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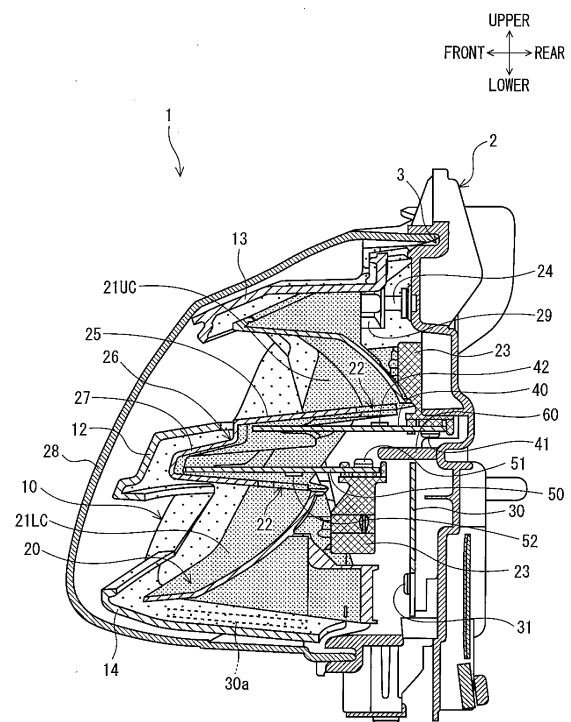
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(54) **HEAD LAMP FOR VEHICLE**

(57) Provided is a head lamp for a vehicle having a lamp body that can be downsized by efficiently housing a resistance circuit that reduces variations in light amounts among LEDs. In a head lamp 1 for a vehicle in which LED substrates 40 and 50 are housed inside a lamp body, a resistivity substrate 30 that is arranged separately from the LED substrates 40 and 50, and has a plurality of resistances and functions as a driving circuit that adjusts drive currents of LED light sources 42 and 52 is disposed inside the lamp body. The LED substrates 40 and 50 consist of a low beam-side LED substrate 40 that supports low beam-side LED light sources 42 and a high beam-side LED substrate 50 that supports high beam-side LED light sources 52, the low beam-side LED substrate 40 and the high beam-side LED substrate 50 are oriented to be parallel to each other and horizontally, and are offset-disposed in the vehicle front-rear direction, and the resistivity substrate 30 is disposed so as to be oriented vertically at a position between the rear end of the LED substrate 40 on the vehicle body front side and the rear end of the LED substrate 50 on the vehicle body rear side.

Fig.3



Description

Technical Field

[0001] The present invention relates to a head lamp for a vehicle, specifically, to a head lamp for a vehicle having a lamp body that is downsized while using LED light sources.

Background Art

[0002] Conventionally, in various equipment to which a plurality of LEDs (light emitting diodes) are applied, uniformity in light amounts among LEDs is required in some cases. Light amounts of LEDs are determined according to currents flowing through them, so that if there is individual variability in a forward voltage V_f among LEDs, even when the same voltage is applied to the LEDs, currents flowing therethrough become different from each other, and variations in the light amounts occur.

[0003] In Patent Literature 1, a technique to suppress variations in light amounts among LEDs by correcting drive currents that flow through the respective LEDs by assigning resistances suitable for the forward voltages V_f of the LEDs is disclosed.

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 04-020450

Summary of Invention

Technical Problem

[0005] However, in a case where a resistance circuit for correcting variations in the forward voltage V_f among LEDs is added to an LED driving circuit of a head lamp for a vehicle, when an attempt is made to dispose the resistance circuit on an LED substrate itself, the LED substrate increases in size, resulting in an increase in size of the head lamp. In addition, since the resistance circuit generates heat, there was a problem that securing of radiation performance is difficult.

[0006] An object of the present invention is to solve the above-described problem in the conventional technique and provide a head lamp for a vehicle having a lamp body that can be downsized by efficiently housing a resistance circuit that reduces variations in light amounts among LEDs.

Solution to Problem

[0007] To achieve the afore-mentioned object, the present invention has a first feature in that a head lamp

for a vehicle arranged by housing LED substrates (40, 50), to which LED light sources (42, 52) are mounted, inside a lamp body that consists of a lens (28) and a housing (2) supporting the lens (28), comprising: a resistivity substrate (30) that is arranged separately from the LED substrates (40, 50), and has a plurality of resistances and functions as a driving circuit that adjusts drive currents of the LED light sources (42, 52), wherein the resistivity substrate (30) is disposed inside the lamp body.

[0008] The present invention has a second feature in that the LED substrates (40, 50) consist of a low beam-side LED substrate (40) that supports the low beam-side LED light sources (42), and a high beam-side LED substrate (50) that supports the high beam-side LED light sources (52), the low beam-side LED substrate (40) and the high beam-side LED substrate (50) are oriented to be parallel to each other and horizontally, and are offset-disposed in the vehicle body front-rear direction, and at a position between the rear end of the LED substrates (40, 50) on the vehicle body front side and the rear end of the LED substrates (50, 40) on the vehicle body rear side, the resistivity substrate (30) is disposed so as to be oriented vertically.

[0009] The present invention has a third feature in comprising a reflector (20) that reflects irradiation light from the LED light sources (42, 52) toward the vehicle body front side, wherein the resistivity substrate (30) is disposed on the back surface side of the reflector (20).

[0010] The present invention has a fourth feature in that a partition wall (60) orientated horizontally is provided between the resistivity substrate (30) and the LED substrate (40) disposed above the resistivity substrate (30).

[0011] The present invention has a fifth feature in that the partition wall (60) extends toward the vehicle body front side to a position that is close to the back surface side of the reflector (20) and overlaps with the rear end of the LED substrate (50) on the vehicle body front side, and above a notched portion (61) formed by notching a portion of the partition wall (60), a breathing hole (62) that makes communication between the inside and the outside of the lamp body is provided.

[0012] The present invention has a sixth feature in that the resistivity substrate (30) is disposed horizontally at a position between a lower portion of the reflector (20) and the lens (28).

Advantageous Effects of Invention

[0013] According to the invention having a first feature, a resistivity substrate is arranged separately from LED substrates, and has a plurality of resistances and functions as a driving circuit that adjusts drive currents of the LED light sources. Therefore, the degree of freedom of disposition of a resistance circuit is improved, and even when the resistance circuit that suppresses variations in light amounts by assigning resistances suitable for the forward voltages of the respective LEDs among a plural-

ity of resistances, is added to a driving circuit of the LEDs, the driving circuit of the LEDs can be disposed inside the lamp body without an increase in size of the lamp body.

[0014] According to the invention having a second feature, the LED substrates consist of a low beam-side LED substrate that supports the low beam-side LED light sources, and a high beam-side LED substrate that supports the high beam-side LED light sources, the low beam-side LED substrate and the high beam-side LED substrate are oriented to be parallel to each other and horizontally, and are offset-disposed in the vehicle body front-rear direction, and at a position between the rear end of the LED substrates on the vehicle body front side and the rear end of the LED substrates on the vehicle body rear side, the resistivity substrate is disposed so as to be oriented vertically. Therefore, substrate disposition along the shape of a lens is enabled by offset-disposing two LED substrates in the vehicle front-rear direction, and in a space produced by the offset disposition, a resistivity substrate can be efficiently disposed. Accordingly, while avoiding an increase in size of the lamp body, the resistivity substrate can be housed inside the lamp body.

[0015] According to the invention having a third feature, a reflector that reflects irradiation light from the LED light sources toward the vehicle body front side is comprised, wherein the resistivity substrate is disposed on the back surface side of the reflector. Therefore, the resistivity substrate can be disposed by utilizing a space formed between the reflector and the housing. In addition, since the resistivity substrate is disposed on the back surface side of the reflector, there is no possibility that the resistivity substrate is viewed from the outside.

[0016] According to the invention having a fourth feature, a partition wall orientated horizontally is provided between the resistivity substrate and the LED substrate disposed above the resistivity substrate. Therefore, heat generated by the resistivity substrate can be prevented from being transmitted to the LED substrates.

[0017] According to the invention having a fifth feature, the partition wall extends toward the vehicle body front side to a position that is close to the back surface side of the reflector and overlaps with the rear end of the LED substrate on the vehicle body front side, and above a notched portion formed by notching a portion of the partition wall, a breathing hole that makes communication between the inside and the outside of the lamp body is provided. Therefore, radiation performance of the resistivity substrate can be improved while preventing heat transmission to the LED substrates.

[0018] According to the invention having a sixth feature, the resistivity substrate is disposed horizontally at a position between a lower portion of the reflector and the lens. Therefore, by utilizing a space between the reflector and the lens, the resistivity substrate can be efficiently disposed while avoiding an increase in size of the lamp body.

Brief Description of Drawings

[0019]

- 5 Fig. 1 is a front view of a head lamp for a vehicle according to an embodiment of the present invention.
- Fig. 2 is a perspective view of the head lamp for a vehicle
- 10 Fig. 3 is a sectional view taken along the line 3-3 in Fig. 1.
- Fig. 4 is a front view of a housing.
- Figs. 5 is a perspective view of the housing.
- 15 Fig. 6 is a perspective view of the housing from the upper front side.

Description of Embodiments

- 20 **[0020]** Hereinafter, a preferred embodiment of the present invention is described in detail with reference to the drawings. Fig. 1 is a front view of a head lamp 1 for a vehicle according to an embodiment of the present invention. Fig. 2 is a perspective view of the head lamp 1 for a vehicle, and Fig. 3 is a sectional view taken along the line 3-3 in Fig. 1.

- 25 **[0021]** The head lamp 1 for a vehicle is a headlight that uses light emitting diodes (LEDs) as light sources and is mounted to a vehicle such as a motorcycle. In the head lamp 1 for a vehicle, a lamp body is arranged by engaging a colorless and transparent lens 28 (refer to Fig. 3) with a vehicle body front side of a housing 2 made of a resin colored with a color such as black, and in this lamp body, housing LED substrates 40 and 50 that support LED light sources 42 and 52 and a reflector 20. The present embodiment is characterized in that a resistivity substrate 30 as a driving circuit for the LED light sources 42 and 52 is also housed inside this lamp body.

- 30 **[0022]** The LED substrates 40 and 50 consist of a low beam-side LED substrate 40 that supports the low beam-side LED light sources 42, and a high beam-side LED substrate 50 that supports the high beam-side LED light sources 52, and both of these LED substrates 40 and 50 are fixed to the back surface side of the reflector 20. Therefore, the head lamp 1 for a vehicle is assembled, generally, in the order of mounting the reflector 20 to which both LED substrates 40 and 50 are fixed to the housing 2 being a base member of the lamp body, and fixing the lens 28 to the housing 2 so as to cover the reflector 20.

- 35 **[0023]** In the present embodiment, an extension 10 that defines a range of irradiation light and functions as a decorative member to improve the external appearance is provided between the reflector 20 and the lens 28. Fig. 1 shows a state where the lens 28 is removed from the head lamp 1 for a vehicle, and Fig. 2 shows a state where the lens 28 and the extension 10 are removed. The lens 28 engages with an engagement groove 3 provided on the outer rim of the housing 2, and is supported by lens

fixing portions 4 provided at two positions of an upper portion of the housing 2.

[0024] The housing 2 is fixed to the vehicle body side by an upper portion mounting portion 5 and left and right lower portion mounting portions 6L and 6R.

[0025] The extension 10 consists of left and right portions 11 that cover the left and right rim portions of the reflector 20, a band-shaped central portion 12 that joins the left and right portions 11 and covers the central portion of the reflector 20, an upper portion 13 that covers the upper rim portion of the reflector 20, and a lower portion 14 that covers the lower rim portion of the reflector 20. With this arrangement, the contours of a low beam that is irradiated from an upper window and a high beam that is irradiated from a lower window become distinct, and the external appearance and visibility of the lamp when it is turned on are improved.

[0026] Referring to Fig. 2, inside the engagement groove 3 of the housing 2, five positioning pins 8 that define the position of the extension 10 are installed bilaterally symmetrically. The reflector 20 mainly consists of an upper reflecting surface that reflects irradiation light from the low beam-side LED light sources 42, a lower reflecting surface that reflects irradiation light from the high beam-side LED light sources 52, and a plate-shaped partitioning portion 21 that joins the upper and lower reflecting surfaces. On the upper surface of the partitioning portion 21, a first surface 25 on the rear side across a stepped portion 26 and a second surface 27 on the front side are formed.

[0027] The low beam-side LED light sources 42 and the high beam-side LED light sources 52 are provided three each. Irradiation light from the low beam-side LED light sources 42 is made incident upward from incidence windows 22 provided on the rear end of the second surface 27. The upper reflecting surface consists of three curved surfaces of a central reflecting surface 21UC, a right reflecting surface 21UR, and a left reflecting surface 21UL corresponding to the three low beam-side LED light sources 42. Similarly, the lower reflecting surface consists of three curved surfaces of a central reflecting surface 21LC, a right reflecting surface 21LR, and a left reflecting surface 21LL corresponding to the three high beam-side LED light sources 52.

[0028] The reflector 20 is supported swingably forward and rearward by two support shafts 24 and an optical axis adjustment shaft 7 mounted to the housing 2. When an adjustment screw projecting to the back surface of the housing 2 from the optical axis adjustment shaft 7 is operated, the lower support portion of the reflector 20 moves back and forth around the support shafts 24, and accordingly, optical axis adjustment is performed. To the support shafts 24, grommets 29 that come into contact with the back surface of the reflector 20 and absorb vibration are attached.

[0029] Referring to Fig. 3, the low beam-side LED substrate 40 and the high beam-side LED substrate 50 are substantially parallel to each other and oriented horizon-

tally. The low beam-side LED substrate 40 is fixed to a pair of left and right support parts 23 mounted to the back surface of the reflector 20 by fixation screws 41 screwed from below. On the other hand, the high beam-side LED substrate 50 is fixed to a pair of left and right support parts 23 mounted to the back surface of the reflector 20 by fixation screws 51 screwed from above.

[0030] The upper and lower LED substrates 40 and 50 are offset-disposed such that the low beam-side LED substrate 40 is positioned on the vehicle body rear side. A stepped portion 26 of the reflector 20, which is formed corresponding to this offset disposition, is arranged so as not to be viewed from the outside by being covered by the central portion 12 of the extension 10.

[0031] The resistivity substrate 30 as a driving circuit for the LED light sources 42 and 52 is disposed on the rear side of the lower reflecting surface of the reflector 20. In detail, at positions spaced rearward from the support parts 23 of the high beam-side LED substrate 50, the resistivity substrate 30 is fixed to the housing 2 by a total of three fixation screws 31, and disposed such that the front and back surfaces are oriented in the vehicle body front-rear direction at a position between a rear end portion of the high beam-side LED substrate 50 and a rear end portion of the low beam-side LED substrate 40. In other words, by disposing the resistivity substrate 30 such that it is oriented vertically, the resistivity substrate 30 can be housed inside the lamp body by efficiently utilizing a space provided by the offset disposition of both LED substrates 40 and 50.

[0032] Here, an amount of heat generation of the resistivity substrate 30 having a plurality of resistances becomes large at the time of driving, however, in the present invention, a partition wall 60 is provided above the resistivity substrate 30 to prevent heat generated by the resistivity substrate 30 from influencing both LED substrates 40 and 50. The partition wall 60 is a plate-shaped member that is formed integrally with the housing 2 and projects toward the vehicle body front side to a position overlapping with the rear end portion of the high beam-side LED substrate 50. The partition wall 60 is disposed close to the high beam-side LED substrate 50 in the up-down direction, and arranged such that warmed air does not easily flow to the upper side of the high beam-side LED substrate 50.

[0033] Fig. 4 is a front view of the housing 2. Fig. 5 is a perspective view of the housing 2, and Fig. 6 is a perspective view of the housing 2 from the upper front side.

[0034] In Fig. 4 to Fig. 6, in order to clearly show the disposition of the LED substrates 40 and 50, the support parts 23 that are removed naturally from the housing 2 together with the reflector 20 are shown in a state where the support parts 23 float in the air singly. In Fig. 5 and Fig. 6, in order to clearly show the shape of the partition wall 60, the low beam-side LED substrate 40 is removed, and only the high beam-side LED substrate 50 is shown.

[0035] Referring to Fig. 4, power supplied from a harness (not shown) connected to the rear side of the hous-

ing 2 is converted into a drive current by the resistivity substrate 30, and supplied to the high beam-side LED substrate 50 by a harness 33. Then, the drive current for a low beam is supplied to the low beam-side LED substrate 40 from the high beam-side LED substrate 50 via a second harness 34. While the second harness 34 is connected to the low beam-side LED substrate 40 by a connecting portion 43, it is removably connected to the high beam-side LED substrate 50 by a connector 54. The first harness 33 is removably connected between the resistivity substrate 30 and the high beam-side LED substrate 50 by connectors 32 and 53.

[0036] The dimension in the left-right direction of the high beam-side LED substrate 50 is slightly smaller than those of the resistivity substrate 30 and the low beam-side LED substrate 40. In an escape portion 35 provided on the lower portion of the resistivity substrate 30, the optical axis adjustment shaft 7 of the reflector 20 is disposed.

[0037] Between the left and right support shafts 64, at a position offset to the left side in the vehicle width direction, a breathing hole 62 that makes communication between the inside and the outside of the lamp body is provided. This breathing hole 62 is positioned above the second harness 34.

[0038] Referring to Fig. 5 and Fig. 6, the high beam-side LED substrate 50 is a plate-shaped member in which only a rim portion on the vehicle body front side is arched, similar to the low beam-side LED substrate 40. In both of these figures, disposition of the low beam-side LED light sources 42 and the high beam-side LED light sources 52 when the LED substrates 40 and 50 are mounted to predetermined positions is shown by dashed lines.

[0039] As described above, a drive current supplied from the resistivity substrate 30 is supplied to the high beam-side LED substrate 50 by the first harness 33, and then supplied to the low beam-side LED substrate 40 by the second harness 34. At this time, since the distance between both LED substrates 40 and 50 is small, if connectors are provided on both of the two surfaces facing each other, the curve of the second harness 34 may become sharp and/or the assembling operation may become difficult. Therefore, in the present embodiment, a connector 54 is connected to the lower surface of the high beam-side LED substrate 50, and the second harness 34 is inserted from the rear side of the high beam-side LED substrate 50 to the upper side.

[0040] On the other hand, the partition wall 60 formed in the housing 2 can prevent air warmed by the resistivity substrate 30 from influencing the respective LED substrates 40 and 50, however, it is preferable that the warmed air is discharged to the outside of the lamp body so as to prevent the temperature of the resistivity substrate 30 itself from excessively rising.

[0041] Therefore, in the present embodiment, a notched portion 61 is provided as a passage of the second harness 34 in the partition wall 60, and this notched portion 61 is set so as to become an air passage that

communicates with the breathing hole 62 at a shortest distance. Accordingly, the air warmed by the resistivity substrate 30 is smoothly discharged to the outside from the breathing hole 62 through the notched portion 61 without flowing to the upper and lower sides of the LED substrates 40 and 50.

[0042] In the present embodiment, corresponding to the offset disposition of the connector 32 of the first harness 33 to the left side in the vehicle width direction while avoiding the optical axis adjustment shaft 7 of the reflector 20, the breathing hole 62 and the notched portion 61 are offset-disposed to the left side in the vehicle width direction, and accordingly, the lengths of the first harness 33 and the second harness 34 are set to be shortest.

[0043] As described above, in the head lamp for a vehicle according to the present invention, by structuring the head lamp for a vehicle in consideration of smooth discharge of warmed air while compactly housing three substrates of the low beam-side substrate 30, the high beam-side substrate 50, and the resistivity substrate 30 in the lamp body, and preventing heat of the resistivity substrate 30 from influencing both LED substrates 40 and 50, a head lamp for a vehicle which is small in size while using a plurality of LED light sources can be obtained.

[0044] The shapes of the housing and the lens, the shapes and structures of the extension and the reflector, the shapes and structures of the LED substrates and the resistivity substrate, the number and disposing positions of the LED light sources, the structure of the partition wall, and the shape of the notched portion, etc., are not limited to those in the above-described embodiment, and can be variously modified. For example, even when the resistivity substrate 30 is disposed horizontally at a position between the reflector 20 and the extension 10 inside the lens 28 as shown by the dashed line in Fig. 3, the resistivity substrate 30 can be efficiently housed and the lamp body can be prevented from increasing in size. The head lamp for a vehicle according to the present invention is applicable to various vehicles such as saddle-type three-wheeled/four-wheeled vehicles as well as motorcycles.

Reference Signs List

[0045]

- 1 head lamp for vehicle,,
- 2 housing,
- 10 extension,
- 20 reflector,
- 23 support parts,
- 28 lens,
- 30 resistivity substrate,
- 40 low beam-side LED substrate,
- 42 low beam-side LED light sources,
- 50 high beam-side LED substrate,
- 52 high beam-side LED light sources,

60 partition wall,
 61 notched portion,
 62 breathing hole

Claims

1. A head lamp for a vehicle arranged by housing LED substrates (40, 50), to which LED light sources (42, 52) are mounted, inside a lamp body that consists of a lens (28) and a housing (2) supporting the lens (28), comprising:

a resistivity substrate (30) that is arranged separately from the LED substrates (40, 50), and has a plurality of resistances and functions as a driving circuit that adjusts drive currents of the LED light sources (42, 52), wherein the resistivity substrate (30) is disposed inside the lamp body.

2. The head lamp for a vehicle according to Claim 1, wherein

the LED substrates (40, 50) consist of a low beam-side LED substrate (40) that supports the low beam-side LED light sources (42), and a high beam-side LED substrate (50) that supports the high beam-side LED light sources (52),

the low beam-side LED substrate (40) and the high beam-side LED substrate (50) are oriented to be parallel to each other and horizontally, and are offset-disposed in the vehicle body front-rear direction, and at a position between the rear end of the LED substrates (40, 50) on the vehicle body front side and the rear end of the LED substrates (50, 40) on the vehicle body rear side, the resistivity substrate (30) is disposed so as to be oriented vertically.

3. The head lamp for a vehicle according to Claim 1 or 2, comprising:

a reflector (20) that reflects irradiation light from the LED light sources (42, 52) toward the vehicle body front side, wherein the resistivity substrate (30) is disposed on the back surface side of the reflector (20).

4. The head lamp for a vehicle according to any of Claims 1 to 3, wherein a partition wall (60) orientated horizontally is provided between the resistivity substrate (30) and the LED substrate (40) disposed above the resistivity substrate (30).

5. The head lamp for a vehicle according to Claim 3, wherein

the partition wall (60) extends toward the vehicle body front side to a position that is close to the back surface side of the reflector (20) and overlaps with

the rear end of the LED substrate (50) on the vehicle body front side, and above a notched portion (61) formed by notching a portion of the partition wall (60), a breathing hole (62) that makes communication between the inside and the outside of the lamp body is provided.

6. The head lamp for a vehicle according to Claim 1, wherein the resistivity substrate (30) is disposed horizontally at a position between a lower portion of the reflector (20) and the lens (28).

Fig.1

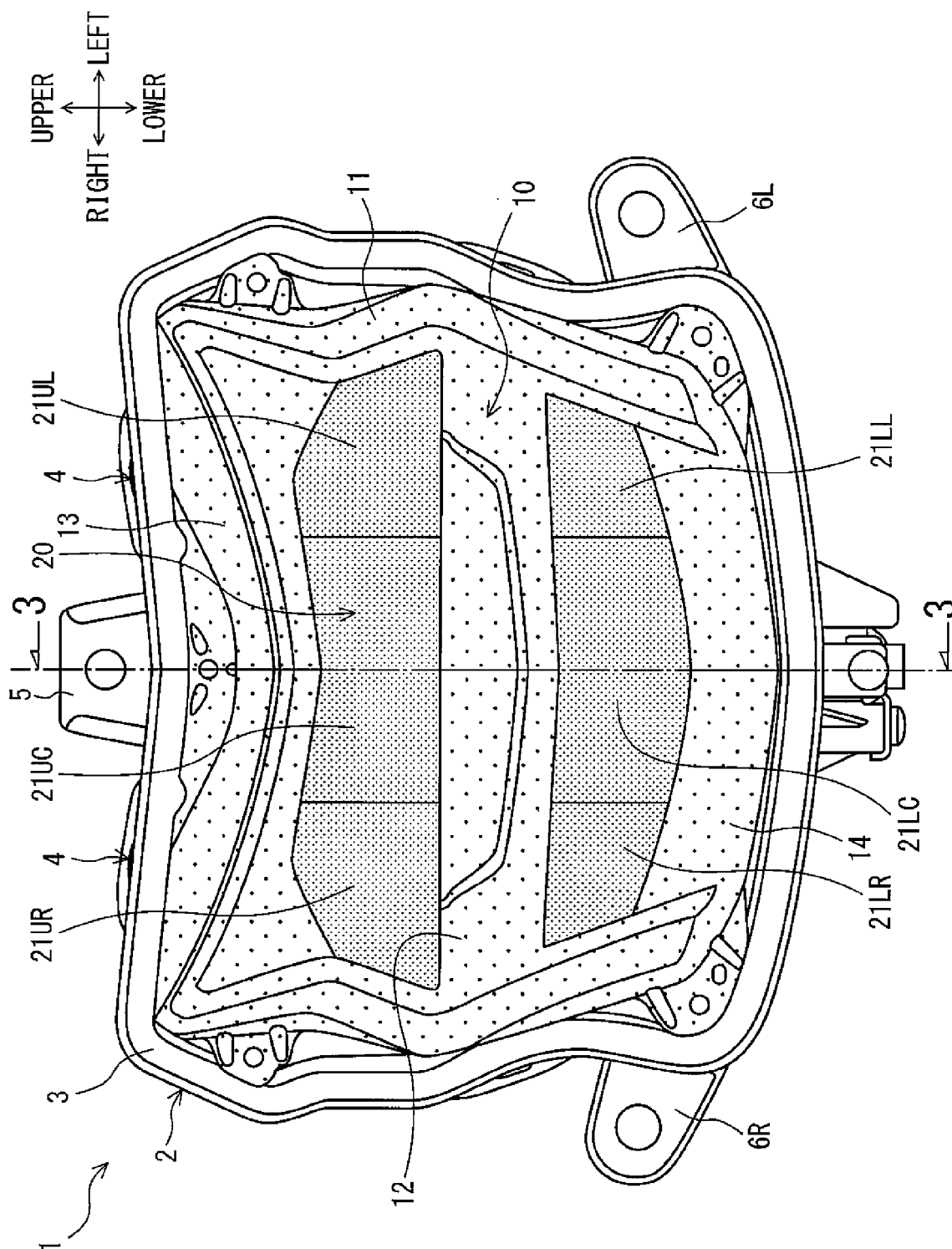


Fig.2

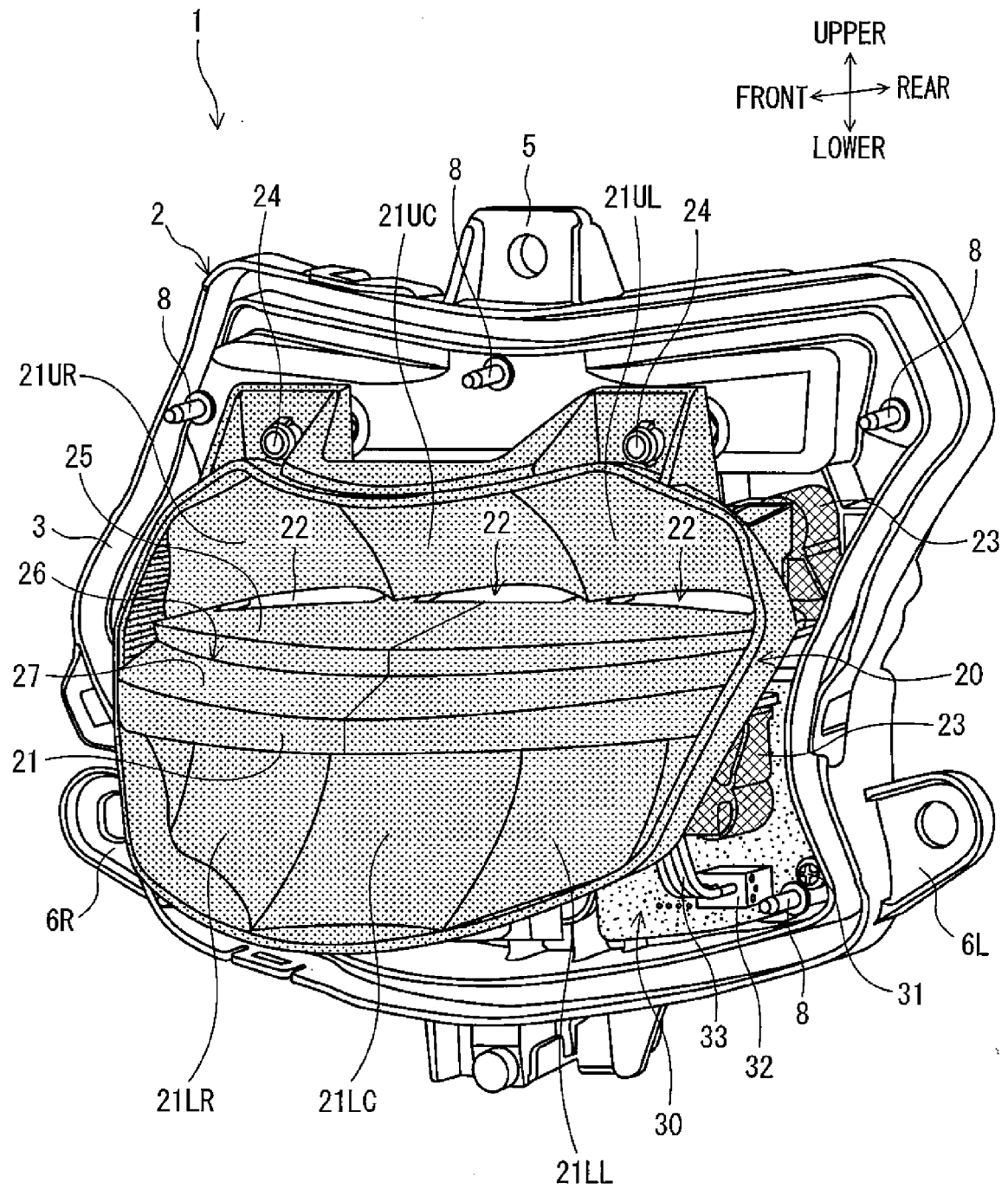


Fig.3

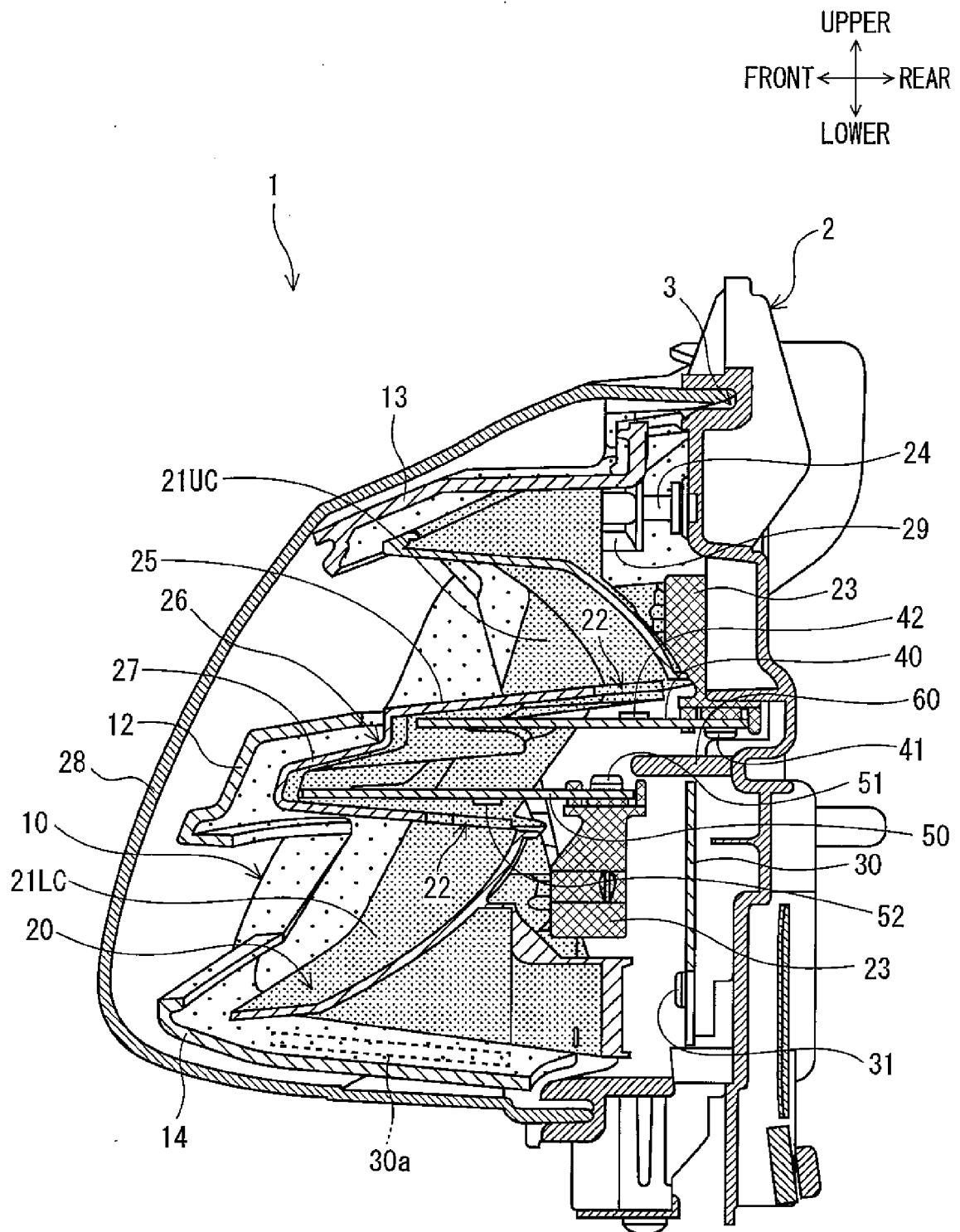


Fig.4

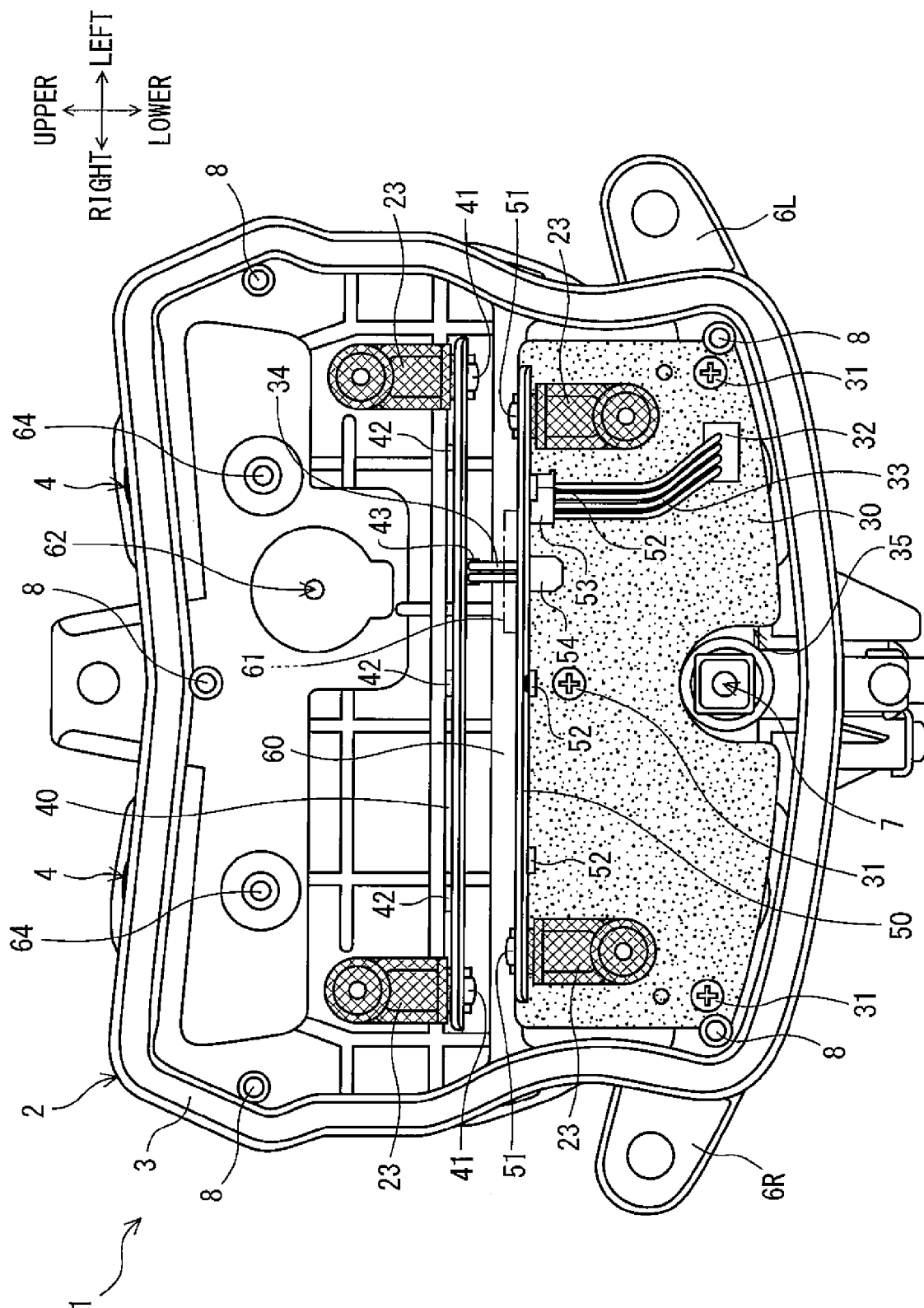


Fig.5

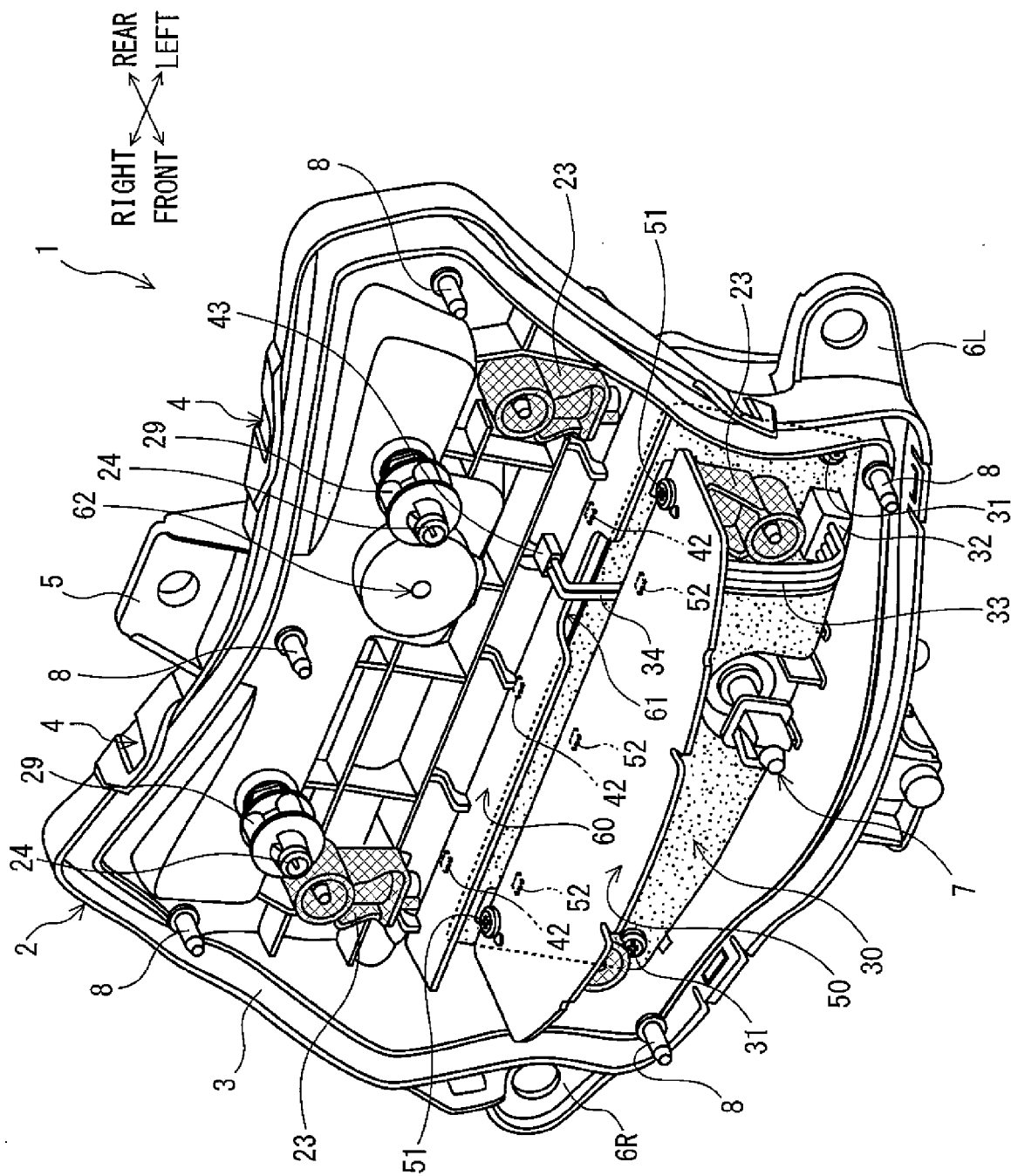
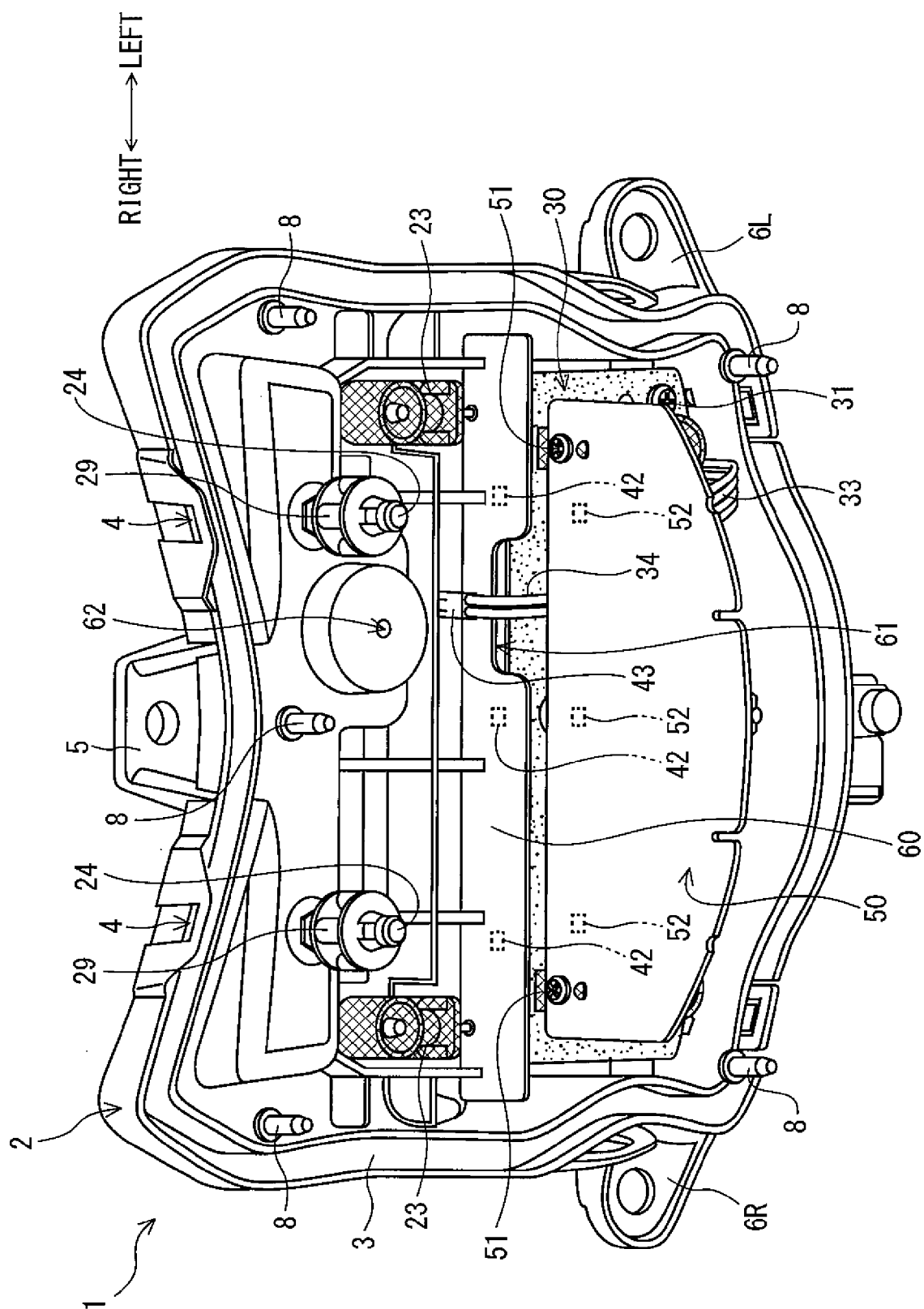


Fig.6





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EP 15 18 5469

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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