in FIG. 3.

[0089] The light unit 10 of the second embodiment has a basic configuration similar to that of the first embodiment, so that the following description is chiefly made on the differences, with the description on like parts being omitted in some cases.

[0090] As shown in FIG. 6, in the second substrate 31 positioned in the inclined portion 43 of the base section 41, a substrate opening 31a allowing gas to flow through from a rear face side toward a front face side is formed below the second light emitting chips 32.

[0091] In addition, an opening 43a allowing gas to flow through from a rear face side toward a front face side is provided in the inclined portion 43 of the base section 41 at a position corresponding to the substrate opening 31a in the second substrate 31.

[0092] In FIG. 6, the longitudinal fins 47 to be seen through the substrate opening 31a and the opening 43a are not shown.

[0093] With the above configuration, gas flows out through the substrate opening 31a toward the lens 50, and the gas as such is allowed to flow toward the lens 50 more efficiently than the gas flowing out from the top of the heat sink 40, leading to an enhanced effect of cooling the lens 50.

[0094] Moreover, part of the gas flowing out through the substrate opening 31a flows toward the second light emitting chips 32, so that the cooling of the second light emitting chips 32 (the second light source unit 30) is carried out at a much higher efficiency.

[0095] In this embodiment, the substrate opening 31a is provided below the second light emitting chips 32. The substrate opening 31a may also be provided in an upper region if there is a space above the second light emitting chips 32, for instance. Even in that case, the lens 50 is efficiently cooled.

[0096] The lens 50 and the second light source unit 30 are further cooled, with the heat dissipation being much more enhanced, by providing the substrate opening 31a in at least part of the second substrate 31 and providing the opening 43a in the inclined portion 43 at a position corresponding to the substrate opening 31a so as to allow gas to flow toward the lens 50, as described above.

[0097] The present invention has been described above based on the specific embodiments thereof, to which the present invention is in no way limited.

[0098] For instance, the cooling fan 80 may be omitted. Even in the case where the cooling fan 80 is omitted, an updraft is generated when gas such as air is warmed by the heat from the heat dissipating fins (the longitudinal fins 47 and the lateral fins 49), and the gas flow as described above spontaneously occurs.

[0099] It, however, is needless to say that providing the cooling fan 80 is preferred because the generated gas flow becomes stronger and the cooling efficiency becomes higher if the cooling fan 80 is provided.

[0100] The horizontal width of the opening 44 may be changed as appropriate.

[0101] It, however, is preferable that the horizontal width of the opening 44 is not less than the horizontal alignment width of the second light emitting chips 32 of the second light source unit 30 as aligned with one another in the horizontal direction because the opening 44 which has a horizontal width not less than the horizontal alignment width of the second light emitting chips 32 allows an efficient cooling of the second light source unit 30.

[0102] In the above embodiments, the longitudinal fins 47 are so formed as to extend up to the inside of the opening 44, as shown in FIG. 3. The longitudinal fins 47, however, does not necessarily need to extend up to the inside of the opening 44.

[0103] Thus, the present invention is not limited to the specific embodiments as above. Any modifications and improvements made without departing from the technical idea of the invention fall within the technical scope of the invention, which is evident to a man of ordinary skill in the art from the recitation in the claims.

REFERENCE SIGNS LIST

[0104]

10	Light unit
20	First light source unit
21	First substrate
22	First light emitting chip
23	First light source
30	Second light source unit
31	Second substrate
31a	Substrate opening
32	Second light emitting chip
33	Second light source
35	Feeding connector
36	Cover
40	Heat sink
41	Base section
41a	Attachment leg
42	Horizontal portion
43	Inclined portion
43a	Opening
44	Opening
44a	Inner face
45	Finned section
46	Longitudinal fin section
47	Longitudinal fin
48	Lateral fin section
49	Lateral fin
50	Lens
50a	Lens holder
60	Reflector
61	Reflecting face
70	Shade
71	Edge
80	Cooling fan
O	Backward focal point
Z	Lens optical axis
101L, 101R	Vehicular front light
102	Vehicle

Claims

1. A vehicular light, comprising: a first light source unit including a first light emitting chip of a semiconductor type configured to emit light for low beam light distribution; a second light source unit located ahead of the first light source unit and including a second light emitting chip of a semiconductor type configured to emit light for high beam light distribution; and a heat sink having the first light source unit and the second light source unit arranged thereon,
wherein the heat sink includes:

a base section where the first light source unit and the second light source unit are positioned; and

a finned section with heat dissipating fins provided on a rear face side of the base section,

wherein the base section has:

a horizontal portion having the first light source unit located therein;
an inclined portion obliquely extending forward and downward from a front of the horizontal portion and having the second light source unit located therein; and
an opening provided at a position between the first light source unit and the second light source unit and allowing gas to flow through from a rear face side toward a front face side,

wherein the finned section includes a longitudinal fin section with a plurality of longitudinal fins each extending from a rear face of the inclined portion backward to a position in the horizontal portion that is ahead of the first light source unit, and aligned with one another in a horizontal direction, and
wherein the opening is so provided as to include a position corresponding to the longitudinal fin section.

2. The vehicular light according to claim 1,
wherein the second light source unit includes:

a second substrate positioned in the inclined portion of the base section; and
the second light emitting chip provided on the second substrate,
wherein at least part of the second substrate is provided with a substrate opening allowing gas to flow through from a rear face side toward a front face side, and
wherein the inclined portion of the base section is provided with an opening allowing gas to flow through from a rear face side toward a front face side, at a position corresponding to the substrate opening of the second substrate.

3. The vehicular light according to claim 1, wherein the finned section includes a lateral fin section provided behind the longitudinal fin section and having a plurality of lateral fins each extending from the horizontal portion downward and aligned with one another in a longitudinal direction.

4. The vehicular light according to claim 3, wherein the opening is provided in the horizontal portion at a position ahead of the lateral fin section.

5. The vehicular light according to claim 1, wherein at least a backward inner face of the opening is forwardly inclined from a bottom toward a top.

6. The vehicular light according to claim 1, comprising:

a lens located ahead of the first light source unit and the second light source unit;
a reflector positioned on the horizontal portion and having a shape forwardly opened to cover the first light source unit in a semi-domed manner; and
a shade configured to partially block light from the first light source unit that is reflected by the reflector, so as to form a cutoff line of a low beam light distribution pattern,
wherein the shade is positioned above the opening so as to guide at least part of gas flowing out through the opening toward the lens.

7. The vehicular light according to claim 1, wherein the opening is so provided as to reach part of the inclined portion.

8. The vehicular light according to claim 1, comprising a cooling fan located lower than the finned section and configured to blow gas toward the base section.

FIG. 1

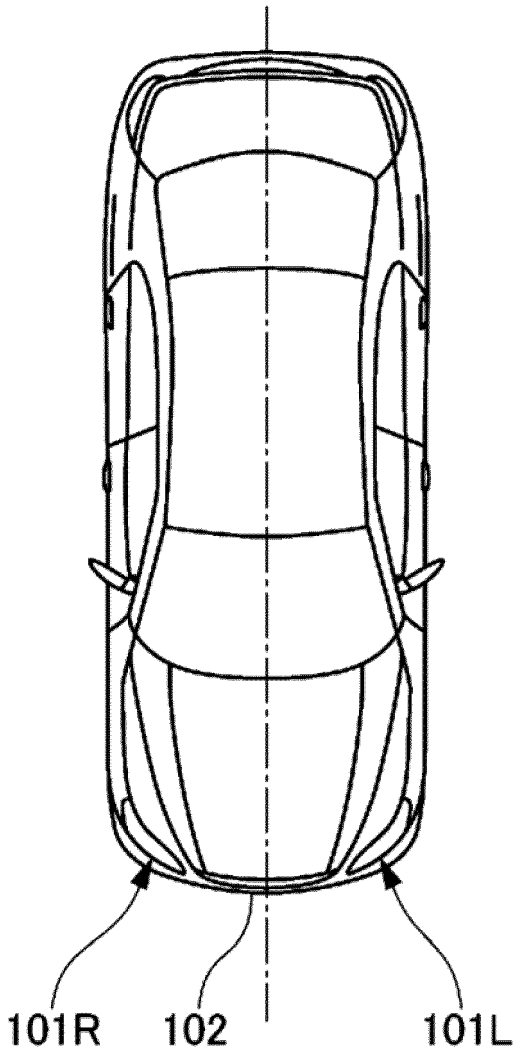


FIG. 2

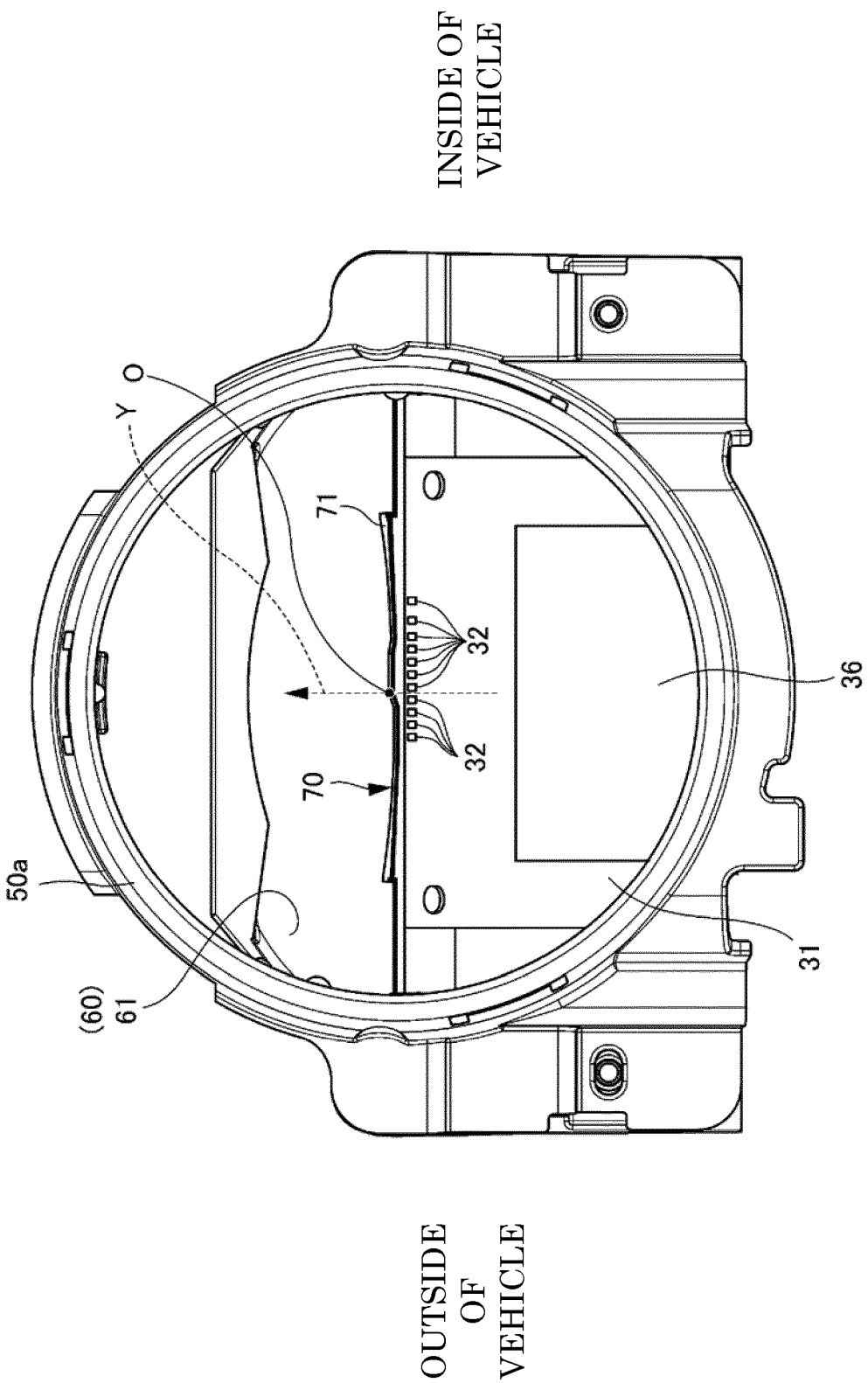

INSIDE OF VEHICLE
OUTSIDE OF VEHICLE
10
Y
O
71
32
32
70
36
50a
(60)
61
31

FIG. 3

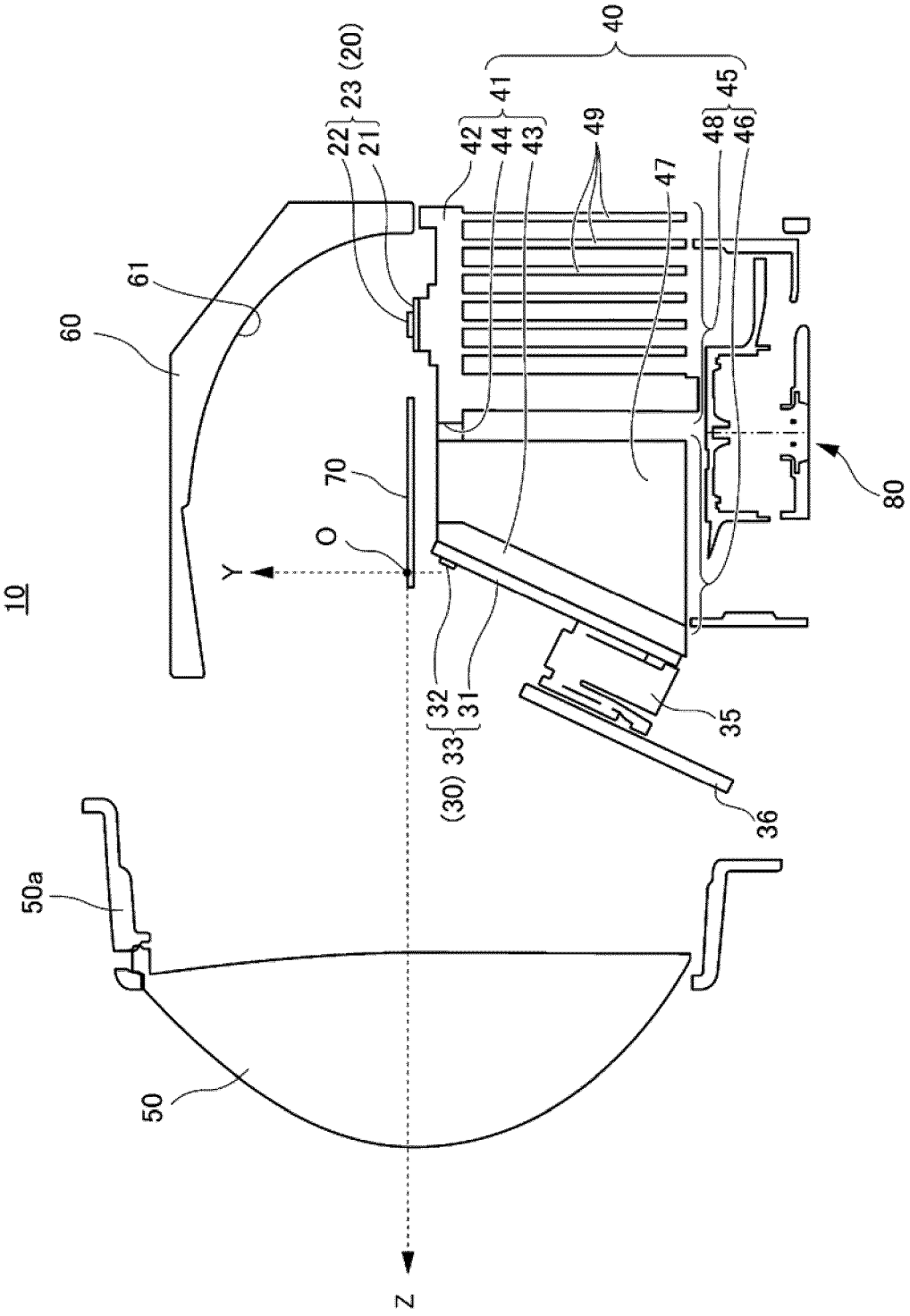

10
60
61
50
50a
70
O
Y
Z
22
21
23 (20)
42
44
43
41
40
49
47
48
46
45
80
32
31
(30) 33
35
36

FIG. 4

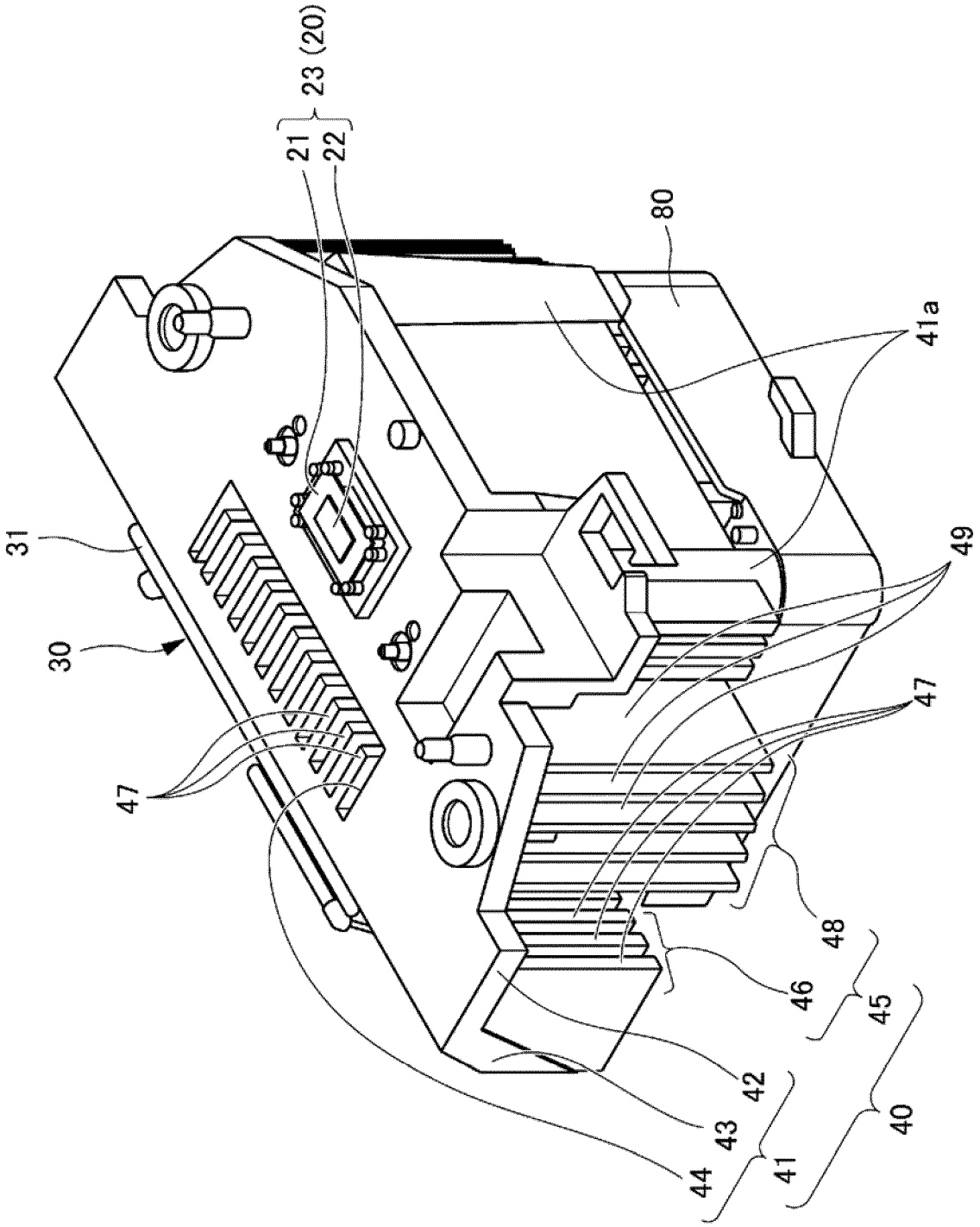


FIG. 5

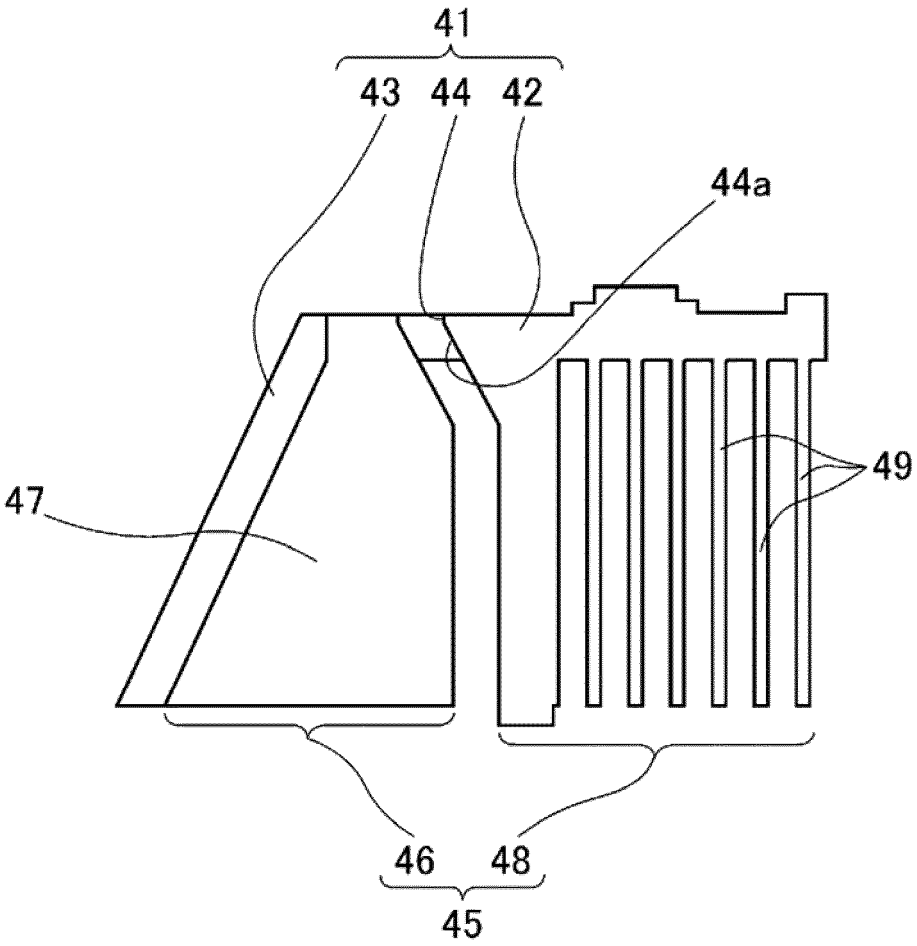
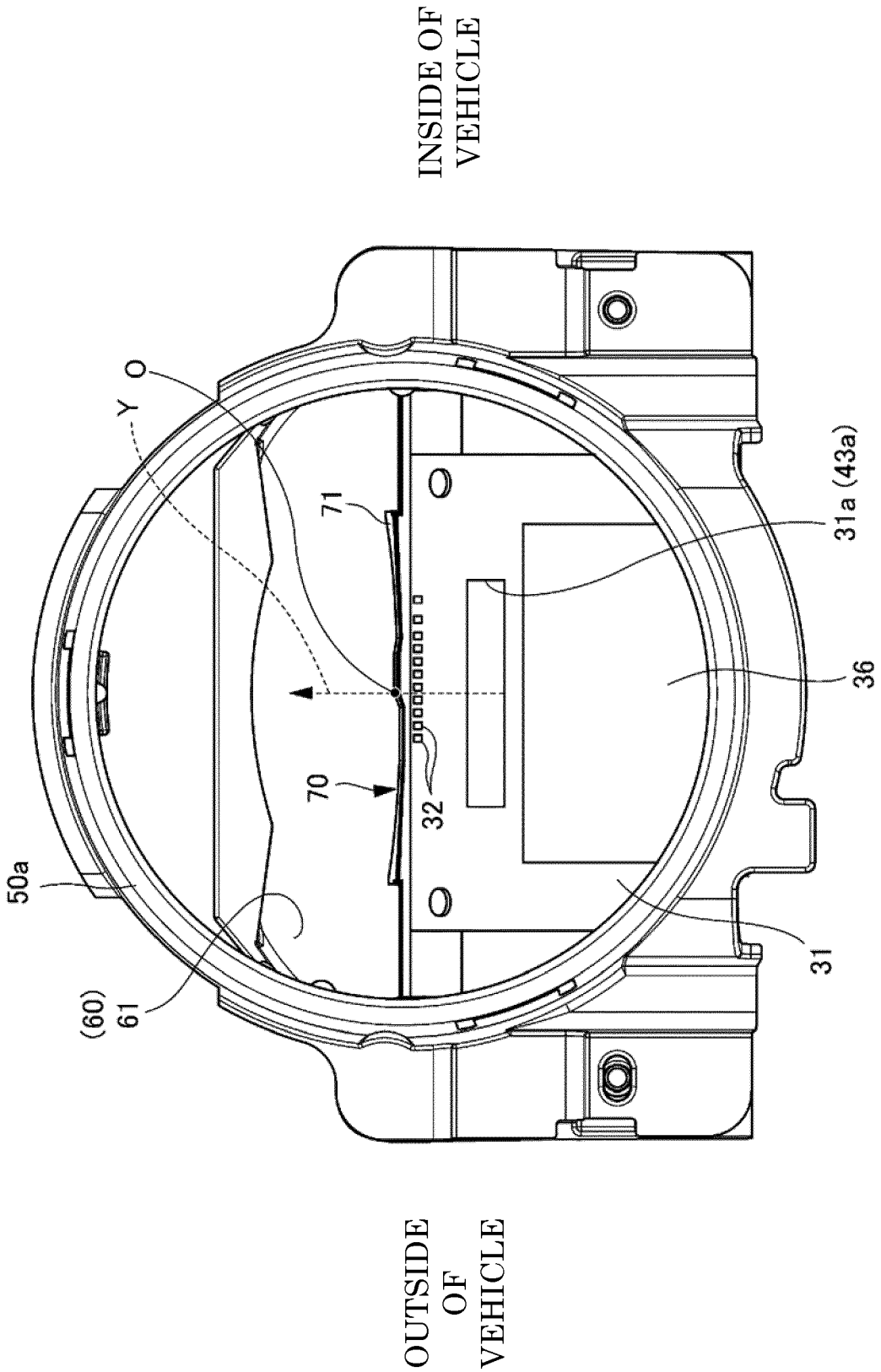


FIG. 6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INSIDE OF VEHICLE
OUTSIDE OF VEHICLE
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71
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32
31a (43a)
36
31
50a
(60)
61

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/040489

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F21S41/00(2018.01)i, F21S43/00(2018.01)i, F21S45/00(2018.01)i, F21V29/503(2015.01)i, F21V29/76(2015.01)i, F21W103/00(2018.01)i, F21W104/00(2018.01)i, F21W105/00(2018.01)i, F21W102/00(2018.01)n, F21Y115/10(2016.01)n, F21Y115/30(2016.01)n
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F21S41/00, F21S43/00, F21S45/00, F21V29/503, F21V29/76, F21W103/00, F21W104/00, F21W105/00, F21W102/00, F21Y115/10, F21Y115/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2016-39020 A (KOITO MANUFACTURING CO., LTD.) 22 March 2016, paragraphs [0026]-[0147] fig. 1-11 & US 2017/0227184 A1, paragraphs [0068]-[0337] fig. 1-11 & WO 2016/021698 A1 & EP 3179158 A1 & CN 106574762 A	1-8
A	JP 2015-222671 A (STANLEY ELECTRIC CO., LTD.) 10 December 2015, paragraphs [0012]-[0049] fig. 1-9 (Family: none)	1-8
A	JP 2011-181314 A (ICHIKOH INDUSTRIES, LTD.) 15 September 2011, paragraphs [0016]-[0058] fig. 1-2 & US 2011/0211361 A1, paragraphs [0023]-[0067] fig. 1-2 & EP 2366938 A1 & CN 102192458 A	1-8

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search 25 January 2018 (25.01.2018)	Date of mailing of the international search report 06 February 2018 (06.02.2018)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

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Patent documents cited in the description

- JP 2016039020 A **[0003]**