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(71) Applicant: **STANLEY ELECTRIC CO., LTD.**
Tokyo 153-8636 (JP)

(72) Inventor: **USHIGUSA, Keita**
Tokyo, 153-8636 (JP)

(74) Representative: **Schmidbauer, Andreas Konrad**
Wagner & Geyer Partnerschaft mbB
Patent- und Rechtsanwälte
Gewürzmühlstrasse 5
80538 München (DE)

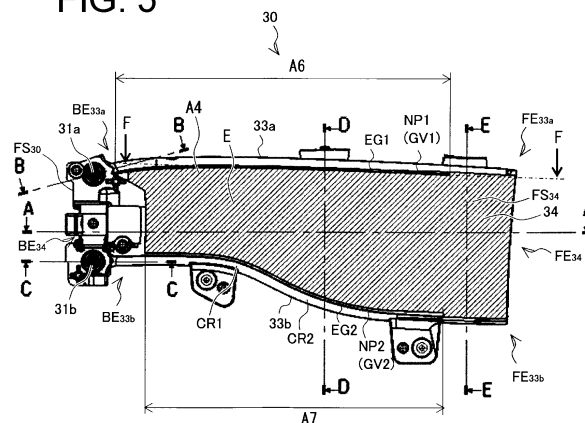
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(54) **VEHICULAR LAMP UNIT AND VEHICULAR LAMP**

(57) Provided is a vehicular lamp in which the plate-shaped light guide portion (34, 34A) can project light uniformly or can be visually recognized/observed as if it emits light uniformly. A vehicular lamp unit (10) includes a light guide body (30, 30A), and a light source (21a, 21b, 21A) configured to emit light guided in the light guide body (30, 30A). The light guide body (30, 30A) includes a first rod-shaped light guide portion (33a, 33Aa) configured to guide light from the light source (21a, 21A) from a proximal end (BE_{33a}) thereof to a distal end (FE_{33a}) thereof, a second rod-shaped light guide portion (33b, 33Ab) configured to guide light from the light source (21b, 21Ab) from a proximal end (BE_{33b}) thereof to a distal end (FE_{33b}) thereof, and a plate-shaped light guide portion (34, 34A) disposed between the first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab). The first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab) are juxtaposed with each other with a space therebetween. The plate-shaped light guide portion (34, 34A) includes a front surface (FS₃₄, FS_{34A}) disposed on a front side of the vehicular lamp unit and a rear surface (RS₃₄, RS_{34A}) disposed on a back side opposite to the front side, and also includes a first end rim portion (EG1, EG1A) configured to be connected to an outer peripheral surface of the first rod-shaped light guide portion (33a, 33Aa), and a second end rim portion (EG2, EG2A) configured to be connected to an outer peripheral surface of the second rod-shaped light guide portion (33b, 33Ab). The rear surface (RS₃₄, RS_{34A}) of the plate-shaped light guide portion (34, 34A) includes a plurality of structures (LC2) configured to diffuse the light from the light source (21a, 21b, 21A) entering the

plate-shaped light guide portion (34, 34A) from the respective first and second rod-shaped light guide portions (33a, 33Aa, 33b, 33Ab) and cause the light to exit from the front surface (FS₃₄, FS_{34A}) of the plate-shaped light guide portion (34, 34A). The first end rim portion (EG1, EG1A) and the second end rim portion (EG2, EG2A) of the plate-shaped light guide portion (34, 34A) each include a thin-walled portion (NP1, NP1A, NP2, NP2A) having a thickness thinner than that of the plate-shaped light guide portion (34, 34A) except for the first and second end rim portions (EG1, EG1A, EG2, EG2A).

FIG. 5



Description

Technical Field

[0001] The present invention relates to a vehicular lamp unit and a vehicular lamp, and more particularly, to a vehicular lamp unit and a vehicular lamp in which a plate-shaped light guide portion can project light uniformly (or can be visually recognized/observed as if it emits light uniformly).

Background Art

[0002] FIG. 30 is a front view of a conventional light guide body including a rod-shaped light guide portion and a plate-shaped light guide portion.

[0003] Conventionally, as shown in FIG. 30, there has been proposed a vehicular lamp including a light guide body 100 including two rod-shaped light guide portions 110A and 110B juxtaposed with each other with a space therebetween, and a plate-shaped light guide portion 120 configured to connect side surfaces (outer circumferential surfaces) of the two rod-shaped light guide portions 110A and 110B that face each other. This type of vehicular lamp has been disclosed in, for example, JP2014-116142A, in particular, FIGS. 1 and 2 of this publication.

[0004] In the vehicular lamp disclosed in JP2014-116142A, light from a not-shown light source enters each of the rod-shaped light guide portions 110A and 110B from each of first end portions 111A and 111B of the rod-shaped light guide portions 110A and 110B to be guided through each of the rod-shaped light guide portions 110A and 110B toward each of second end portions 113A and 113B, and then exits from the front surface 121 of the plate-shaped light guide portion 120. As a result, the plate-shaped light guide portion 120 projects light.

[0005] However, the present inventor has investigated that in the vehicular lamp disclosed in JP2014-116142A, the amount (amount of light or intensity) of light entering the plate-shaped light guide portion 120 from the rod-shaped light guide portions 110A and 110B is relatively large on the side close to the first end portions 111A and 111B and relatively small on the side close to the second end portions 113A and 113B of the rod-shaped light guide portions 110A and 110B. This means that the amount of light entering the plate-shaped light guide portion 120 from the rod-shaped light guide portions 110A and 110B becomes uneven between the side closer to the first end portions 111A and 111B and the side closer to the second end portions 113A and 113B, so that the plate-shaped light guide portion 120 does not project light uniformly (i.e., not visually recognized/observed as if it emits light uniformly).

Summary

[0006] The present invention has been made in view of the above-described circumstances, and an object thereof is to provide a vehicular lamp in which the plate-shaped light guide portion can project light uniformly or can be visually recognized/observed as if it emits light uniformly.

[0007] In order to achieve the foregoing object, one aspect of the present invention is a vehicular lamp unit including a light guide body and a light source configured to emit light guided in the light guide body. In this vehicular lamp unit, the light guide body includes a first rod-shaped light guide portion configured to guide light from the light source from a proximal end thereof to a distal end thereof, a second rod-shaped light guide portion configured to guide light from the light source from a proximal end thereof to a distal end thereof, and a plate-shaped light guide portion disposed between the first rod-shaped light guide portion and the second rod-shaped light guide portion. The first rod-shaped light guide portion and the second rod-shaped light guide portion are juxtaposed with each other with a space therebetween. The plate-shaped light guide portion includes a front surface disposed on a front side of the vehicular lamp unit and a rear surface disposed on a back side opposite to the front side, and also includes a first end rim portion configured to be connected to an outer peripheral surface of the first rod-shaped light guide portion and a second end rim portion configured to be connected to an outer peripheral surface of the second rod-shaped light guide portion. The rear surface of the plate-shaped light guide portion includes a plurality of structures configured to diffuse the light, which is emitted from the light source and enters the plate-shaped light guide portion from the respective first and second rod-shaped light guide portions, to cause the light to exit from the front surface of the plate-shaped light guide portion. Then, the first end rim portion and the second end rim portion of the plate-shaped light guide portion each include a thin-walled portion having a thickness thinner than a thickness of the plate-shaped light guide portion other than the first and second end rim portions.

[0008] According to this aspect, it is possible to provide a vehicular lamp unit in which the plate-shaped light guide portion can project light uniformly (or can be visually recognized/observed as if it emits light uniformly).

[0009] This is because the first end rim portion and the second end rim portion of the plate-shaped light guide portion each include a thin-walled portion whose thickness is smaller than that of the plate-shaped light guide portion other than the first and second end rim portions.

[0010] The adjustment of the area where the thin-walled portion is provided and the thickness of the thin-walled portion can allow the plate-shaped light guide portion to project light uniformly (be visually recognized/observed as if it emits light uniformly).

[0011] According to a preferable embodiment of the

above-described invention, the structure may be a dot-shaped lens cut.

[0012] According to this aspect, since not a V-groove but the dot cut is used as the structure, light that enters the plate-shaped light guide portion from the first rod-shaped light guide portion and the second rod-shaped light guide portion in various directions can be properly diffused and caused to exit from the front surface of the plate-shaped light guide portion.

[0013] According to a preferable embodiment of the above-described invention, the structures may be randomly arranged.

[0014] According to this aspect, since the structures are randomly arranged, it is possible to suppress moire from being visually recognized through the plate-shaped light guide portion when the light source is not turned on.

[0015] According to a preferable embodiment of the above-described invention, the plate-shaped light guide portion may be a curved plate-shaped light guide body (semi-cylindrical light guide body).

[0016] According to this aspect, use of the curved plate-shaped light guide body as the plate-shaped light guide portion can provide a vehicular lamp unit in which the plate-shaped light guide portion, which is the curved plate-shaped light guide body, can project light uniformly (or can be visually recognized/observed as if it emits light uniformly).

[0017] According to a preferable embodiment of the above-described invention, the plate-shaped light guide portion may be a flat plate-shaped lens body.

[0018] According to this aspect, use of the flat plate-shaped lens body as the plate-shaped light guide portion can provide a vehicular lamp unit in which the plate-shaped light guide portion, which is the flat plate-shaped lens body, can project light uniformly (or can be visually recognized/observed as if it emits light uniformly).

[0019] According to a preferable embodiment of the above-described invention, the first rod-shaped light guide portion and the second rod-shaped light guide portion may have a symmetrical shape.

[0020] According to this aspect, use of this configuration can provide a vehicular lamp unit in which the first rod-shaped light guide portion and the second rod-shaped light guide portion are symmetrical in shape with each other.

[0021] According to an alternative preferable embodiment of the above-described invention, the first rod-shaped light guide portion and the second rod-shaped light guide portion may have an asymmetric shape.

[0022] According to this aspect, use of this configuration can provide a vehicular lamp unit in which the first rod-shaped light guide portion and the second rod-shaped light guide portion are asymmetric in shape with each other.

[0023] According to a preferable embodiment of the above-described invention, at least one of the first rod-shaped light guide portion and the second rod-shaped light guide portion may include a correction cut config-

ured to correct optical paths of the light that enters the plate-shaped light guide portion from the at least one of the first rod-shaped light guide portion and the second rod-shaped light guide portion so that optical paths of the light that enters the plate-shaped light guide portion from the first rod-shaped light guide portion and optical paths of the light that enters the plate-shaped light guide portion from the second rod-shaped light guide portion are symmetrical with each other.

[0024] According to this aspect, even if the first rod-shaped light guide portion and the second rod-shaped light guide portion are asymmetric in shape, provision of the correction cuts can make the optical paths of the light that enters the plate-shaped light guide portion from the first rod-shaped light guide portion and the optical paths of the light that enters the plate-shaped light guide portion from the second rod-shaped light guide portion symmetric with each other. As a result, it is possible to suppress generation of the dark portion (dark area) in the middle of the plate-shaped light guide portion (for example, in the middle in the vertical direction).

[0025] According to a preferable embodiment of the above-described invention, the light guide body may be disposed in a state where the light guide body is inclined at a predetermined angle with respect to a reference axis extending in a front-rear direction of the vehicle in a top view so that the plate-shaped light guide portion is visually recognized from the front of the vehicle.

[0026] According to this aspect, since the light guide body is disposed in a state where the light guide body is inclined at a predetermined angle with respect to the reference axis extending in the front-rear direction of the vehicle in a top view, visibility (visually recognizability) from the front of the vehicle is improved.

[0027] Furthermore, according to a preferable embodiment of the above-described invention, the vehicular lamp unit may further include a black or black-based color member which is visually recognized through the plate-shaped light guide portion.

[0028] According to this aspect, it is possible to realize a new-looking vehicular lamp unit having a high light-to-dark ratio between a state when the light source is turned on and a state when the light source is turned off.

[0029] This is because the plate-shaped light guide portion which projects light uniformly is visually recognized when the light source is turned on, and on the other hand, the black or black-based color member is visually recognized through the plate-shaped light guide portion when the light source is turned off.

[0030] Still another aspect of the present invention is a vehicular lamp including the vehicular lamp unit according to any one of the foregoing aspects and a second vehicular lamp unit, wherein the vehicular lamp unit is arranged in a state in which a rear surface of the light guide body and a side surface of the second vehicular lamp unit face each other.

[0031] According to this aspect, it is possible to realize a new-looking vehicular lamp in which the side surface

of the second vehicular lamp unit is covered with the vehicular lamp unit which also functions as a lamp, for example, a position lamp, in addition to the function as an extension.

[0032] According to a preferable embodiment of the above-described invention, the second vehicular lamp unit may be a lamp unit for a headlamp.

[0033] According to this aspect, it is possible to realize a new-looking vehicular lamp in which the side surface of the lamp unit for a headlamp is covered with the vehicular lamp unit which functions as a lamp, for example, a position lamp, in addition to the function as an extension.

Brief Description of Drawings

[0034]

FIG. 1 is a perspective view of a vehicular lamp unit 10.

FIG. 2 is a top view of the vehicular lamp unit 10.

FIG. 3 is a front view of a vehicle V on which the vehicular lamp unit 10 is mounted.

FIG. 4 is an exploded perspective view of the vehicular lamp unit 10.

FIG. 5 is a side view of a light guide body 30.

FIG. 6 is an opposite side view of the light guide body 30.

FIG. 7 is a front view of the light guide body 30.

FIG. 8 is an A-A cross-sectional view of the light guide body 30 shown in FIG. 5.

FIG. 9 (a) is a B-B cross-sectional view of the light guide body 30 shown in FIG. 5 and FIG. 9(b) is a C-C cross-sectional view of the light guide body 30 shown in FIG. 5.

FIG. 10 is a D-D cross-sectional view of the light guide body 30 shown in FIG. 5.

FIG. 11 is an E-E cross-sectional view of the light guide body 30 shown in FIG. 5.

FIG. 12 is a diagram illustrating optical paths of light that enters a plate-shaped light guide portion 34 from a first rod-shaped light guide portion 33a and a second rod-shaped light guide portion 33b.

FIG. 13 is a cross-sectional view of a structure LC2 (dot cut LC2).

FIG. 14 is an enlarged view taken out of the dot cuts LC2 from FIG. 6.

FIG. 15 shows another example of an arrangement of the dot cuts LC2.

FIG. 16(a) is an enlarged view of the vicinity of the first rod-shaped light guide portion 33a shown in FIG. 10 and FIG. 16(b) is an enlarged view of the vicinity of the second rod-shaped light guide portion 33b shown in FIG. 10.

FIG. 17 is a side view of the light guide body 30A.

FIG. 18 is an opposite side view of the light guide body 30A.

FIG. 19 is a front view of the light guide body 30A.

FIG. 20 is an A-A cross-sectional view of the light guide body 30A shown in FIG. 17.

FIG. 21 is a B-B cross-sectional view of the light guide body 30A shown in FIG. 17.

FIG. 22 is a C-C cross-sectional view of the light guide body 30A shown in FIG. 17.

FIG. 23 is a D-D cross-sectional view of the light guide body 30A shown in FIG. 17.

FIG. 24 is a diagram showing optical paths of light that enters the plate-shaped light guide portion 34A from the first rod-shaped light guide portion 33Aa and the second rod-shaped light guide portion 33Ab.

FIG. 25 is an F-F cross-sectional view of the light guide body 30 (first neck portion NP1) shown in FIG. 5.

FIG. 26(a) is a G-G cross-sectional view of the light guide body 30 shown in FIG. 25 and FIG. 26(b) is the light guide body shown in FIG. 25.

FIG. 27 shows a modified example of the first neck portion NP1.

FIG. 28 shows a modified example of the first neck portion NP1.

FIG. 29 shows another example of a first groove GV1 formed on a first end rim portion EG1 of the plate-shaped light guide portion 34.

FIG. 30 is a front view of a conventional light guide body including a rod-shaped light guide portion and the plate-shaped light guide portion.

Description of Exemplary Embodiments

[0035] Hereinafter, a vehicular lamp unit 10 according to an embodiment of the present invention will be described with reference to the accompanying drawings. Components corresponding to each other in the drawings are denoted by the same reference numerals, and repetitive descriptions thereof will be omitted. Further, herein, the term/phrase "symmetric in the vertical direction", "vertical symmetric" and the like mean that objects are accurately or substantially symmetric in the vertical direction relative to a (virtual) center line located between the objects in the vertical direction.

[0036] FIG. 1 is a perspective view of a vehicular lamp unit 10, FIG. 2 is a top view thereof and FIG. 3 is a front view of a vehicle V on which the vehicular lamp unit 10 is mounted.

[0037] The vehicular lamp unit 10 shown in FIGS. 1 and 2 is a vehicular signal lamp that functions as a position lamp. As shown in FIG. 3, the vehicular lamp unit 10 is a side-emitting type vehicular lamp unit that is mounted on both left and right sides of a front end portion of a vehicle V such as an automobile in a state where the side surface of the low-beam lamp unit 62 is covered. In addition to the vehicular lamp unit 10, a top surface portion 60 of the outer lens, a lamp unit for a headlamp including a high beam lamp unit 61 and a low beam lamp unit 62 and a DRL lamp 63 (or turn signal lamp) are mounted on the front end portion of the vehicle V.

[0038] Since the vehicular lamp unit 10 mounted on both the left and right sides has a symmetrical configuration, the vehicular lamp unit 10 mounted on the right side of the front end portion of the vehicle V, i.e., on the right side toward the front of the vehicle, will be described below as a representative. Hereinafter, for convenience of description, XYZ axes will be defined. The X-axis extends in the front-rear direction of the vehicle, the Y-axis extends in the vehicle width direction and the Z-axis extends in the vertical direction.

[0039] FIG. 4 is an exploded perspective view of the vehicular lamp unit 10.

[0040] As shown in FIG. 4, the vehicular lamp unit 10 includes a substrate 20 on which a first light source 21a and a second light source 21b are mounted, a light guide body 30 (or inner lens), a bracket 40, a first extension 50 and a second extension 52. Although not shown, the vehicular lamp unit 10 is disposed in a lamp chamber formed by an outer lens and a housing, and is fixed to the housing or the like.

[0041] FIG. 5 is a side view of the light guide body 30, FIG. 6 is an opposite side view thereof and FIG. 7 is a front view thereof. FIG. 8 is a cross-sectional view of the light guide body 30 taken along line A-A shown in FIG. 5. FIG. 9(a) is a cross-sectional view of the light guide body 30 taken along line B-B shown in FIG. 5 and FIG. 9(b) is a cross-sectional view of the light guide body 30 taken along line C-C shown in FIG. 5.

[0042] As shown in FIGS. 5 to 9, the light guide body 30 includes a first light incident portion 31a, a second light incident portion 31b, a first reflection surface 32a, a second reflection surface 32b, a first rod-shaped light guide portion 33a, a second rod-shaped light guide portion 33b and a plate-shaped light guide portion 34. The material of the light guide body 30 is, for example, a transparent resin such as an acryl or polycarbonate resin material.

[0043] First, the first light incident portion 31a and the second light incident portion 31b will be described.

[0044] As shown in FIG. 9(a), the first light incident portion 31a is configured to collimate the light Ray 1 from the first light source 21a entering the light guide body 30 from the first light incident portion 31a. The first light incident portion 31a is disposed on a surface FS₃₀ of the light guide body 30 in the vicinity of a rear end portion BE_{33a} of the first rod-shaped light guide portion 33a (see FIG. 5). The first light incident portion 31a may have any configuration as long as it can collimate the light Ray1 from the first light source 21a. The optical axis AX_{31a} of the first light incident portion 31a extends in a direction substantially orthogonal to the front surface FS₃₀ of the light guide body 30 (see FIG. 9(a)).

[0045] As shown in FIG. 9(b), the second light incident portion 31b is configured to collimate the light Ray2 from the second light source 21b entering the light guide body 30 from the second light incident portion 31b. The second light incident portion 31b is disposed on the front surface FS₃₀ of the light guide body 30 in the vicinity of a rear

end BE_{33b} of the second rod-shaped light guide portion 33b (see FIG. 5). The second light incident portion 31b may have any configuration as long as it can collimate the light Ray2 from the second light source 21b. The optical axis AX_{31b} of the second light incident portion 31b extends in a direction substantially orthogonal to the front surface FS₃₀ of the light guide body 30 (see FIG. 9(b)).

[0046] Next, the first light source 21a and the second light source 21b will be described.

[0047] As shown in FIGS. 4 and 9, the first light source 21a and the second light source 21b are mounted on the substrate 20. Each of the first light source 21a and the second light source 21b is a semiconductor light emitting element such as an LED that emits white light. Each of the first light source 21a and the second light source 21b includes a light emitting surface EF_{21a} or EF_{21b} (e.g., a rectangular light emitting surface of 1mm square).

[0048] The substrate 20 is a metal substrate made of, for example, aluminum or the like, and is fixed to the light guide body 30 by screwing in a state where the first light source 21a and the second light source 21b are opposed to the first light incident portion 31a and the second light incident portion 31b, respectively, as shown in FIGS. 9(a) and 9(b).

[0049] As shown in FIG. 9(a), the optical axis AX_{21a} of the first light source 21a coincides with the optical axis AX_{31a} of the first light incident portion 31a. The optical axis AX_{31a} of the first light incident portion 31a extends through the center of the light emitting surface EF_{21a} and in a direction orthogonal to the light emitting surface EF_{21a}. The first light source 21a emits the light Ray1 that enters the light guide body 30 from the first light incident portion 31a, is internally reflected by the first reflecting surface 32a and travels in the first rod-shaped light guide portion 33a toward the front end portion FE_{33a} of the first rod-shaped light guide portion 33a.

[0050] As shown in FIG. 9(b), the optical axis AX_{21b} of the second light source 21b coincides with the optical axis AX_{31b} of the second light incident portion 31b. The optical axis AX_{31b} of the second light incident portion 31b extends through the center of the light emitting surface EF_{21b} and in a direction orthogonal to the light emitting surface EF_{21b}. The second light source 21b emits the light Ray2 that enters the light guide body 30 from the second light incident portion 31b, is internally reflected by the second reflecting surface 32b and travels in the second rod-shaped light guide portion 33b toward the front end portion FE_{33b} of the second rod-shaped light guide portion 33b.

[0051] Next, the first reflection surface 32a and the second reflection surface 32b will be described.

[0052] As shown in FIG. 9(a), the first reflection surface 32a is a planar reflection surface and is disposed on the optical path of the light Ray1 from the first light source 21a collimated by the first light incident portion 31a. Specifically, the first reflection surface 32a is disposed in an attitude inclined by 45 degrees with respect to the optical axis AX_{31a} of the first light incident portion 31a so that

the light Ray1 internally reflected by the first reflection surface 32a enters the first rod-shaped light guide portion 33a from the rear end portion BE_{33a} of the first rod-shaped light guide portion 33a and travels toward the front end portion FE_{33a} thereof.

[0053] As shown in FIG. 9(b), the second reflection surface 32b is a planar reflection surface and is disposed on the optical path of the light Ray2 from the second light source 21b collimated by the second light incident portion 31b. Specifically, the second reflection surface 32b is disposed in an attitude inclined by 45 degrees with respect to the optical axis AX_{31b} of the second light incident portion 31b so that the light Ray2 internally reflected by the second reflection surface 32b enters the second rod-shaped light guide portion 33b from the rear end portion BE_{33b} of the second rod-shaped light guide portion 33b and travels toward the front end portion FE_{33b} thereof.

[0054] Next, the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b will be described.

[0055] As shown in FIG. 5, the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b are juxtaposed with each other with a space therebetween.

[0056] The first rod-shaped light guide portion 33a extends linearly from the rear end portion BE_{33a} (corresponding to the proximal end portion of the present invention) toward the front end portion FE_{33a} (corresponding to the distal end portion of the present invention). The first rod-shaped light guide portion 33a guides the light Ray 1 from the first light source 21a internally reflected by the first reflecting surface 32a from the rear end portion BE_{33a} toward the front end portion FE_{33a}.

[0057] The second rod-shaped light guide portion 33b extends from the rear end portion BE_{33b} (corresponding to the proximal end portion of the present invention) toward the front end portion FE_{33b} (corresponding to the distal end of the present invention) via a first curved portion CR1 and a second curved portion CR2. The second rod-shaped light guide portion 33b guides the light Ray2 from the second light source 21b internally reflected by the second reflecting surface 32b from the rear end portion BE_{33b} toward the front end portion FE_{33b}.

[0058] FIG. 10 is a cross-sectional view of the light guide body 30 taken along line D-D shown in FIG. 5 and FIG. 11 is a cross-sectional view thereof taken along line E-E.

[0059] As shown in FIGS. 10 and 11, the cross-sections of the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b are substantially circular. The thickness T1 (diameter) of the first rod-shaped light guide portion 33a is, for example, 5 mm. The thickness T2 (diameter) of the second rod-shaped light guide portion 33b is, for example, 5 mm.

[0060] FIG. 12 is a diagram showing optical paths of light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b.

[0061] As shown in FIG. 12, the light Ray1 from the first light source 21a guided in the first rod-shaped light guide portion 33a enters the plate-shaped light guide portion 34 (see the obliquely downward arrows in FIG. 12). Although not shown, light in various directions other than the light indicated by the respective obliquely downward arrows from the first rod-shaped light guide portion 33a also enters the plate-shaped light guide portion 34.

[0062] The light Ray2 from the second light source 21b guided in the second rod-shaped light guide portion 33b enters the plate-shaped light guide portion 34 (see the obliquely upward arrows in FIG. 12). Although not shown, light in various directions other than the light indicated by the respective obliquely upward arrows from the second rod-shaped light guide portion 33b also enters the plate-shaped light guide portion 34.

[0063] As shown in FIG. 6, the second rod-shaped light guide portion 33b includes correction cuts LC1.

[0064] The correction cuts LC1 are formed of cut surfaces by forming V-grooves in the lower portion of the second rod-shaped light guide portion 33b. In FIG. 6, the V-grooves extend in a direction orthogonal to the paper surface. A plurality of the correction cuts LC1 are provided in the ranges A2 and A3 in FIG. 6.

[0065] The technical meaning of providing the correction cuts LC1 is as follows.

[0066] That is, since the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b are asymmetric in the vertical direction (see FIGS. 5 and 6), when the correction cuts LC1 are not provided, the optical paths of the light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a (see the respective obliquely downward arrows in FIG. 12) and the optical paths of the light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b are asymmetric in the vertical direction. As a result, a dark portion (dark area) may be generated in the middle of the plate-shaped light guide portion 34 in the vertical direction (for example, the area A12 surrounded by an ellipse in FIG. 12).

[0067] The correction cuts LC1 are provided in order to correct the optical paths of the light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b so as to be symmetric in the vertical direction (relative to a not-shown virtual center line) with respect to the optical paths of the light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a (see the respective obliquely downward arrows in FIG. 12).

[0068] Even if the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b are asymmetrical in shape, the provision of the corrective cuts LC1 as shown in FIG. 12 can make the optical paths of the light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a (see the respective obliquely downward arrows in FIG. 12) and the optical paths of the light entering the plate-

shaped light guide portion 34 from the second rod-shaped light guide portion 33b (see the respective obliquely upward arrows in FIG. 12) symmetrical in the vertical direction relative to a virtual center line. As a result, it is possible to suppress the generation of the dark portion (dark area) in the middle of the plate-shaped light guide portion 34 in the vertical direction (for example, the area A12 surrounded by an ellipse in FIG. 12).

[0069] The ranges in which the correction cuts LC1 are provided and the angles of the V-grooves may be adjusted so that the optical paths of the light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a (see the respective obliquely downward arrows in FIG. 12) and the optical paths of the light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b (see the respective obliquely upward arrows in FIG. 12) are symmetrical in the vertical direction. This adjustment can be performed using, for example, predetermined simulation software. The correction cuts LC1 may be provided in the first rod-shaped light guide portion 33a, or may be provided in both the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b.

[0070] A description for the plate-shaped light guide portion 34 will next be given.

[0071] As shown in FIG. 5, the plate-shaped light guide portion 34 is disposed between the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b.

[0072] The plate-shaped light guide portion 34 is a curved plate-shaped light guide body extending from the rear end portion BE₃₄ toward the front end portion FE₃₄, as shown in FIGS. 7, 10, and 11. The plate-shaped light guide portion 34 is not a complete cylinder, but a semi-cylindrical lens body which is formed by cutting a part of a cylinder.

[0073] The plate-shaped light guide portion 34 includes a front surface FS₃₄ disposed on the front side of the vehicular lamp unit and a rear surface RS₃₄ disposed on a back side opposite to the front surface FS₃₄.

[0074] The front surface FS₃₄ of the plate-shaped light guide portion 34 is subjected to a graining treatment (provided with a grain surface E). The grain surface E includes a plurality of minute irregularities and is provided to the hatched area A4 in FIG. 5. The grain surface E is provided mainly for the purpose of allowing a viewer to visually recognize that the plate-shaped light guide portion 34 projects light uniformly.

[0075] The rear surface RS₃₄ of the plate-shaped light guide portion 34 includes a plurality of structures LC2. The structures LC2 are configured to diffuse light from the first light source 21a and the second light source 21b (and light from the correction cuts LC1) entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b, respectively, and cause the light to exit from the front surface FS₃₄ of the plate-shaped light guide portion 34. The structures LC2 are provided to the

hatched area A5 in FIG. 6.

[0076] FIG. 13 is a cross-sectional view of the structures LC2 (dot cuts LC2).

[0077] As shown in FIG. 13, the structure LC2 is a dot-shaped lens cut. Hereinafter, the structure LC2 is referred to as a dot cut LC2 as appropriate. The dot cut LC2 is, for example, a spherical cut surface having a radius R, which is, for example, 0.2 mm. The dot cut LC2 may be a conical or conical cut surface, an N-pyramid or an N-pyramid cut surface, where N is an integer of 3 or more.

[0078] FIG. 14 is an enlarged view of the dot cuts LC2 extracted from FIG. 6, and shows an exemplary arrangement of the dot cuts LC2.

[0079] As shown in FIG. 14, a plurality of dot cuts LC2 are arranged at pitches p1 in the lateral direction (laterally in line). The pitch p1 is, for example, 0.6 mm. Hereinafter, the plurality of dot cuts LC2 arranged laterally are referred to as a dot cut LC2 group.

[0080] On the other hand, the plurality of dot cut LC2 groups are arranged in the longitudinal direction at pitches p2. The pitch p2 is, for example, 0.8 mm. At this time, the respective dot cut LC2 groups are arranged so as to be offset with respect to the straight line L1 extending in the longitudinal direction.

[0081] FIG. 15 shows another exemplary arrangement of the dot cuts LC2.

[0082] As shown in FIG. 15, a plurality of dot cuts LC2 may be arranged at pitches p2 in the longitudinal direction (vertical row) and the plurality of dot cut LC2 groups arranged in the longitudinal direction may be arranged at pitches p1 in the lateral direction. At this time, the respective dot cut LC2 groups are arranged so as to be offset with respect to the straight line L2 extending in the lateral direction.

[0083] As described above, random arrangement of the respective dot cuts LC2 as illustrated in FIGS. 14 and 15 can suppress the moire from being visually recognized through the plate-shaped light guide portion 34 when the first light source 21a and the second light source 21b are turned off.

[0084] The radius of curvature (or curvature) of the plate-shaped light guide portion 34 differs between the rear end portion BE₃₄ side and the front end portion FE₃₄ side.

[0085] Specifically, from the viewpoint of enhancing the design property (aesthetic property), the radius of curvature of the plate-shaped light guide portion 34 on the front end portion FE₃₄ side (see FIG. 11) is set to be smaller than the radius of curvature of the plate-shaped light guide portion 34 on the rear end BE₃₄ side (see FIG. 10). The radii of curvature of the plate-shaped light guide portion 34 are thus set so as to gradually decrease from the rear end portion BE₃₄ side toward the front end portion FE₃₄ side.

[0086] The thickness T3 (basic thickness, see FIGS. 10 and 11) of the plate-shaped light guide portion 34 is, for example, 3.5 mm.

[0087] As shown in FIG. 5, the plate-shaped light guide

portion 34 includes a first end rim portion EG1 connected to the outer peripheral surface of the first rod-shaped light guide portion 33a and a second end rim portion EG2 connected to the outer peripheral surface of the second rod-shaped light guide portion 33b.

[0088] The first end rim portion EG1 of the plate-shaped light guide portion 34 includes a first wall thickness gradual-change portion NP1. The first wall thickness gradual-change portion NP1 is a portion having a thickness smaller than that of the plate-shaped light guide portion 34 (thickness T3) other than the first end rim portion EG1 of the plate-shaped light guide portion 34. Hereinafter, the first wall thickness gradual-change portion NP1 is referred to as a first neck portion NP1. Similarly, the second end rim portion EG2 of the plate-shaped light guide portion 34 includes a second wall thickness gradual-change portion NP2. The second wall thickness gradual-change portion NP2 is a portion having a thickness smaller than that of the plate-shaped light guide portion 34 (thickness T3) other than the second end rim portion EG2 of the plate-shaped light guide portion 34. Hereinafter, the second wall thickness gradual-change portion NP2 is referred to as a second neck portion NP2.

[0089] As shown in FIG. 10, the first neck portion NP1 is a thin portion formed by forming a first groove portion GV1 in the front surface FS₃₄ of the first end rim portion EG1 of the plate-shaped light guide portion 34, and is configured to adjust the amount (light amount or intensity) of light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a. The first neck portion NP1 and the first groove portion GV1 are provided in the area A6 in FIG. 5. Specifically, the first neck portion NP1 and the first groove portion GV1 are provided along the first rod-shaped light guide portion 33a in the area A6 in FIG. 5.

[0090] The area A6, in which the first neck portion NP1 and the first groove portion GV1 are provided, and the thickness T4 of the first neck portion NP1 are adjusted so that the amount of light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a becomes substantially uniform at respective positions (for example, see respective positions p1 to p8 shown in FIG. 12) between the rear end portion BE_{33a} and the front end portion FE_{33a} of the first rod-shaped light guide portion 33a. This adjustment can be performed using, for example, predetermined simulation software.

[0091] Next, the thickness T4 of the first neck portion NP1 will be described in detail.

[0092] FIG. 25 is a cross-sectional view of the light guide body 30 (first neck portion NP1) taken along line F-F shown in FIG. 5. FIG. 26(a) is a cross-sectional view of the light guide body 30 taken along line G-G shown in FIG. 25, and FIG. 26(b) is a cross-sectional view of the light guide body 30 taken along line H-H shown in FIG. 25.

[0093] As shown in FIG. 25, the thickness T4 of the first neck portion NP1 differs between the rear end portion BE_{33a} side (see FIG. 26(a)) and the front end portion

FE_{33a} side (see FIG. 26(b)) of the first rod-shaped light guide portion 33a.

[0094] For example, the thickness T4 of the first neck portion NP1 on the rear end portion BE_{33a} side of the first rod-shaped light guide portion 33a is 2 mm. On the other hand, the thickness T4 of the first neck portion NP1 on the front end portion FE_{33a} side of the first rod-shaped light guide portion 33a is 3.5 mm. The thickness T4 of the first neck portion NP1 thus gradually increases from the rear end portion BE_{33a} of the first rod-shaped light guide portion 33a toward the front end portion FE_{33a} thereof. For example, the thickness T4 of the first neck portion NP1 linearly and gradually increases from the rear end portion BE_{33a} of the first rod-shaped light guide portion 33a toward the front end portion FE_{33a}.

[0095] The adjustment of the thickness T4 of the first neck portion NP1 in this manner (gradual-change) can make the amount (light amount or intensity) of light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a substantially uniform at respective positions (for example, see respective positions p1 to p8 shown in FIG. 12) between the rear end portion BE_{33a} and the front end portion FE_{33a} of the first rod-shaped light guide portion 33a. The reasons are as follows:

[0096] That is, as shown in FIG. 26(a), when the thickness T4 of the first neck portion NP1 is decreased, compared to a case where the thickness T4 of the first neck portion NP1 is increased (see FIG. 26(b)), an area in which the light Ray1 from the first light source 21a guided in the first rod-shaped light guide portion 33a is internally reflected back into the first rod-shaped light guide portion 33a (see an area indicated by the symbol A13 in FIG. 26(a)) is increased. That is, when the thickness T4 of the first neck portion NP1 is reduced, the light can be guided to a further distance.

[0097] In other words, when the thickness T4 of the first neck portion NP1 is decreased (see FIG. 26(a)), compared to a case where the thickness T4 of the first neck portion NP1 is increased (see FIG. 26(b)), light Ray1 entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a decreases (see the arrow representing the light Ray1 in FIG. 26(a)). Conversely, when the thickness T4 of the first neck portion NP1 is increased (see FIG. 26(b)), compared to a case where the thickness T4 of the first neck portion NP1 is decreased (see FIG. 26(a)), light Ray1 entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a increases (see the arrow representing the light Ray1 in FIG. 26(b)).

[0098] Therefore, the adjustment of the thickness T4 of the first neck portion NP1 can control the amount of light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a.

[0099] Therefore, appropriate gradual-change of the thickness T4 of the first neck portion NP1 can make the amount (light amount or intensity) of light entering the plate-shaped light guide portion 34 from the first rod-

shaped light guide portion 33a substantially uniform at respective positions (for example, see the respective positions p1 to p8 shown in FIG. 12) between the rear end portion BE_{33a} and the front end portion FE_{33a} of the first rod-shaped light guide portion 33a.

[0100] As shown in FIG. 10, the second neck portion NP2 is a thin portion formed by forming a second groove portion GV2 in the front surface FS₃₄ of the second end rim portion EG2 of the plate-shaped light guide portion 34, and is configured to adjust the amount of light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b. The second neck portion NP2 and the second groove portion GV2 are provided in the area A7 in FIG. 5. Specifically, the second neck portion NP2 and the second groove portion GV2 are provided along the second rod-shaped light guide portion 33b in the area A7 in FIG. 5.

[0101] The area A7, in which the second neck portion NP2 and the second groove portion GV2 are provided, and the thickness T5 of the second neck portion NP2 are adjusted so that the amount of light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b becomes substantially uniform at respective positions (for example, see respective positions p9 to p16 shown in FIG. 12) between the rear end portion BE_{33b} and the front end portion FE_{33b} of the second rod-shaped light guide portion 33b. This adjustment can be performed using, for example, predetermined simulation software.

[0102] The thickness T5 of the second neck portion NP2 differs between the rear end portion BE_{33b} side and the front end portion FE_{33b} side of the second rod-shaped light guide portion 33b.

[0103] For example, the thickness T5 of the second neck portion NP2 on the rear end portion BE_{33b} side of the second rod-shaped light guide portion 33b is 2 mm. On the other hand, the thickness T5 of the second neck portion NP2 on the front end portion FE_{33b} side of the second rod-shaped light guide portion 33b is 3.5 mm. The thickness T5 of the second neck portion NP2 thus gradually increases from the rear end portion BE_{33b} of the second rod-shaped light guide portion 33b toward the front end portion FE_{33b}. For example, the thickness T5 of the second neck portion NP2 linearly and gradually increases from the rear end portion BE_{33b} of the second rod-shaped light guide portion 33b to the front end portion FE_{33b}.

[0104] The adjustment of the thickness T5 of the second neck portion NP2 in this manner (gradual-change) can make the amount (light amount or intensity) of light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b substantially uniform at respective positions (for example, see respective positions p9 to p16 shown in FIG. 12) between the rear end portion BE_{33b} and the front end portion FE_{33b} of the second rod-shaped light guide portion 33b. The reason for this is the same as the reason for gradually changing the thickness T4 of the first neck portion NP1,

and therefore a description thereof is omitted.

[0105] FIG. 16(a) is an enlarged view of the vicinity of the first rod-shaped light guide portion 33a shown in FIG. 10.

5 [0106] As shown in FIG. 16(a), a first gradual-change portion 35a connecting the first rod-shaped light guide portion 33a and the plate-shaped light guide portion 34 is provided between them. The first gradual-change portion 35a is a portion in which the thickness of the first neck portion NP1 gradually changes (increases) from T4 to T3 (= 3.5 mm), and includes a curved surface (gradual-change surface) smoothly and continuously without a step. The first gradual-change portion 35a is provided in the area A6 in FIG. 5.

10 [0107] The first gradual-change portion 35a is provided in consideration of the mold releasability (moldability) at the time of injection molding of the light guide body 30.

[0108] FIG. 16(b) is an enlarged view of the vicinity of the second rod-shaped light guide portion 33b shown in FIG. 10.

20 [0109] As shown in FIG. 16(b), a second gradual-change portion 35b connecting the second rod-shaped light guide portion 33b and the plate-shaped light guide portion 34 is provided between them. The second gradual-change portion 35b is a portion in which the thickness of the second neck portion NP2 gradually changes (increases) from T5 to T3 (= 3.5 mm), and includes a curved surface (gradual-change surface) smoothly and continuously without a step. The second gradual-change portion 35b is provided in the range A7 in FIG. 5.

25 [0110] The second gradual-change portion 35b is provided in consideration of the mold-release ability (moldability) at the time of injection molding of the light guide body 30.

30 [0111] Next, the bracket 40 will be described.

[0112] As shown in FIG. 4, the bracket 40 is not a complete cylinder, but a semi-cylindrical bracket in which a part of the cylinder is cut, and includes an annular bracket 41. The material of the bracket 40 is, for example, a synthetic resin such as an acryl or polycarbonate resin, for example, a black or black-based opaque resin.

35 [0113] The outer peripheral surface 42 of the bracket 40 is, for example, colored black or black-based color. The outer peripheral surface 42 of the bracket 40 is disposed with the rear surface of the light guide body 30 (the rear surface RS₃₄ of the plate-shaped light guide portion 34) facing each other, and is visually recognized through the light guide body 30 (the plate-shaped light guide portion 34).

40 [0114] As shown in FIG. 3, an annular lamp, for example, a DRL lamp 63, is fixed to the annular bracket 41.

[0115] Next, the first extension 50 will be described.

45 [0116] The first extension 50 is provided mainly for the purpose of improving the design of the vehicular lamp unit 10. As shown in FIG. 4, the first extension 50 is not a complete cylinder, but a semi-cylindrical decorative member in which a part of the cylinder is cut. The surface of the first extension 50 is subjected to a mirror surface

treatment such as aluminum deposition. The material of the first extension 50 is, for example, a synthetic resin such as an acryl or polycarbonate resin.

[0117] As shown in FIGS. 1 and 4, the first extension 50 includes a plurality of slits 51. Each slit 51 penetrates the outer peripheral surface and the inner peripheral surface of the first extension 50, and extends from the rear end portion toward the front end portion in the rightward direction from the left side in the example illustrated in FIG. 1. Of the light emitted from the front surface of the light guide body 30 (the front surface FS_{34} of the plate-shaped light guide portion 34), the light passing through the respective slits 51 is projected forward.

[0118] Next, the second extension 52 will be described.

[0119] The second extension 52 is provided mainly for the purpose of improving the design of the vehicular lamp unit 10.

[0120] As shown in FIGS. 1 and 4, the second extension 52 is a decorative member having a V-shaped open space opened toward the front. The surface of the second extension 52 is subjected to a mirror surface treatment such as aluminum deposition. The material of the second extension 52 is, for example, a synthetic resin such as an acryl or polycarbonate resin.

[0121] As shown in FIG. 4, the light guide body 30 having the aforementioned configuration is disposed between the bracket 40 and the first extension 50 with the rear surface of the light guide body 30 (the rear surface RS_{34} of the plate-shaped light guide portion 34) and the bracket 40 (the outer peripheral surface 42 thereof) facing each other, and with the front surface of the light guide body 30 (the front surface FS_{34} of the plate-shaped light guide portion 34) and the first extension 50 (the inner peripheral surface thereof) facing each other. The second extension 52 is disposed outside the first extension 50.

[0122] The light guide body 30, the first extension 50 and the second extension 52 arranged as described above are fixed in a state of being positioned with respect to each other by, for example, screwing screws (not shown) inserted into respective flange portions to the bracket 40 (see FIG. 1).

[0123] As shown in FIG. 3, the vehicular lamp unit 10 having the aforementioned configuration is disposed in a state of covering the side surface of the low beam lamp unit 62. More specifically, although not shown, the vehicular lamp unit 10 is disposed in a state in which the inner peripheral surface of the bracket 40 and the side surface (not shown) of the low beam lamp unit 62 face each other, that is, in a state in which the vehicular lamp unit 10 covers the side surface of the low beam lamp unit 62. At this time, the annular bracket 41 is disposed in a state of surrounding the light emitting region (for example, the projection lens 62a) of the low beam lamp unit 62 in a front view (see FIG. 3).

[0124] In addition, the vehicular lamp unit 10 is disposed such that, as shown in FIG. 2, the center axis AX_{30} of the light guide body 30 (plate-shaped light guide por-

tion 34) is inclined at an angle θ_1 with respect to a reference axis AX (X-axis) extending in the front-rear direction of the vehicle in the top view so that the light guide body 30 (plate-shaped light guide portion 34) can be visually observed from the front side of the vehicle. For example, the angle θ_1 may be 11 degrees. The angle θ_1 is not limited to 11 degrees as long as it covers the irradiation range required for the position lamp, i.e., 125 degrees in total of 45 degrees to the left and 80 degrees to the right with respect to the vertical plane including the reference axis AX.

[0125] In the vehicular lamp unit 10 having the aforementioned configuration, when the first light source 21a and the second light source 21b are turned on, the light Ray1 from the first light source 21a enters the light guide body 30 from the first light incident portion 31a as shown in FIG. 9(a). At this time, the light Ray1 from the first light source 21a is collimated by the first light incident portion 31a into light that is parallel to the optical axis AX_{31a} . The collimated light Ray1 is internally reflected by the first reflecting surface 32a, enters the first rod-shaped light guide portion 33a, and travels in the first rod-shaped light guide portion 33a toward the front end portion FE_{33a} of the first rod-shaped light guide portion 33a.

[0126] As shown in FIG. 12, the light Ray1 traveling in the first rod-shaped light guide portion 33a enters the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a (see the obliquely downward arrows in FIG. 12). At this time, the amount of light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a becomes substantially uniform at respective positions (for example, see respective positions p1 to p8 shown in FIG. 12) between the rear end portion BE_{33a} and the front end portion FE_{33a} of the first rod-shaped light guide portion 33a by the action of the first neck portion NP1 (first wall thickness gradual-change portion NP1).

[0127] Then, the light from the first rod-shaped light guide portion 33a entering the plate-shaped light guide portion 34 is internally reflected (diffusely reflected) by the rear surface RS_{34} (having the dot cuts LC2) of the plate-shaped light guide portion 34, and exits from the front surface FS_{34} of the plate-shaped light guide portion 34. At this time, the light exiting from the front surface FS_{34} of the plate-shaped light guide portion 34 is further diffused by the action of the grain surface E formed on the front surface FS_{34} .

[0128] In addition, as shown in FIG. 9(b), the light Ray2 from the second light source 21b enters the light guide body 30 from the second light incident portion 31b. At this time, the light Ray2 from the second light source 21b is collimated by the second light incident portion 31b into light that is parallel to the optical axis AX_{31b} . The collimated light Ray2 is internally reflected by the second reflecting surface 32b, enters the second rod-shaped light guide portion 33b, and travels in the second rod-shaped light guide portion 33b toward the front end portion FE_{33b} of the second rod-shaped light guide portion

33b.

[0129] As shown in FIG. 12, the light Ray2 traveling in the second rod-shaped light guide portion 33b enters the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b (see the respective obliquely upward arrows in FIG. 12). At this time, part of the light Ray2 traveling in the second rod-shaped light guide portion 33b is reflected by the correction cuts LC1. Accordingly, the optical paths of the light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b (see the respective obliquely upward arrows in FIG. 12) is symmetric in the vertical direction with respect to the optical paths of the light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a (see the respective obliquely downward arrows in FIG. 12).

[0130] In addition, the amount of light entering the plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b becomes substantially uniform at respective positions (for example, see respective positions p9 to p16 shown in FIG. 12) between the rear end portion BE_{33b} and the front end portion FE_{33b} of the second rod-shaped light guide portion 33b by the action of the second neck portion NP2 (second wall thickness gradual-change portion NP2).

[0131] Then, the light from the second rod-shaped light guide portion 33b entering the plate-shaped light guide portion 34 is internally reflected (diffusely reflected) by the rear surface RS₃₄ (having the dot cuts LC2) of the plate-shaped light guide portion 34, and exits from the front surface FS₃₄ of the plate-shaped light guide portion 34. At this time, the light exiting from the front surface FS₃₄ of the plate-shaped light guide portion 34 is further diffused by the action of the grain surface E formed on the front surface FS₃₄.

[0132] As described above, the light internally reflected (diffusely reflected) by the rear surface RS₃₄ (having the dot cuts LC2) of the plate-shaped light guide portion 34 is further diffused by the grain surface E of the front surface FS₃₄ when the light exits from the front surface FS₃₄ of the plate-shaped light guide portion 34.

[0133] The light diffused as described above passes through the respective slits 51 formed in the first extension 50 and is projected forward.

[0134] At this time, the front surface FS₃₄ of the plate-shaped light guide portion 34 projects light uniformly (can be visually recognized/observed as if it emits light uniformly). The front surface FS₃₄ of the plate-shaped light guide portion 34 is visually observed through the respective slits 51 formed in the first extension 50. It should be noted that the term "uniform" used in this specification is not limited to the meaning of "uniform" in a strict sense, and even if the brightness of the front surface FS₃₄ of the plate-shaped light guide portion 34 is partially different, this can be evaluated as being "uniform" as long as it can be recognized that the light is visually projected uniformly.

[0135] As described above, the position lamp can be

realized.

[0136] When the first light source 21a and the second light source 21b are turned off, the outer peripheral surface 42 (black or black-based color) of the bracket 40 can be visually observed through the slits 51 formed in the first extension 50 and the light guide body 30 (plate-shaped light guide portion 34).

[0137] As described above, according to the present embodiment, it is possible to provide the vehicular lamp unit 10 in which the plate-shaped light guide portion 34 can project light uniformly (or can be visually recognized/observed as if it emits light uniformly).

[0138] This is because the first end rim portion EG1 and the second end rim portion EG2 of the plate-shaped light guide portion 34 include the first neck portion NP1 and the second neck portion NP2 (thin-walled portion) whose thickness is thinner than that of the plate-shaped light guide portion 34 other than the first end rim portion EG1 and the second end rim portion EG2, respectively (see FIG. 10).

[0139] The adjustment of the area in which the first neck portion NP1 or the second neck portion NP2 is provided and the thicknesses T4 and T5 of the first neck portion NP1 and the second neck portion NP2 can cause the plate-shaped light guide portion 34 to project light uniformly (or can be visually recognized/observed as if it emits light uniformly).

[0140] Further, according to the present embodiment, since the dot cuts LC2 are used instead of the V-groove as the structures formed on the rear surface RS₃₄ of the plate-shaped light guide portion 34 (see FIG. 13), light entering the plate-shaped light guide portion 34 in various directions from the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b can be diffused and exit from the front surface FS₃₄ of the plate-shaped light guide portion 34.

[0141] Further, according to the present embodiment, since the dot cuts LC2 are randomly arranged (see FIGS. 14 and 15), it is possible to suppress the moire from being visually recognized through the plate-shaped light guide portion 34 when the first light source 21a and the second light source 21b are not turned on.

[0142] In addition, according to the present embodiment, use of the curved plate-shaped light guide body as the plate-shaped light guide portion 34 can provide a vehicular lamp unit in which the plate-shaped light guide portion 34, which is the curved plate-shaped light guide body, can project light uniformly (or can be visually recognized/observed as if it emits light uniformly).

[0143] In addition, according to the present embodiment, even if the first rod-shaped light guide portion 33a and the second rod-shaped light guide portion 33b are asymmetric in shape in the vertical direction (see FIG. 12), provision of the correction cuts LC1 can make the optical paths of the light entering the plate-shaped light guide portion 34 from the first rod-shaped light guide portion 33a (see the respective obliquely downward arrows in FIG. 12) and the optical paths of the light entering the

plate-shaped light guide portion 34 from the second rod-shaped light guide portion 33b (see the respective obliquely upward arrows in FIG. 12) symmetric with each other in the vertical direction. As a result, it is possible to suppress generation of the dark portion (dark area) in the middle of the plate-shaped light guide portion 34 in the vertical direction.

[0144] Further, according to the present embodiment, since the vehicular lamp unit 10 (such as the light guide body 30) is disposed in a state of being inclined at a predetermined angle $\theta 1$ with respect to the reference axis AX extending in the front-rear direction of a vehicle (X-axis direction) in a top view (see FIG. 2), visibility (visually recognizability) from the front of the vehicle is improved. The angle $\theta 1$ may be any angle as long as it covers the irradiation range required for the position lamp, i.e., 125 degrees in total of 45 degrees to the left and 80 degrees to the right with respect to the vertical plane including the reference axis AX. The center axis AX_{30} is a center axis (cylindrical axis) of the light guide body 30 (the plate-shaped light guide portion 34 as a curved plate-shaped light guide body).

[0145] In addition, according to the present embodiment, it is possible to realize a new-looking vehicular lamp unit 10 having a high light-dark ratio when the first light source 21a and the second light source 21b are turned on and off.

[0146] This is because when the first light source 21a and the second light source 21b are turned on, the plate-shaped light guide portion 34 that uniformly projects light can be visually observed through the respective slits 51 formed in the first extension 50, and on the other hand, when the first light source 21a and the second light source 21b are turned off, the black or black-based color outer peripheral surface 42 of the bracket 40 is visually recognized through the respective slits 51 formed in the first extension 50 and the plate-shaped light guide portion 34.

[0147] Further, according to the present embodiment, it is possible to realize a new appearance vehicle lamp (see FIG. 3) in which the side surface of the low beam lamp unit 62 (an example of another vehicle lamp unit of the present invention) is covered with the vehicular lamp unit 10 (such as the light guide body 30) which also functions as a lamp (for example, a position lamp) in addition to the function as an extension.

[0148] Modified examples will next be described.

[0149] In the foregoing embodiment, an example in which the vehicular lamp unit of the present invention is applied to a position lamp has been described, but the present invention is not limited thereto. For example, the vehicular lamp unit of the present invention may also be applied to a tail lamp, a stop lamp, a back lamp, a side marker lamp, a turn lamp, and a DRL (Daytime Running Lamps) lamp.

[0150] In the foregoing embodiment, an example in which the low beam lamp unit 62 is used as another (second) vehicular lamp unit whose side surface is covered by the vehicular lamp unit 10 has been described, but

the present invention is not limited thereto. For example, the high beam lamp unit 61 may be used as the another vehicle lamp unit, or further another lamp unit may be used. For example, when the vehicular lamp unit of the present invention is applied to a tail lamp, a stop lamp or a back lamp may be used as the another vehicular lamp unit whose side surface is covered by the vehicular lamp unit 10.

[0151] In the foregoing embodiments, an example in which the bracket 40, the first extension 50 and the second extension 52 are used has been described, but the present invention is not limited thereto. For example, at least one of the bracket 40, the first extension 50 and the second extension 52 may be omitted.

[0152] In the foregoing embodiments, the radius of curvature of the plate-shaped light guide portion 34 differs between the rear end portion BE_{34} side and the front end portion FE_{34} side, but the present invention is not limited thereto. For example, the radius of curvature of the plate-shaped light guide portion 34 may be the same on the rear end portion BE_{34} side and the front end portion FE_{34} side.

[0153] Next, a modified example of the first neck portion NP1 (also the second neck portion NP2) will be described.

[0154] FIGS. 27 and 28 are diagrams showing modified examples of the first neck portion NP1.

[0155] In the foregoing embodiments, as shown in FIG. 25, the thickness T4 of the first neck portion NP1 linearly and gradually increases from the rear end portion BE_{33a} to the front end portion FE_{33a} of the first rod-shaped light guide portion 33a, but the present invention is not limited thereto. For example, as shown in FIG. 27(a), the thickness T4 of the first neck portion NP1 may gradually increase in a curved manner from the rear end portion BE_{33a} of the first rod-shaped light guide portion 33a toward the front end portion FE_{33b} .

[0156] In the foregoing embodiments, the first neck portion NP1 is formed by forming the first groove portion GV1 in the front surface FS_{34} of the first end rim portion EG1 of the plate-shaped light guide portion 34, but the present invention is not limited thereto. For example, as shown in FIG. 27(b), the first neck portion NP1 may be formed by forming the first groove portion GV1 in the rear surface RS_{34} of the first end rim portion EG1 of the plate-shaped light guide portion 34. Further, as shown in FIG. 28(a), the first neck portion NP1 may be formed by forming the first groove portion GV1 in the front surface FS_{34} and also in the rear surface RS_{34} of the first end rim portion EG1 of the plate-shaped light guide portion 34, respectively.

[0157] Furthermore, as shown in FIG. 28(a), the area in which the first neck portion NP1 is provided may differ between the front surface FS_{34} and the rear surface RS_{34} of the first end rim portion EG1 of the plate-shaped light guide portion 34, or may be the same between the front surface FS_{34} and the rear surface RS_{34} of the first end rim portion EG1 of the plate-shaped light guide portion

34, as shown in FIG. 28(b). In FIG. 28(a), the first neck portion NP1 is provided in an area A6 of the front surface FS_{34} of the first end rim portion EG1 of the plate-shaped light guide portion 34, and is also provided in an area A13 of the rear surface RS_{34} . In FIG. 28(b), the first neck portion NP1 is provided in the area A6 of the front surface FS_{34} and the rear surface RS_{34} of the first end rim portion EG1 of the plate-shaped light guide portion 34.

[0158] FIGS. 29(a) to 29(c) are other examples of the first groove portion GV1 formed on the first end rim portion EG1 of the plate-shaped light guide portion 34.

[0159] The first groove portion GV1 (also the second groove portion GV2) may be a groove portion having a concave cross section (for example, a groove portion having a concave cross section; see FIG. 29(a)), a groove portion having a linear cross section (for example, a groove portion having a straight line in cross section; see FIG. 29(b)), or a concave portion having a convex shape in cross section (for example, a groove portion having a convex curved line in cross section).

[0160] Considering the mold releasability (moldability) at the time of injection molding of the light guide body 30, it is preferable that the first groove GV1 (and the second groove GV2) is a groove (see FIG. 29(a)) having a concave shape in cross section.

[0161] Next, a modified example of the light guide body 30 (hereinafter referred to as a light guide body 30A) will be described.

[0162] FIG. 17 is a side view of the light guide body 30A, FIG. 18 is an opposite side view thereof, and FIG. 19 is a front view thereof. FIG. 20 is a cross-sectional view of the light guide body 30A taken along line A-A shown in FIG. 17. FIG. 21 is a cross-sectional view of the light guide body 30A taken along line B-B shown in FIG. 17.

[0163] As shown in FIGS. 17 to 21, the light guide body 30A includes a light incident portion 31A, a first reflection surface 32Aa, a second reflection surface 32Ab, a first rod-shaped light guide portion 33Aa, a second rod-shaped light guide portion 33Ab and a plate-shaped light guide portion 34A. The material of the light guide body 30A is, for example, a transparent resin such as an acrylic or polycarbonate resin.

[0164] First, the light incident portion 31A will be described.

[0165] As shown in FIG. 21, the light incident portion 31A is a light incident portion that collimates light RayA from the light source 21A entering the light guide body 30A from the light incident portion 31A, and is disposed on the front surface FS_{30A} of the light guide body 30A in the vicinity of the rear end BE_{33Aa} of the first rod-shaped light guide portion 33Aa (see FIG. 17). The light incident portion 31A may have any configuration as long as it can collimate the light RayA from the light source 21A. The optical axis AX_{31A} of the light incident portion 31A extends in a direction substantially orthogonal to the front surface FS_{30A} of the light guide body 30A.

[0166] Next, the light source 21A will be described.

[0167] As shown in FIG. 21, the light source 21A is mounted on the substrate 20A. The light source 21A is a semiconductor light emitting element such as an LED that emits white light. The light source 21A has a light emitting surface EF_{21A} , for example, a rectangular light emitting surface of 1mm square.

[0168] The substrate 20A is, for example, a metal substrate made of aluminum or the like, and is fixed to the light guide body 30A by screwing in a state in which the light source 21A faces the light incident portion 31A.

[0169] The optical axis AX_{21A} of the light source 21A coincides with the optical axis AX_{31A} of the light incident portion 31A. The optical axis AX_{31A} of the light incident portion 31A extends through the center of the light emitting surface EF_{21A} in a direction orthogonal to the light emitting surface EF_{21A} . The light source 21A emits light Ray1A and light Ray 2A. The light Ray 1A enters the light guide body 30A from the light incident portion 31A, is internally reflected by the first reflection surface 32Aa and travels in the first rod-shaped light guide portion 33Aa toward the front end portion FE_{33Aa} of the first rod-shaped light guide portion 33Aa. The light Ray2A enters the light guide body 30A from the light incident portion 31A, is internally reflected by the second reflection surface 32Ab and travels in the second rod-shaped light guide portion 33Ab toward the front end portion FE_{33Ab} of the second rod-shaped light guide portion 33Ab.

[0170] Next, the first reflection surface 32Aa and the second reflection surface 32Ab will be described.

[0171] As shown in FIG. 21, the first reflection surface 32Aa is a planar reflection surface and is arranged on the optical path of the light RayA from the light source 21A collimated by the light incident portion 31A. Specifically, the first reflecting surface 32Aa is disposed in an attitude inclined by 45 degrees with respect to the optical axis AX_{31A} of the light incident portion 31A so that the light Ray1A internally reflected by the first reflecting surface 32Aa enters the first rod-shaped light guide portion 33Aa from the rear end portion BE_{33Aa} of the first rod-shaped light guide portion 33Aa and travels upward thereinside.

[0172] The second reflecting surface 32Ab is a planar reflecting surface and is arranged on the optical path of the light Ray2A from the light source 21A collimated by the light incident portion 31A. Specifically, the second reflecting surface 32Ab is disposed in an attitude inclined by 45 degrees with respect to the optical axis AX_{31A} of the light incident portion 31A so that the light Ray2A internally reflected by the second reflecting surface 32Ab enters the second rod-shaped light guide portion 33Ab from the rear end portion BE_{33Ab} of the second rod-shaped light guide portion 33Ab and travels downward thereinside.

[0173] Next, the first rod-shaped light guide portion 33Aa and the second rod-shaped light guide portion 33Ab will be described.

[0174] As shown in FIG. 17, the first rod-shaped light guide portion 33Aa and the second rod-shaped light

guide portion 33Ab are juxtaposed with each other with a space therebetween.

[0175] The first rod-shaped light guide portion 33Aa is configured to linearly extend from the rear end portion BE_{33Aa} toward the front end portion FE_{33Aa} via a curved portion CR1A. The first rod-shaped light guide portion 33Aa guides the light Ray1A from the light source 21A internally reflected by the first reflecting surface 32Aa from the rear end portion BE_{33Aa} toward the front end portion FE_{33Aa}.

[0176] The second rod-shaped light guide portion 33Ab is configured to linearly extend from the rear end portion BE_{33Ab} toward the front end portion FE_{33Ab} via a curved portion CR2A. The second rod-shaped light guide portion 33Ab guides the light Ray2A from the light source 21A internally reflected by the second reflecting surface 32Ab from the rear end portion BE_{33Ab} toward the front end portion FE_{33Ab}.

[0177] FIG. 22 is a cross-sectional view of the light guide body 30A taken along line C-C shown in FIG. 17, and FIG. 23 is a cross-sectional view taken along line D-D.

[0178] As shown in FIGS. 22 and 23, the cross sections of the first rod-shaped light guide portion 33Aa and the second rod-shaped light guide portion 33Ab are substantially circular. The thickness T1 (diameter) of the first rod-shaped light guide portion 33Aa is, for example, 5 mm. The thickness T2 (diameter) of the second rod-shaped light guide portion 33Ab is, for example, 5 mm.

[0179] FIG. 24 is a diagram showing optical paths of light entering the plate-shaped light guide portion 34A from the first rod-shaped light guide portion 33Aa and the second rod-shaped light guide portion 33Ab.

[0180] As shown in FIG. 24, the light Ray1 A from the light source 21A guided in the first rod-shaped light guide portion 33Aa enters the plate-shaped light guide portion 34A (see the obliquely downward arrows in FIG. 24). Although not shown, light in various directions other than the light indicated by the respective obliquely downward arrows from the first rod-shaped light guide portion 33Aa also enters the plate-shaped light guide portion 34A.

[0181] The light Ray2A from the light source 21A guided in the second rod-shaped light guide portion 33Ab enters the plate-shaped light guide portion 34A (see the obliquely upward arrows in FIG. 24). Although not shown, light in various directions other than the light indicated by the respective obliquely upward arrows from the second rod-shaped light guide portion 33Ab also enters the plate-shaped light guide portion 34A.

[0182] Since the first rod-shaped light guide portion 33Aa and the second rod-shaped light guide portion 33Ab are symmetric with each other in the vertical direction (see FIG. 24), the optical paths of the light entering the plate-shaped light guide portion 34A from the first rod-shaped light guide portion 33Aa (see the respective obliquely downward arrows in FIG. 24) and the optical paths of the light entering the plate-shaped light guide portion 34A from the second rod-shaped light guide por-

tion 33Ab (see the respective obliquely upward arrows in FIG. 24) are vertically symmetric. Therefore, the light guide body 30A of the present modified example is not provided with a correction cut LC1.

[0183] Next, the plate-shaped light guide portion 34A will be described.

[0184] As shown in FIG. 17, the plate-shaped light guide portion 34A is disposed between the first rod-shaped light guide portion 33Aa and the second rod-shaped light guide portion 33Ab.

[0185] The plate-shaped light guide portion 34A is a flat plate-shaped lens body extending from the rear end portion BE_{34A} toward the front end portion FE_{34A}, as shown in FIGS. 19, 22, and 23.

[0186] The plate-shaped light guide portion 34A includes a front surface FS_{34A} disposed on the front side of the vehicular lamp unit and a rear surface RS_{34A} disposed on the back side opposite to the front side.

[0187] The front surface FS_{34A} of the plate-shaped light guide portion 34A is subjected to a graining treatment (provided with a grain surface E). The grain surface E includes a plurality of minute irregularities and is provided to the hatched area A8 in FIG. 17. The grain surface E is provided mainly for the purpose of allowing a viewer to visually recognize that the plate-shaped light guide portion 34A projects light uniformly.

[0188] The rear surface RS_{34A} of the plate-shaped light guide portion 34A includes a plurality of structures LC2A. The structures LC2 are configured to diffuse light from the light source 21A entering the plate-shaped light guide portion 34A from the first rod-shaped light guide portion 33Aa and the second rod-shaped light guide portion 33Ab, respectively, and cause the light to exit from the front surface FS_{34A} of the plate-shaped light guide portion 34A. The structures LC2A are provided to the hatched area A9 in FIG. 18.

[0189] The structures LC2A are dot-shaped lens cuts similar to those shown in FIG. 13. Hereinafter, the structure LC2A is referred to as a dot cut LC2A as appropriate.

[0190] The dot cuts LC2 are randomly arranged in the same manner as shown in FIG. 14 or FIG. 15. As a result, it is possible to suppress the moire from being visually recognized through the plate-shaped light guide portion 34A when the light source 21A is turned off.

[0191] The thickness T3 (basic thickness; see FIGS. 22 and 23) of the plate-shaped light guide portion 34A is, for example, 3.5 mm.

[0192] As shown in FIG. 18, the plate-shaped light guide portion 34A includes a first end rim portion EG1A connected to the outer peripheral surface of the first rod-shaped light guide portion 33Aa and a second end rim portion EG2A connected to the outer peripheral surface of the second rod-shaped light guide portion 33Ab.

[0193] The first end rim portion EG1A of the plate-shaped light guide portion 34A includes a first wall thickness gradual-change portion NP1A. The first wall thickness gradual-change portion NP1A is a portion having a thickness smaller than that of the plate-shaped light guide

portion 34A (thickness T3) other than the first end rim portion EG1A of the plate-shaped light guide portion 34A. Hereinafter, the first wall thickness gradual-change portion NP1A is referred to as a first neck portion NP1A. Similarly, the second end rim portion EG2A of the plate-shaped light guide portion 34A includes a second wall thickness gradual-change portion NP2A. The second wall thickness gradual-change portion NP2A is a portion having a thickness smaller than that of the plate-shaped light guide portion 34A (thickness T3) other than the second end rim portion EG2A of the plate-shaped light guide portion 34A. Hereinafter, the second wall thickness gradual-change portion NP2A is referred to as a second neck portion NP2A.

[0194] As shown in FIG. 22, the first neck portion NP1A is a thin portion formed by forming a first groove portion GV1A in the rear surface RS_{34A} of the first end rim portion EG1A of the plate-shaped light guide portion 34A, and is configured to adjust the amount of light entering the plate-shaped light guide portion 34A from the first rod-shaped light guide portion 33Aa. The first neck portion NP1A and the first groove portion GV1A are provided in the area A10 in FIG. 18. Specifically, the first neck portion NP1A and the first groove portion GV1A are provided along the first rod-shaped light guide portion 33Aa in the area A10 in FIG. 18.

[0195] The area A10, in which the first neck portion NP1A and the first groove portion GV1A are provided, and the thickness T4 of the first neck portion NP1A are adjusted so that the amount of light entering the plate-shaped light guide portion 34A from the first rod-shaped light guide portion 33Aa becomes substantially uniform at respective positions between the rear end portion BE_{33Aa} and the front end portion FE_{33Aa} of the first rod-shaped light guide portion 33Aa. This adjustment can be performed using, for example, predetermined simulation software.

[0196] The thickness T4 of the first neck portion NP1A differs between the rear end portion BE_{33Aa} side and the front end portion FE_{33Aa} side of the first rod-shaped light guide portion 33Aa.

[0197] For example, the thickness T4 of the first neck portion NP1A on the rear end BE_{33Aa} side of the first rod-shaped light guide portion 33Aa is 2 mm. On the other hand, the thickness T4 of the first neck portion NP2A on the front end portion FE_{33Aa} side of the first rod-shaped light guide portion 33Aa is 3.5 mm. The thickness T4 of the first neck portion NP1A gradually increases from the rear end portion BE_{33Aa} of the first rod-shaped light guide portion 33Aa toward the front end portion FE_{33Aa} thereof. For example, the thickness T4 of the first neck portion NP1A linearly and gradually increases from the rear end portion BE_{33Aa} of the first rod-shaped light guide portion 33Aa to the front end portion FE_{33Aa}.

[0198] The adjustment of the thickness T4 of the first neck portion NP1A in this manner (gradual-change) can make the amount (light amount or intensity) of light entering the plate-shaped light guide portion 34A from the

first rod-shaped light guide portion 33Aa substantially uniform at respective positions between the rear end portion BE_{33Aa} and the front end portion FE_{33Aa} of the first rod-shaped light guide portion 33Aa. The reason for this is the same as the reason for gradually changing the thickness T4 of the first neck portion NP1 of the foregoing embodiments, and therefore the explanation thereof is omitted here.

[0199] As shown in FIG. 22, the second neck portion NP2A is a thin portion formed by forming a second groove portion GV2A in the rear surface RS_{34A} of the second end rim portion EG2A of the plate-shaped light guide portion 34A, and is configured to adjust the amount of light entering the plate-shaped light guide portion 34A from the second rod-shaped light guide portion 33Ab. The second neck portion NP2A and the second groove portion GV2A are provided in the area A11 in FIG. 18. Specifically, the second neck portion NP2A and the second groove portion GV2A are provided along the second rod-shaped light guide portion 33Ab in the area A11 in FIG. 18.

[0200] The area A11, in which the second neck portion NP2A and the second groove portion GV2A are provided, and the thickness T5 of the second neck portion NP2A are adjusted so that the amount of light entering the plate-shaped light guide portion 34A from the second rod-shaped light guide portion 33Ab becomes substantially uniform at respective positions between the rear end portion BE_{33Ab} and the front end portion FE_{33Ab} of the second rod-shaped light guide portion 33Ab. This adjustment can be performed using, for example, predetermined simulation software.

[0201] The thickness T5 of the second neck portion NP2A differs between the rear end portion BE_{33Ab} side and the front end portion FE_{33Ab} side of the second rod-shaped light guide portion 33Ab.

[0202] For example, the thickness T5 of the second neck portion NP2A on the rear end portion BE_{33Ab} of the second rod-shaped light guide portion 33Ab is 2 mm. On the other hand, the thickness T5 of the second neck portion NP2A on the front end FE_{33Ab} of the second rod-shaped light guide portion 33Ab is 3.5 mm. The thickness T5 of the second neck portion NP2A gradually increases from the rear end portion BE_{33Ab} to the front end portion FE_{33Ab} of the second rod-shaped light guide portion 33Ab. For example, the thickness T5 of the second neck portion NP2A linearly and gradually increases from the rear end portion BE_{33Ab} of the second rod-shaped light guide portion 33Ab to the front end portion FE_{33Ab}.

[0203] The adjustment of the thickness T5 of the second neck portion NP2A in this manner (gradual-change) can make the amount (light amount or intensity) of light entering the plate-shaped light guide portion 34A from the second rod-shaped light guide portion 33Ab substantially uniform at respective positions between the rear end portion BE_{33Ab} and the front end portion FE_{33Ab} of the second rod-shaped light guide portion 33Ab. The reason for this is the same as the reason for gradually chang-

ing the thickness T4 of the first neck portion NP1 of the foregoing embodiments, and therefore the explanation thereof is omitted.

[0204] The light guide body 30A of the present modified example can also achieve the same effect as the above-described embodiment.

Claims

1. A vehicular lamp unit (10) comprising a light guide body (30, 30A), and a light source (21a, 21b, 21A) configured to emit light guided in the light guide body (30, 30A), wherein
the light guide body (30, 30A) includes a first rod-shaped light guide portion (33a, 33Aa) configured to guide light from the light source (21a, 21A) from a proximal end (BE_{33a}) thereof to a distal end (FE_{33a}) thereof, a second rod-shaped light guide portion (33b, 33Ab) configured to guide light from the light source (21b, 21Ab) from a proximal end (BE_{33b}) thereof to a distal end (FE_{33b}) thereof, and a plate-shaped light guide portion (34, 34A) disposed between the first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab),
the first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab) are juxtaposed with each other with a space therebetween, the vehicular lamp unit being **characterized in that**
the plate-shaped light guide portion (34, 34A) includes a front surface (FS₃₄, FS_{34A}) disposed on a front side of the vehicular lamp unit and a rear surface (RS₃₄, RS_{34A}) disposed on a back side opposite to the front side, and also includes a first end rim portion (EG1, EG1A) configured to be connected to an outer peripheral surface of the first rod-shaped light guide portion (33a, 33Aa), and a second end rim portion (EG2, EG2A) configured to be connected to an outer peripheral surface of the second rod-shaped light guide portion (33b, 33Ab),
the rear surface (RS₃₄, RS_{34A}) of the plate-shaped light guide portion (34, 34A) includes a plurality of structures (LC2) configured to diffuse the light, which is emitted from the light source (21a, 21b, 21A) and enters the plate-shaped light guide portion (34, 34A) from the respective first and second rod-shaped light guide portions (33a, 33Aa, 33b, 33Ab), to cause the light to exit from the front surface (FS₃₄, FS_{34A}) of the plate-shaped light guide portion (34, 34A), and the first end rim portion (EG1, EG1A) and the second end rim portion (EG2, EG2A) of the plate-shaped light guide portion (34, 34A) each include a thin-walled portion (NP1, NP1A, NP2, NP2A) having a thickness thinner than a thickness of the plate-shaped light guide portion (34, 34A) other than the first and second end rim portions (EG1, EG1A, EG2,

EG2A).

2. The vehicular lamp unit (10) according to claim 1, **characterized in that** the structure (LC2) is a dot-shaped lens cut.
3. The vehicular lamp unit (10) according to claim 2, **characterized in that** the structures (LC2) are randomly arranged.
4. The vehicular lamp unit (10) according to any one of claims 1 to 3, **characterized in that** the plate-shaped light guide portion (34, 34A) is a curved plate-shaped light guide body.
5. The vehicular lamp unit (10) according to any one of claims 1 to 3, **characterized in that** the plate-shaped light guide portion (34, 34A) is a flat plate-shaped lens body.
6. The vehicular lamp unit (10) according to any one of claims 1 to 5, **characterized in that** the first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab) have a symmetrical shape.
7. The vehicular lamp unit (10) according to any one of claims 1 to 5, **characterized in that** the first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab) have an asymmetric shape.
8. The vehicular lamp unit (10) according to claim 7, **characterized in that** at least one of the first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab) includes a correction cut (LC1) configured to correct optical paths of the light that enters the plate-shaped light guide portion (34, 34A) from the at least one of the first rod-shaped light guide portion (33a, 33Aa) and the second rod-shaped light guide portion (33b, 33Ab) so that optical paths of the light that enters the plate-shaped light guide portion (34, 34A) from the first rod-shaped light guide portion (33a, 33Aa) and optical paths of the light that enters the plate-shaped light guide portion (34, 34A) from the second rod-shaped light guide portion (33b, 33Ab) are symmetrical with each other.
9. The vehicular lamp unit (10) according to any one of claims 1 to 8, **characterized in that** the light guide body (30, 30A) is disposed in a state where the light guide body (30, 30A) is inclined at a predetermined angle with respect to a reference axis extending in a front-rear direction of the vehicle in a top view so that the plate-shaped light guide portion is visually recognized from the front of the vehicle (34, 34A).

10. The vehicular lamp unit (10) according to any one of claims 1 to 9, **characterized by** further comprising a black or black-based color member which is visually recognized through the plate-shaped light guide portion (34, 34A). 5

11. A vehicular lamp **characterized by** comprising:

the vehicular lamp unit (10) according to any one of claims 1 to 10; and 10
a second vehicular lamp unit (62), wherein the vehicular lamp unit (10) is arranged in a state in which a rear surface of the light guide body (30, 30A) and a side surface of the second vehicular lamp unit (62) face each other. 15

12. The vehicular lamp according to claim 11, **characterized in that** the second vehicular lamp unit (62) is a lamp unit for a headlamp. 20

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FIG. 1

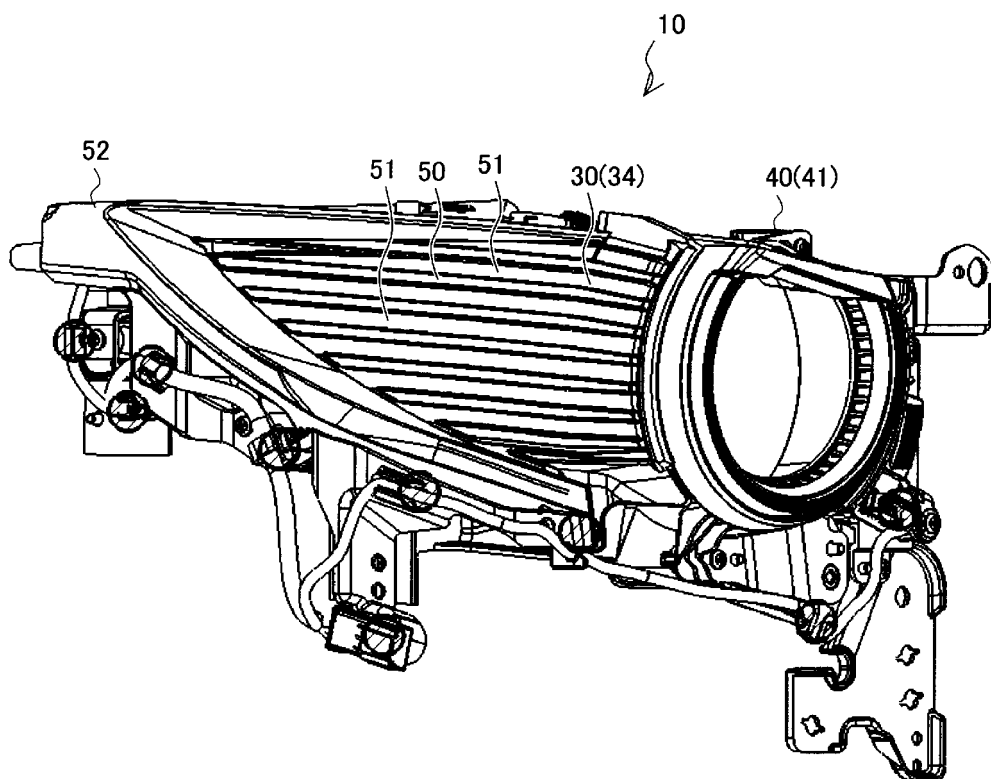


FIG. 2

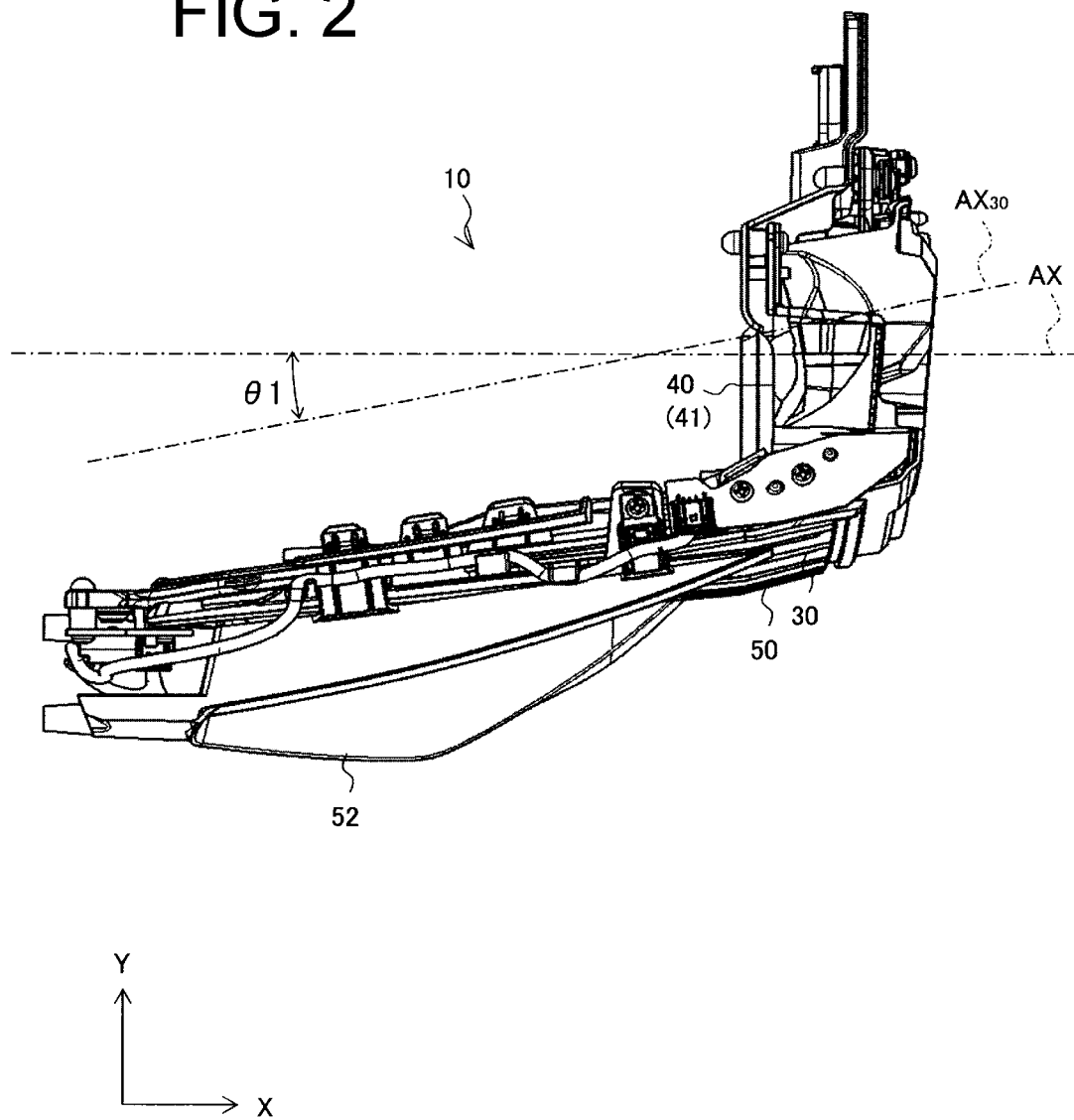
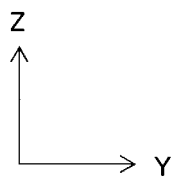
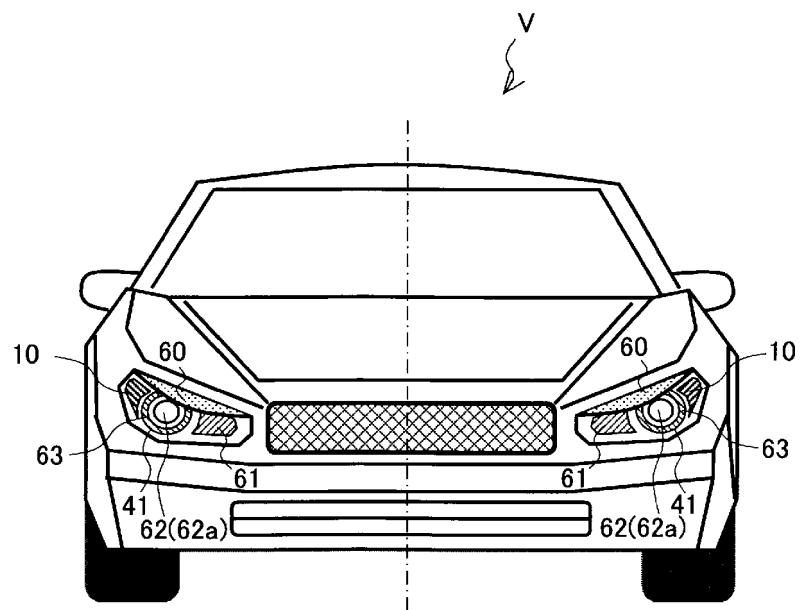


FIG. 3



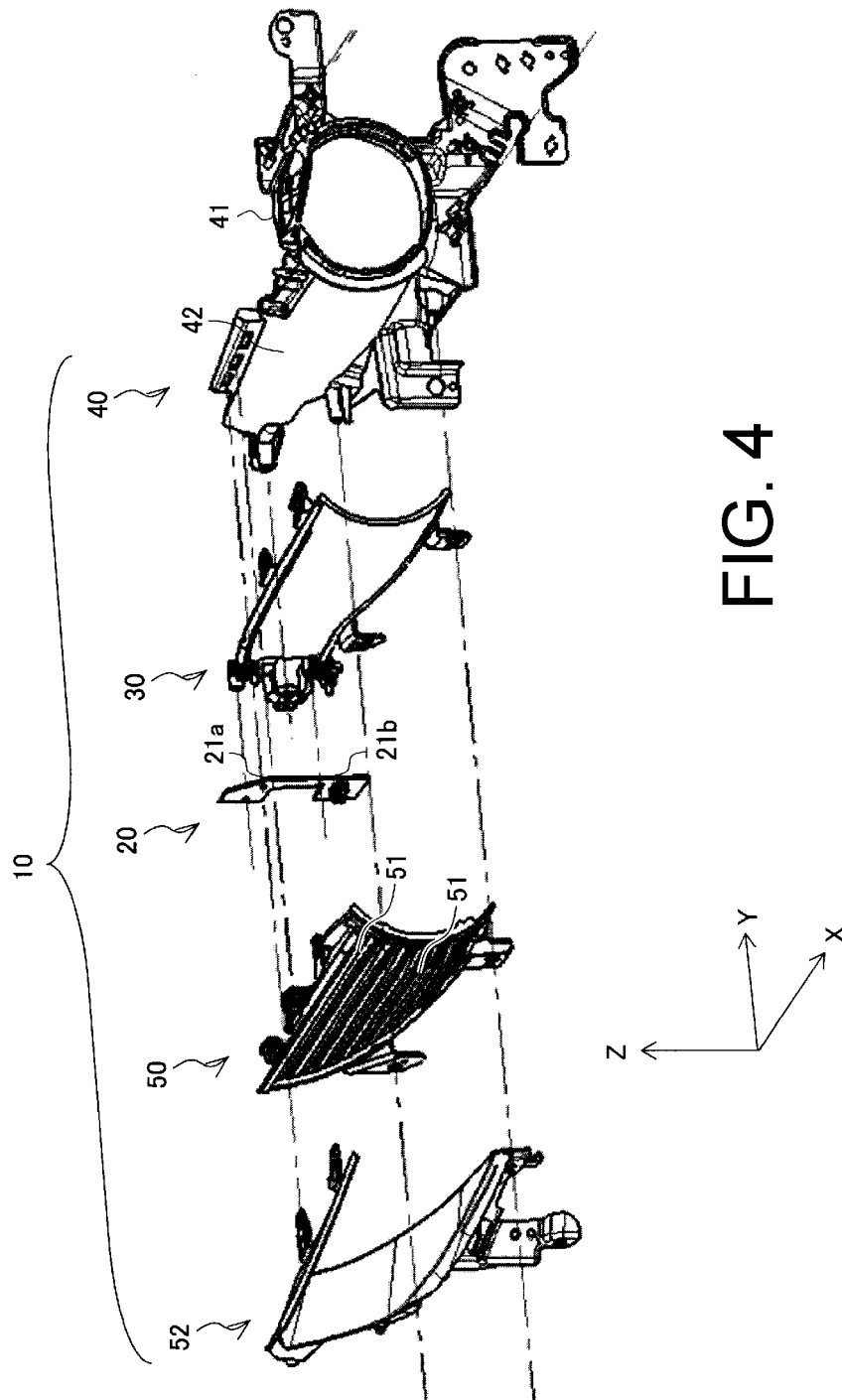


FIG. 4

FIG. 5

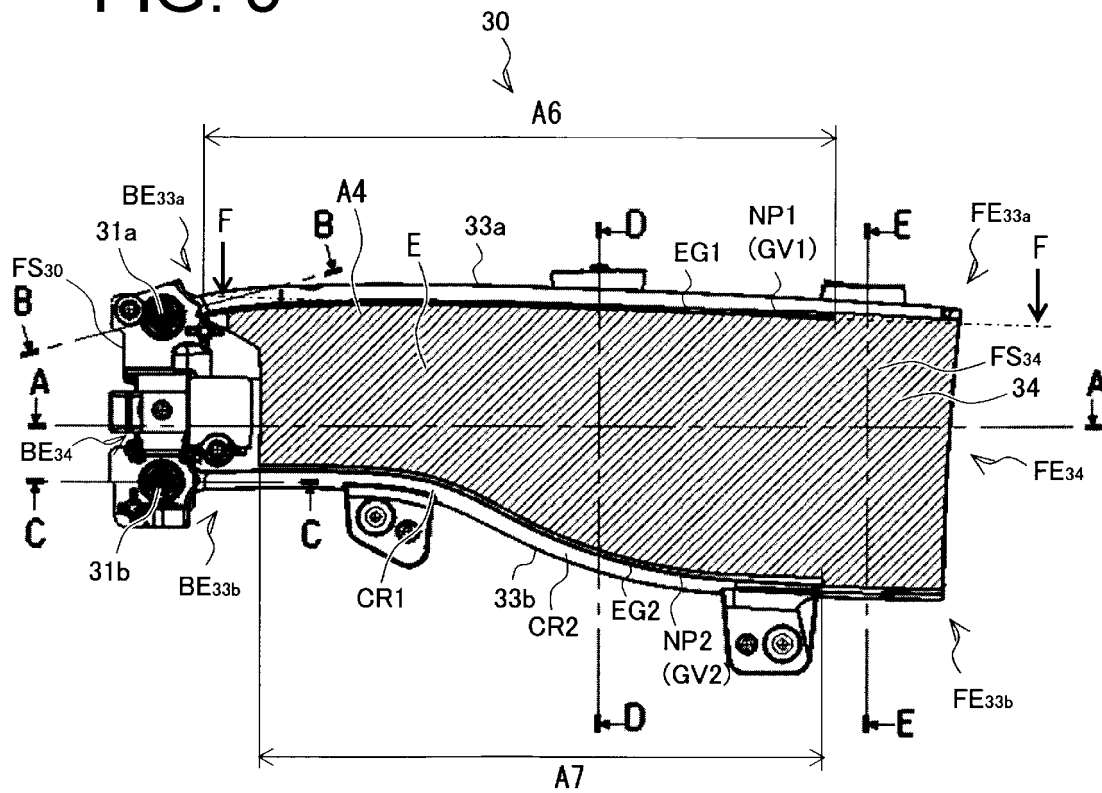


FIG. 6

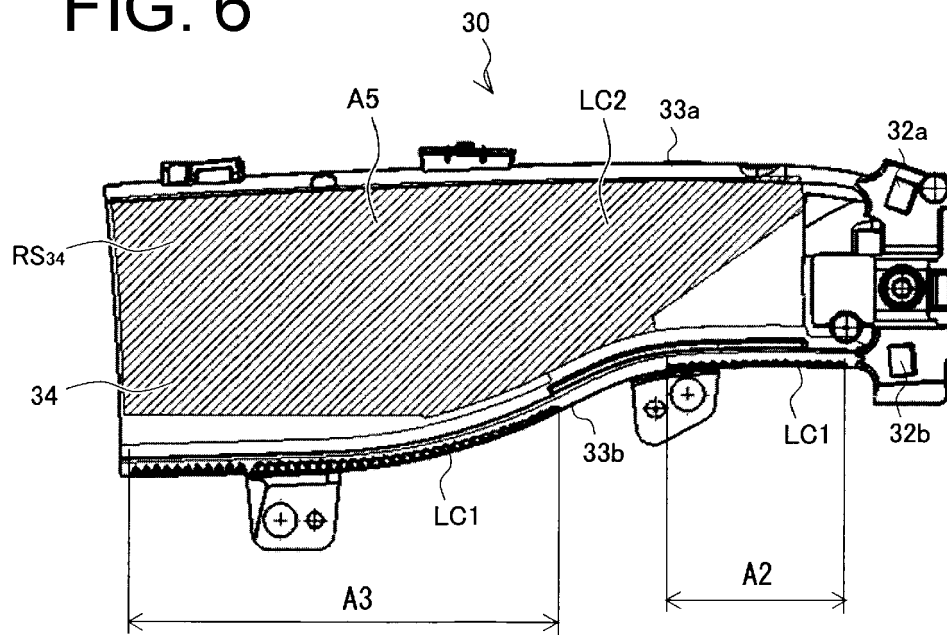


FIG. 7

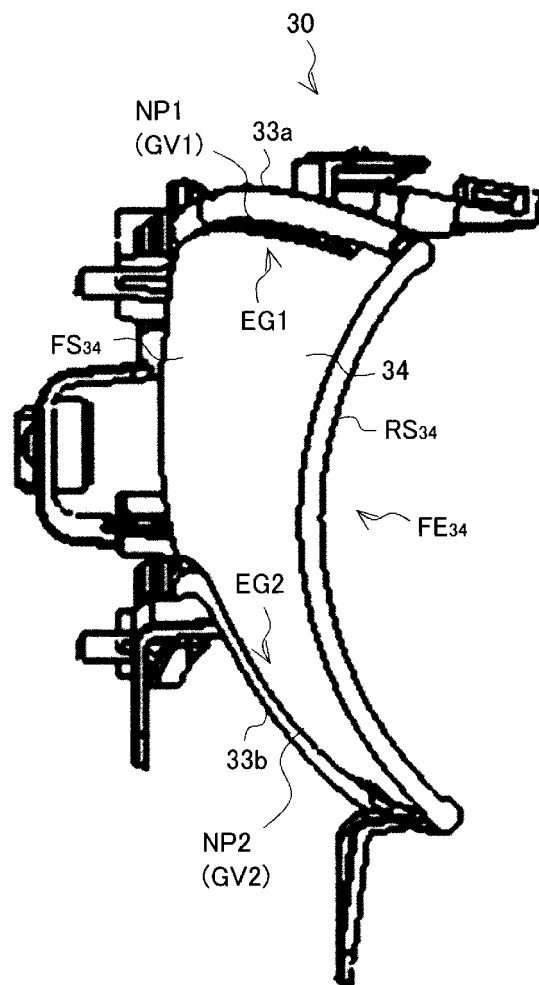


FIG. 8

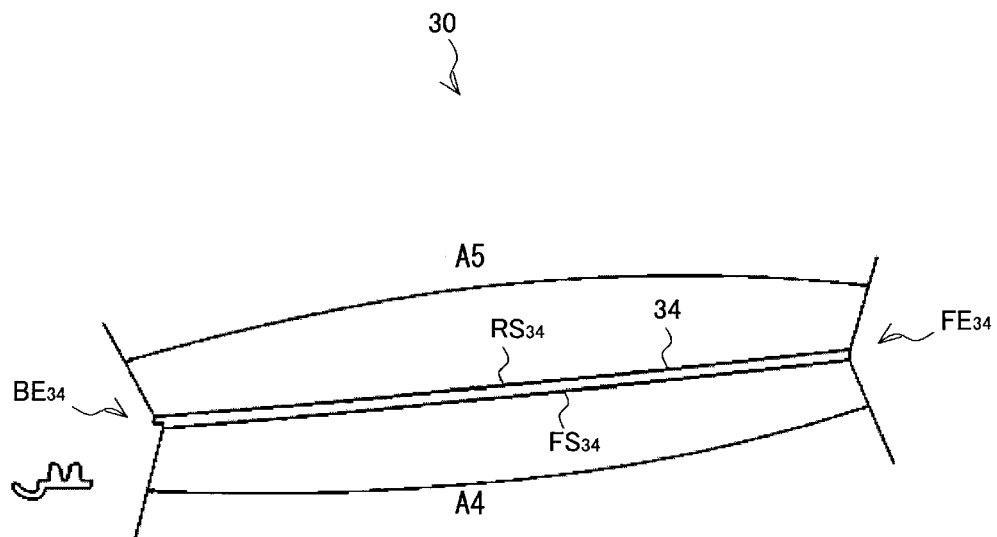
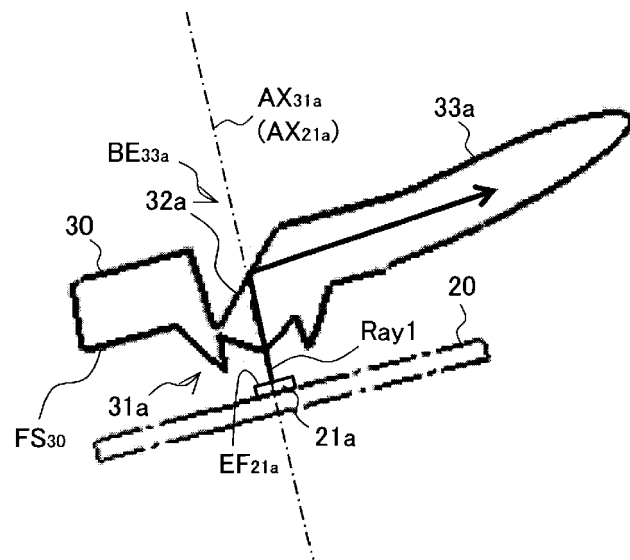


FIG. 9

(a)



(b)

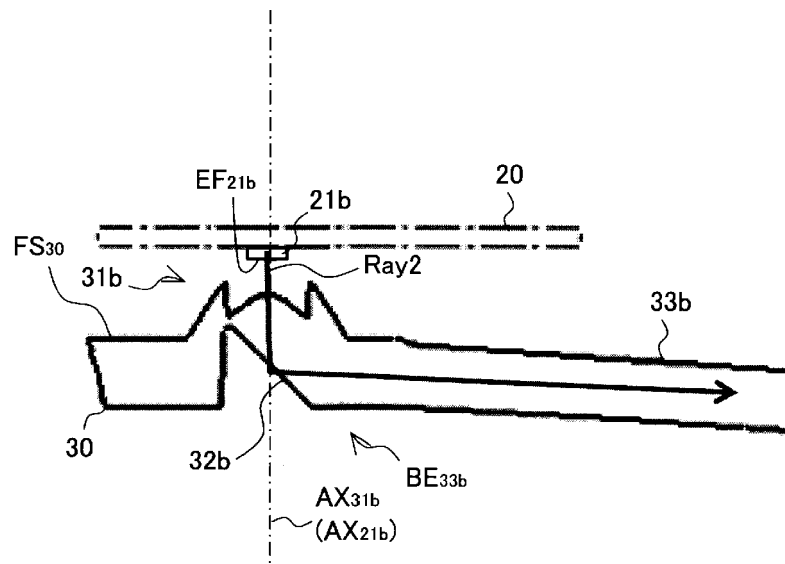


FIG. 10

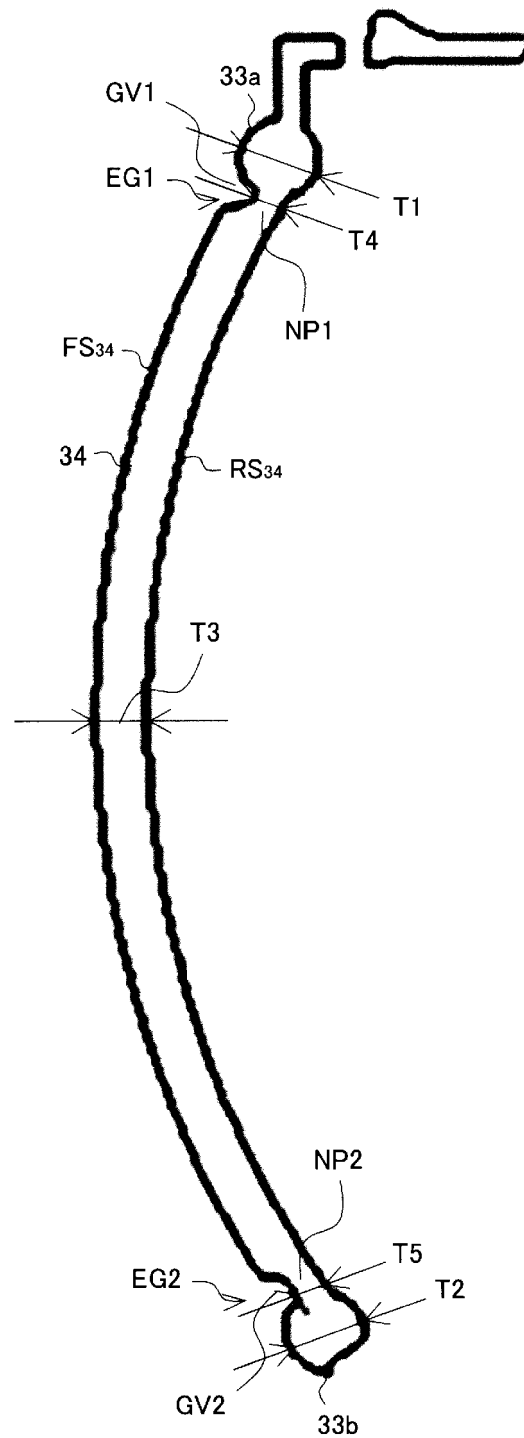


FIG. 11

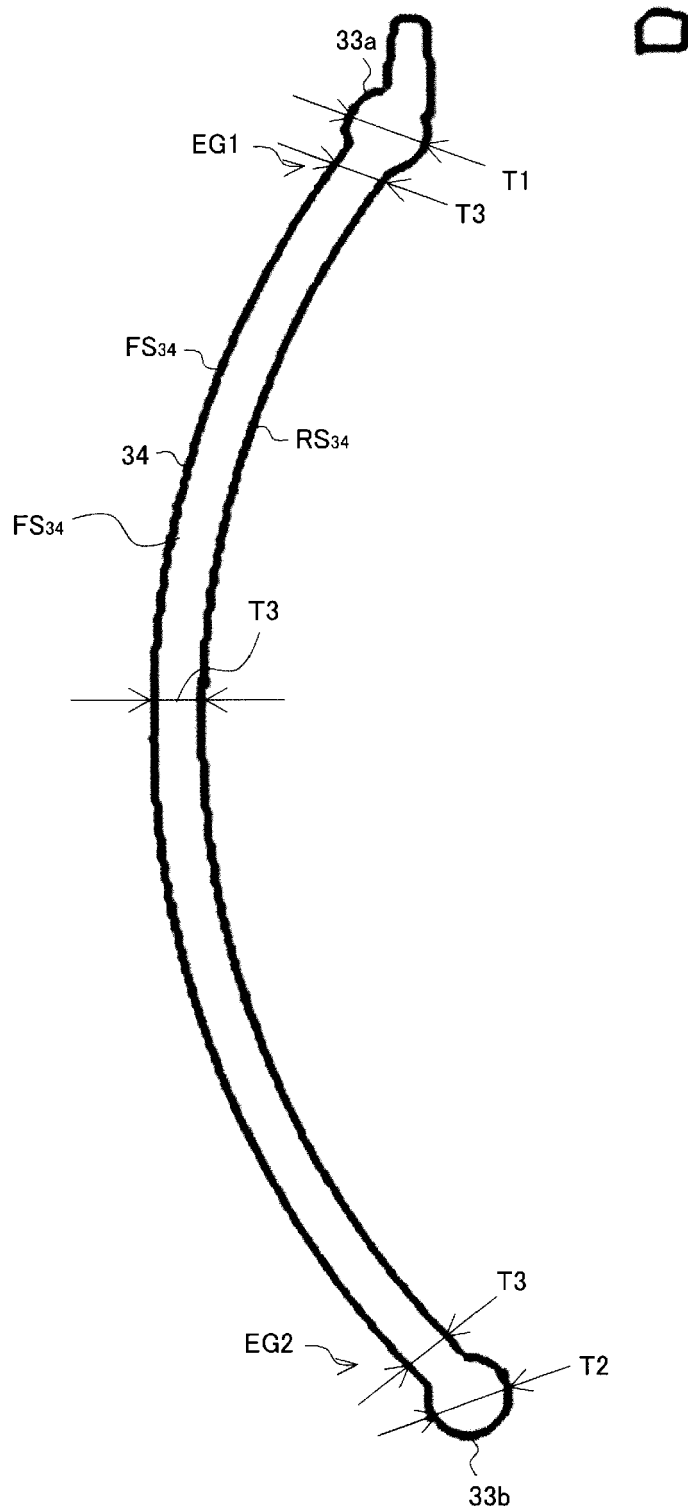


FIG. 12

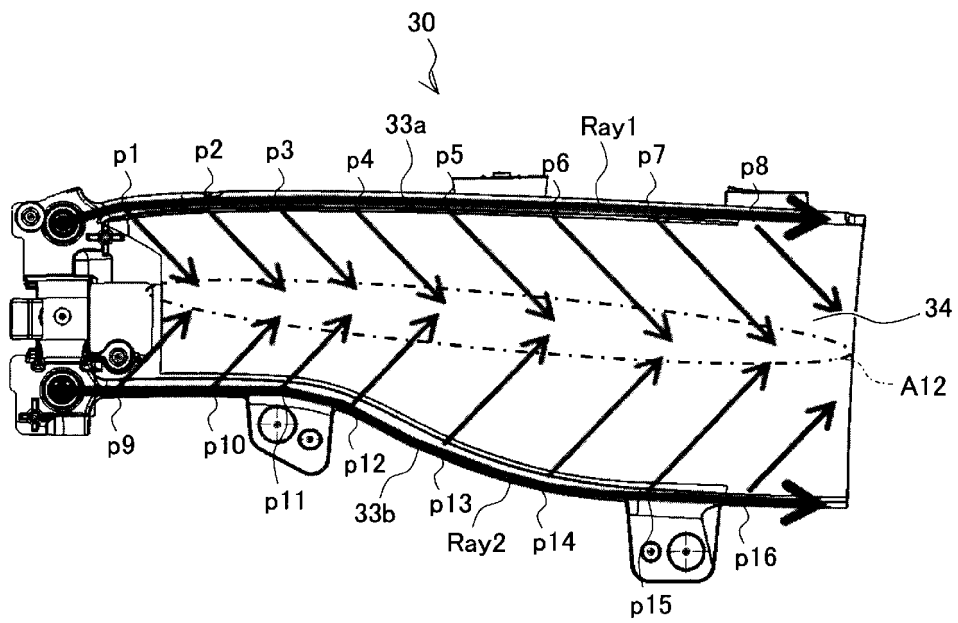


FIG. 13

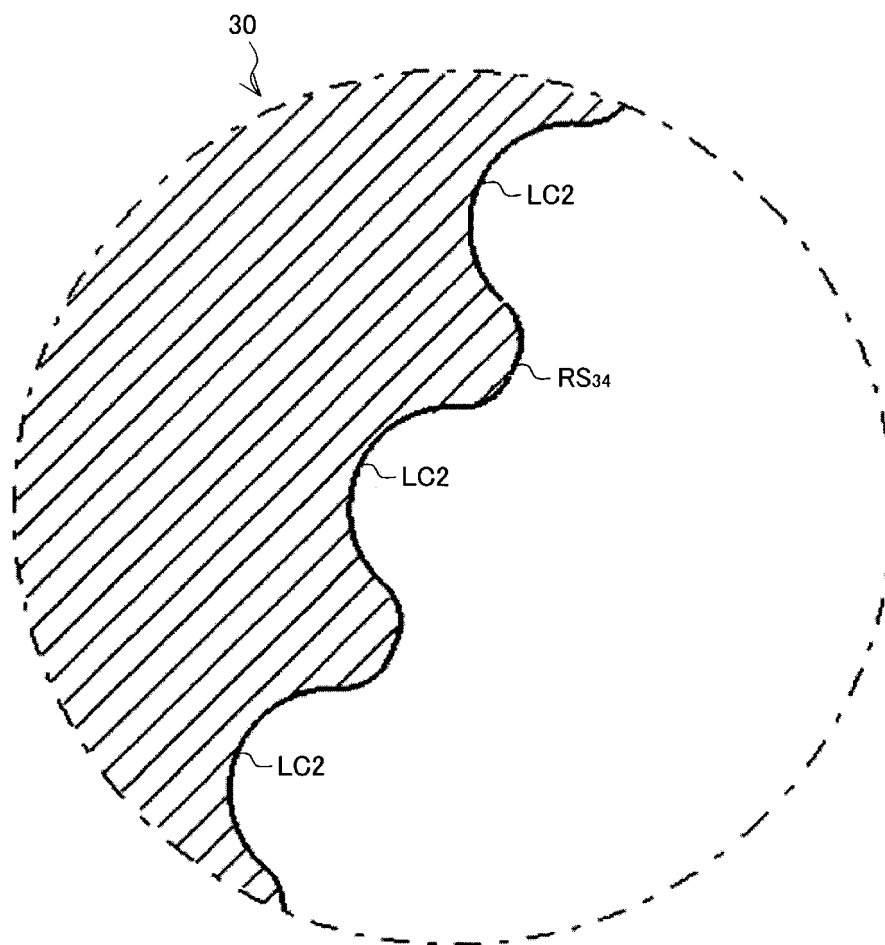
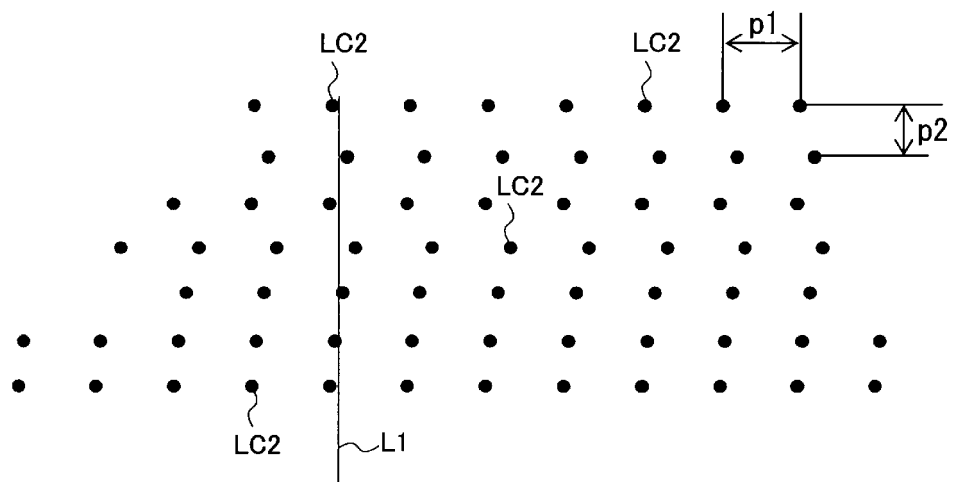
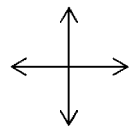


FIG. 14



Longitudinal Direction



Lateral Direction

FIG. 15

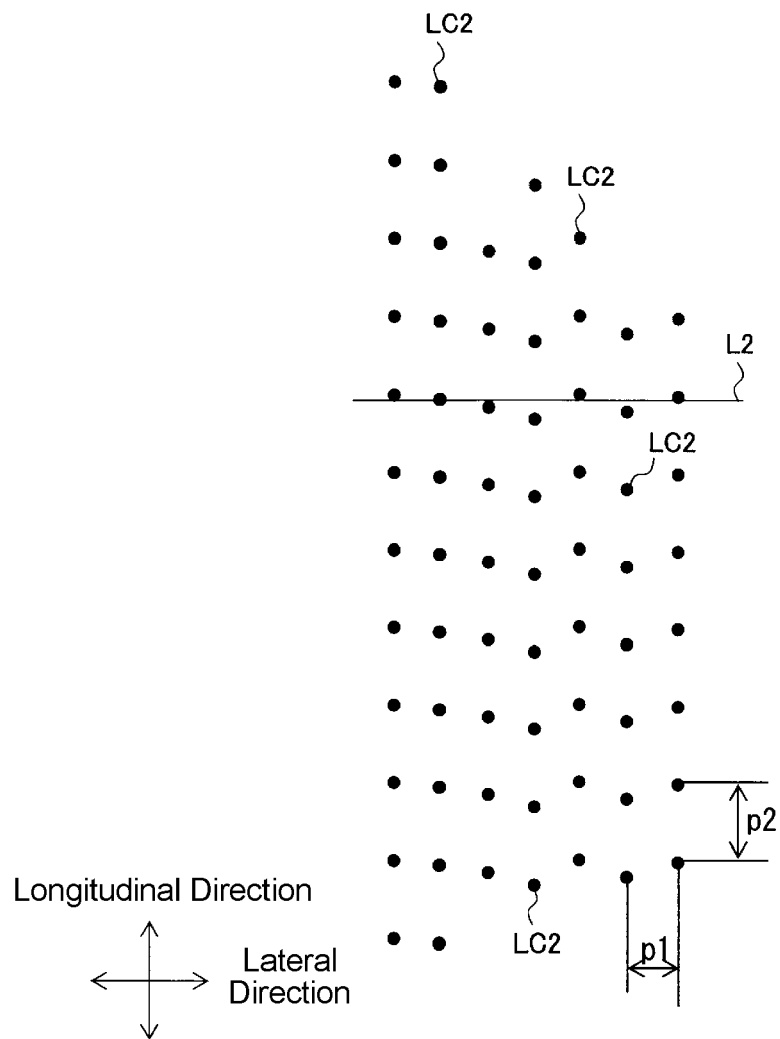
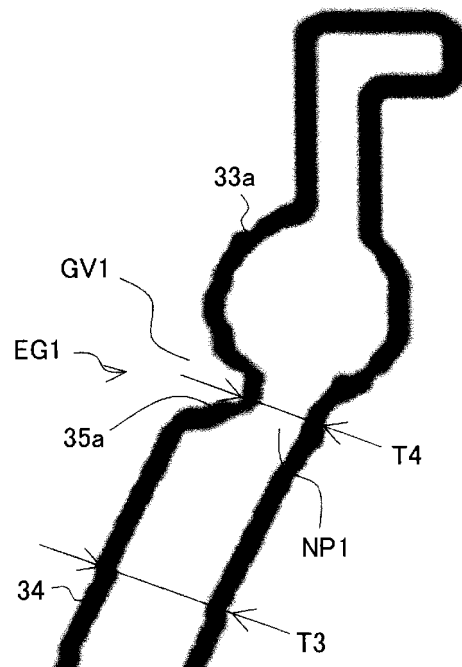


FIG. 16

(a)



(b)

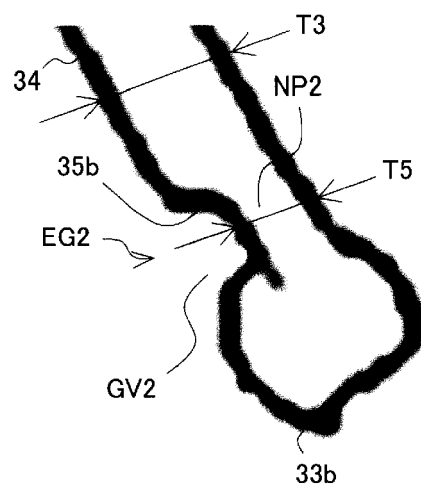


FIG. 17

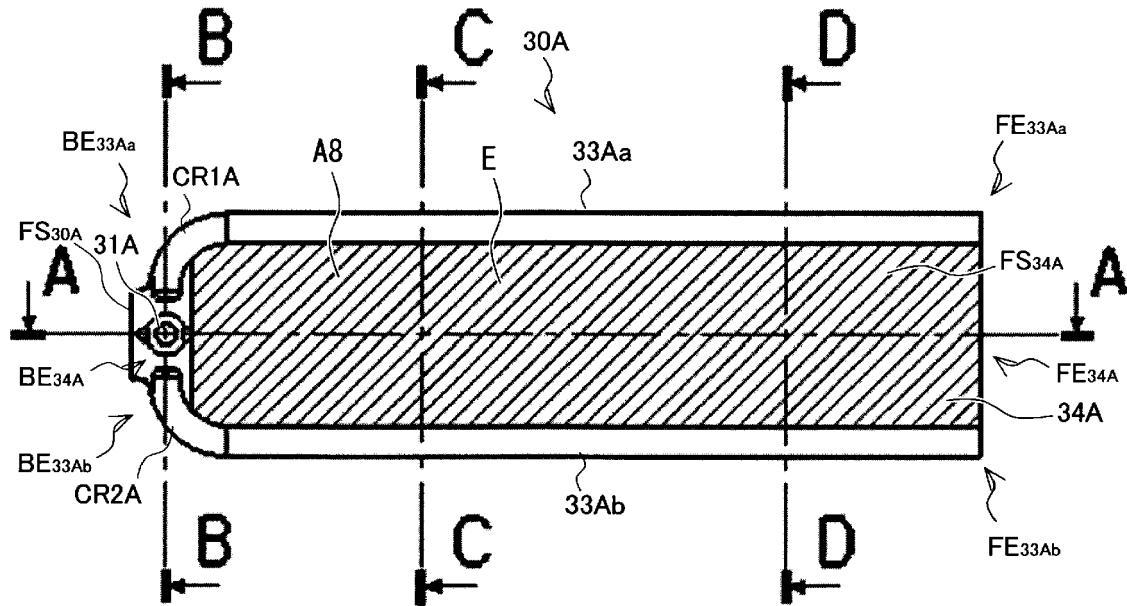


FIG. 18

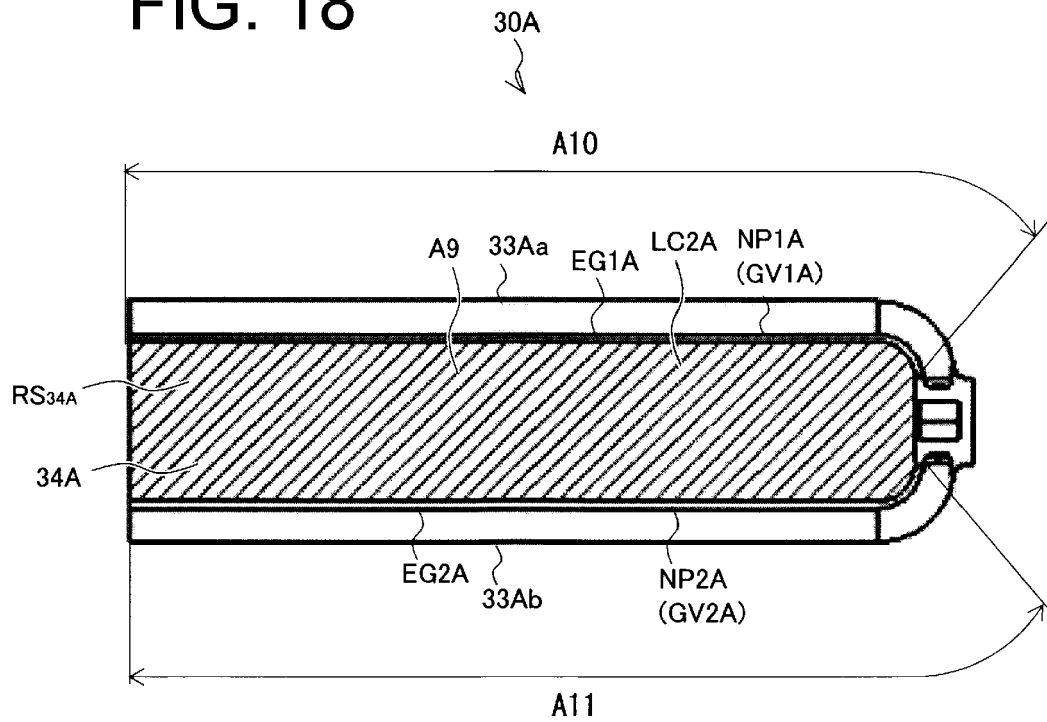


FIG. 19

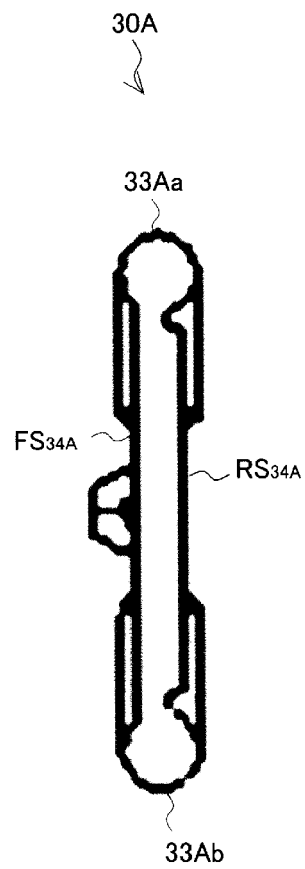


FIG. 20

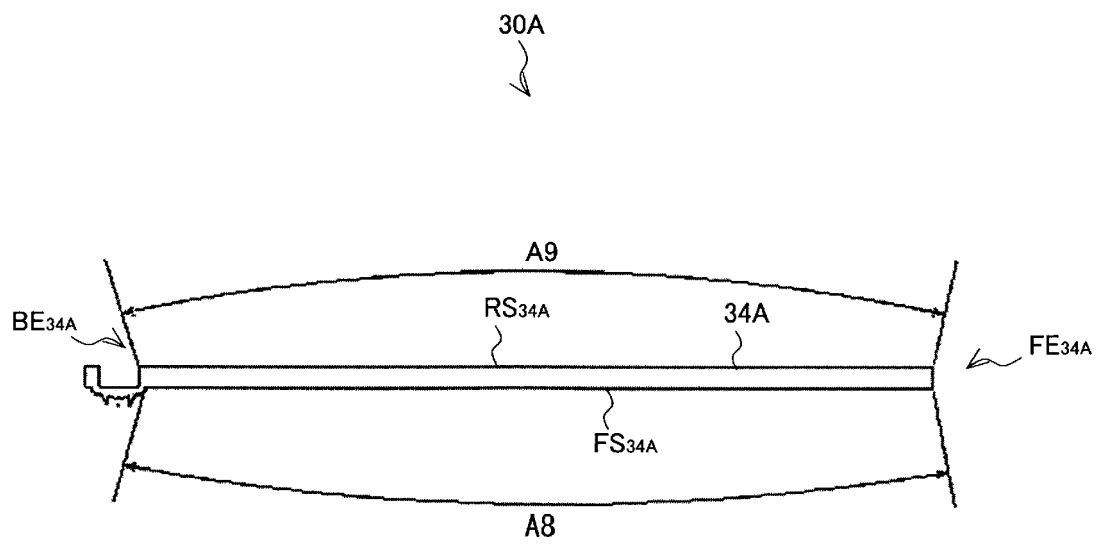


FIG. 21

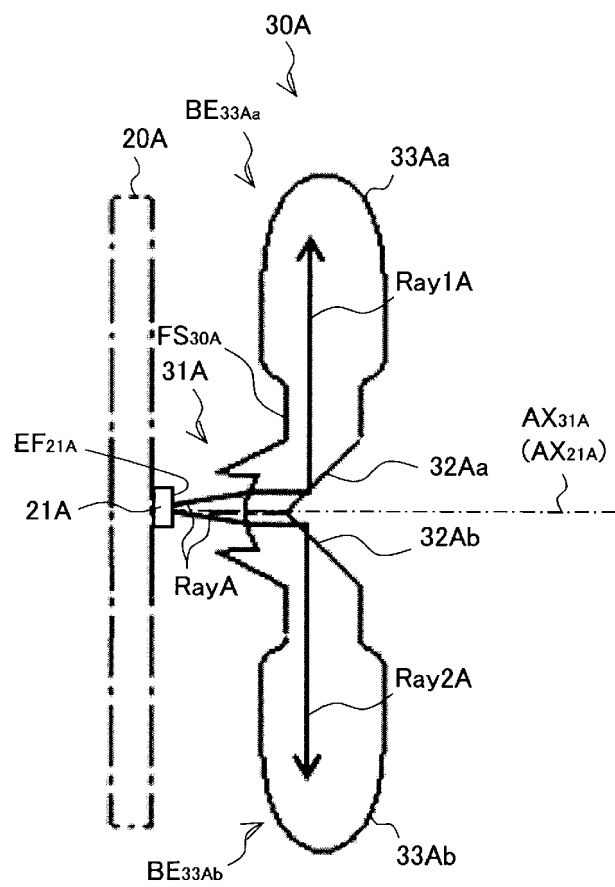


FIG. 22

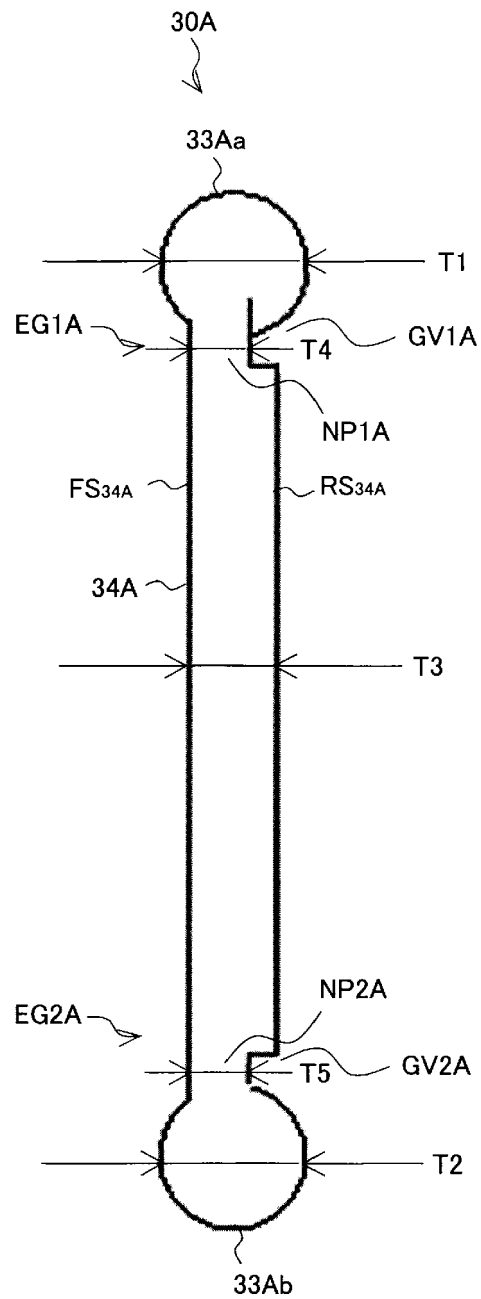


FIG. 23

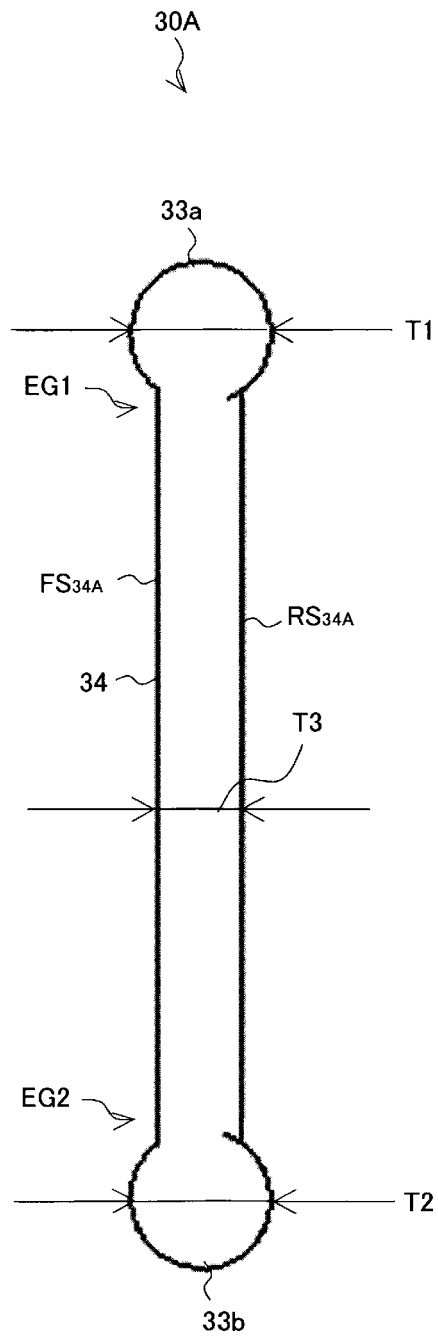


FIG. 24

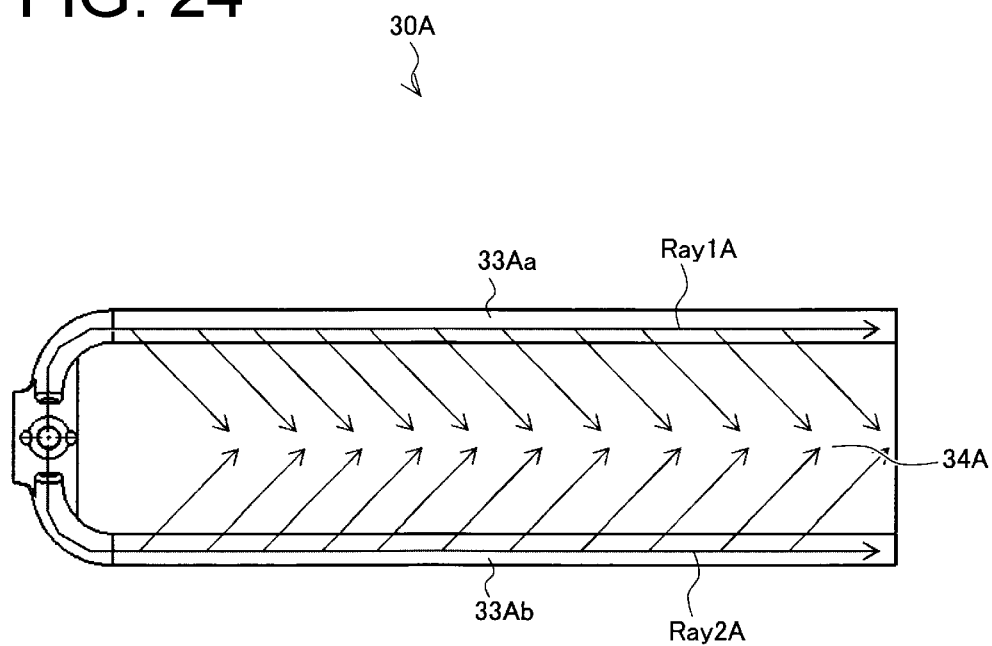


FIG. 25

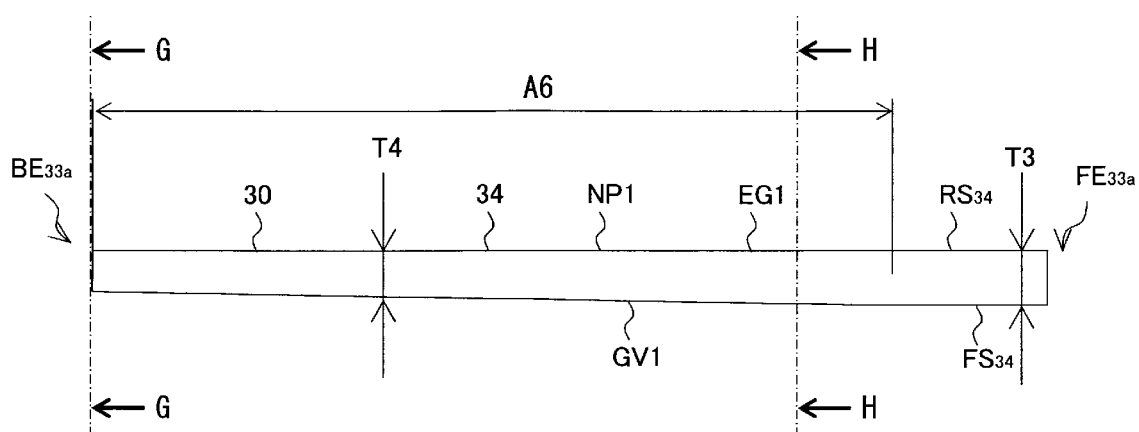
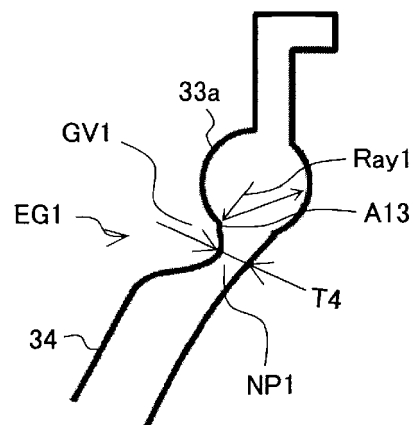


FIG. 26

(a)



(b)

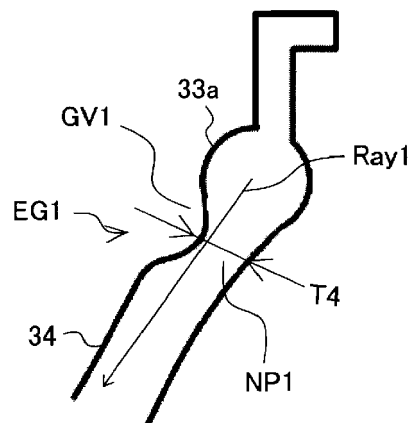
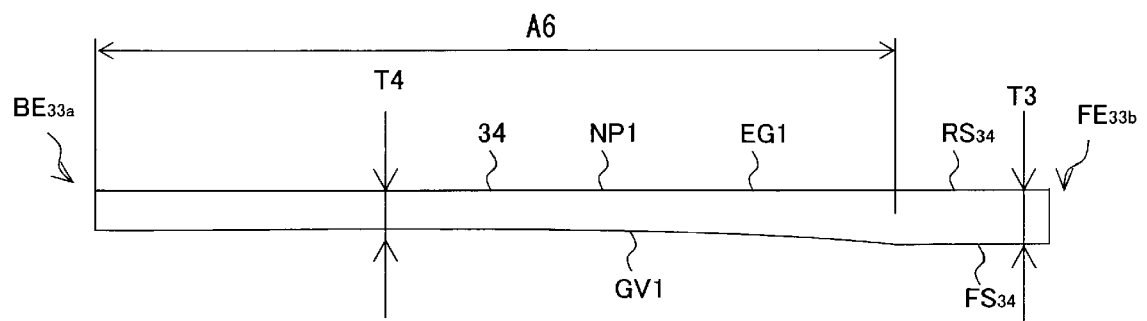


FIG. 27

(a)



(b)

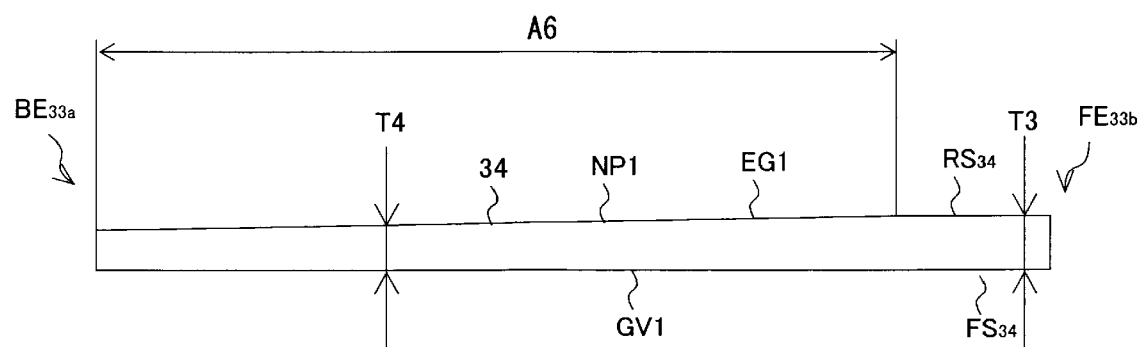
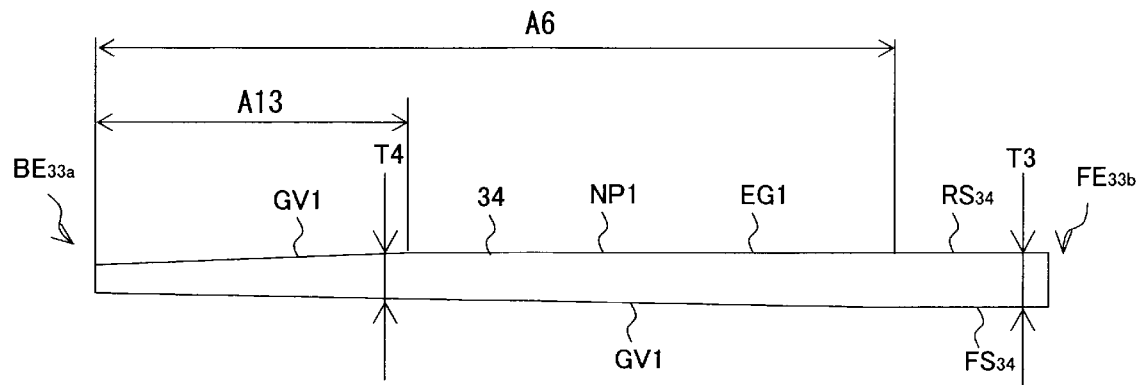


FIG. 28

(a)



(b)

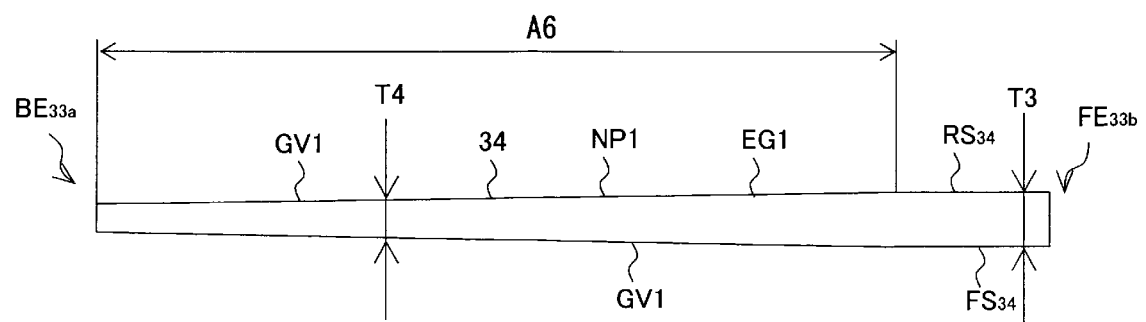
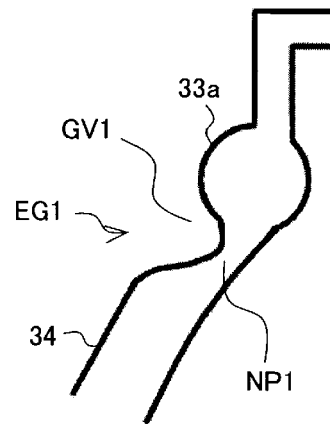
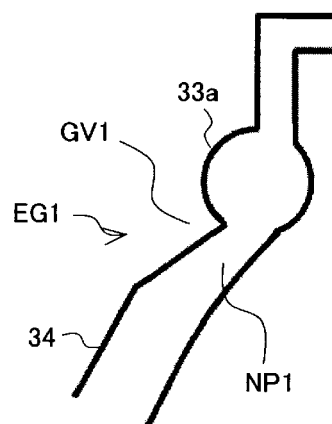


FIG. 29

(a)



(b)



(c)

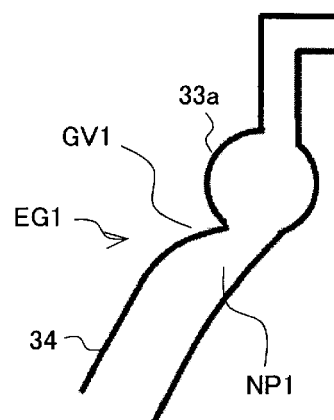
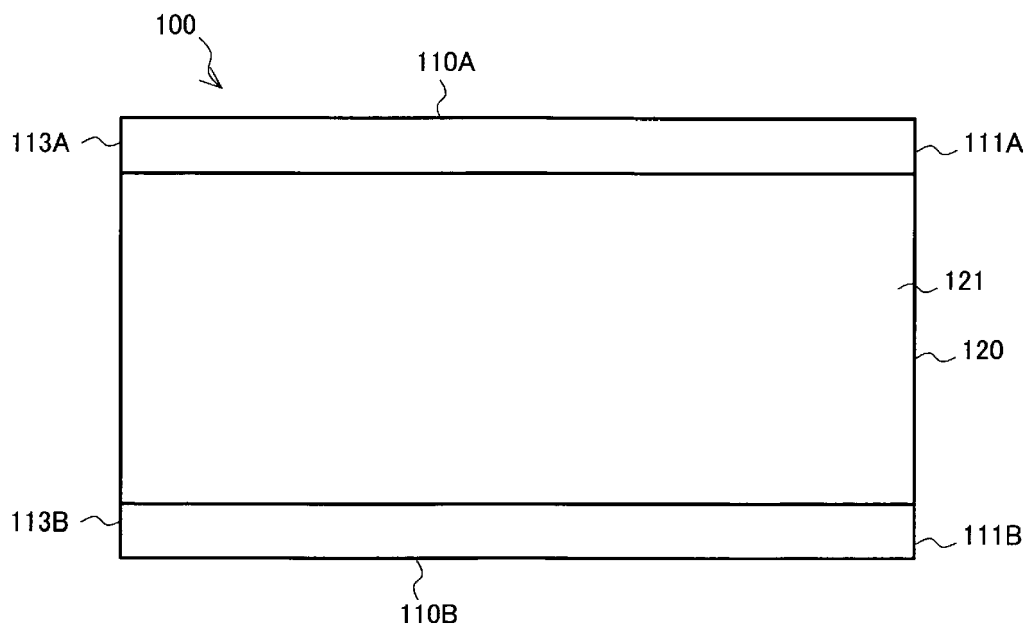


FIG. 30





EUROPEAN SEARCH REPORT

Application Number
EP 20 16 4675

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Place of search Munich		Date of completion of the search 24 July 2020	Examiner Schulz, Andreas
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