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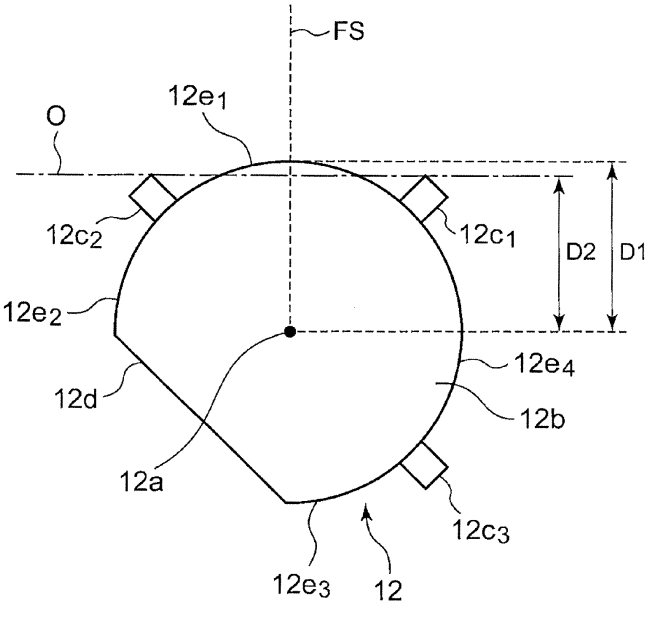
(54) Vehicle headlamp

(57) A vehicle headlamp includes a mounting portion mounted with a light source; a rotary shade for forming light distribution patterns using light from the light source, wherein the rotary shade is driven to rotate so as to select and form any one of the plurality of light distribution patterns and the rotary shade comprises a cylindrical member which extends in the direction of a rotating shaft and light distribution pattern forming portions which are disposed circumferentially at intervals on an outer circumferential surface of the cylindrical member; and a projection lens for projecting light which passes through the rotary shade toward the front of a vehicle. Portions of the cylindrical member located between the light distribution pattern forming portions are formed so that a vertical height of an area to which light is shone while the light distribution patterns are being switched is not higher than a predetermined height.

Fig. 2



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Description

FIELD

[0001] The present invention relates to a vehicle headlamp and more particularly to a vehicle headlamp which can change light distribution patterns.

BACKGROUND

[0002] Vehicle headlamps which employ a rotating-type shade have been known (herein after, referred to as a rotary shade (see JP-A-2010-86863, for instance). This rotary shade includes a cylindrical member which can rotate about a rotating shaft and a plurality of shade plates which are disposed circumferentially on an outer circumferential surface of the cylindrical member at intervals. Each of plurality of shade plates has a different shape. The rotary shade is rotated by a motor to select one shade plate from the plurality of shade plates, whereby the light distribution pattern of the headlamp can be switched to one of a plurality of light distribution patterns.

[0003] However, in the vehicle headlamp which employs the related art rotary shade, a flash of light occurs due to light from the light source being cut off appropriately when the light distribution patterns are switched or when the shade plates are switched, leading to fears that drivers of vehicles running ahead of the subject vehicle, including oncoming vehicles and preceding vehicles, are temporarily blinded by glare.

SUMMARY

[0004] Embodiments of the present invention have been made in view of these situations, and an object thereof is to provide a vehicle headlamp which can make it difficult for drivers of vehicles running ahead of the subject vehicles to be blinded with glare produced when the light distribution patterns are switched.

[0005] With a view to solving the problem, according to an aspect of the invention, there is provided a vehicle headlamp comprising a mounting portion with a light source mounted to the mounting portion, a rotary shade for forming a plurality of light distribution patterns using light from the light source, wherein the rotary shade is driven to rotate so as to select and form any one of the plurality of light distribution patterns, and wherein the rotary shade comprises a cylindrical member, which extends in the direction of a rotating shaft and a plurality of light distribution pattern forming portions, which are disposed circumferentially at intervals on an outer circumferential surface of the cylindrical member, and a projection lens for projecting light which passes through the rotary shade toward the front of a vehicle. Portions of the cylindrical member which are located between the light distribution pattern forming portions are formed so that a vertical height of an area to which light is shone while the light distribution patterns are switched is not higher than a predetermined height.

[0006] According to this aspect, the vertical height of the area to which light is shone while the light distribution patterns are switch is not higher than the predetermined height. For example, when the predetermined height is set at a horizontal line, the shining of light above the horizontal line when the light distribution patterns are switch can be suppressed, whereby it may become difficult to blind drivers of preceding and/or oncoming vehicles with glare.

[0007] A first distance from the rotating shaft to the portion located between the light distribution pattern forming portions may be equal to or longer than a second distance from the rotating shaft to an optical axis of the projection lens. As this occurs, the shining of light above the optical axis when the light distribution patterns are switch can be suppressed, whereby it may become difficult to blind drivers of preceding and/or oncoming vehicles with glare.

[0008] According to the invention, the vehicle headlamp can be provided which can make it difficult for drivers of preceding and/or oncoming vehicles to be blinded by glare produced when the light distribution patterns are switched.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] A general configuration that implements the various features of an embodiment of the invention will be described with reference to the drawings. The drawings and the associated descriptions are provided to illustrate embodiments of the invention and should not limit the scope of the invention.

Fig. 1 is a schematic sectional view showing an interior construction of a vehicle headlamp according to an embodiment of the invention.

Fig. 2 is a drawing depicting a rotary shade.

Figs. 3A and 3B show drawings depicting a low-beam light distribution pattern.

Figs. 4A and 4B show drawings depicting a light distribution pattern produced when light distribution patterns are switched.

Figs. 5A and 5B show drawings depicting a left high-beam light distribution pattern.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0010] Hereinafter, an embodiment of the invention will be described in detail by reference to the drawings.

[0011] Fig. 1 is a schematic sectional view showing an interior construction of a vehicle headlamp 210 according to an embodiment of the invention. The vehicle headlamp 210 shown in Fig. 1 is a variable light distribution headlamp which is disposed individually at each of the left- and right-hand sides of a front of a vehicle with respect to a vehicle's width direction. The interior construction is common between the left and right headlamps, and

therefore, the construction of a vehicle headlamp 210R which is disposed at the right-hand side of the front of the vehicle will be described here and is representative of the constructions of the left and right headlamps,.

[0012] The vehicle headlamp 210R has a lamp compartment 216 made up of a lamp body 212 having an opening portion in the direction of the front of the vehicle and a transparent cover 214, which covers the opening portion in the lamp body 212. A lamp unit 10 which shines light in the direction of the front of the vehicle is accommodated in the lamp compartment 216. A lamp bracket 218 having a pivot mechanism 218a which constitutes an oscillation center of the lamp unit 10 is formed at part of the lamp unit 10. The lamp bracket 218 is connected to a body bracket 220, which is provided on an inner wall surface of the lamp body 212 so as to be joined thereto by a fastening member such as a screw. Consequently, the lamp unit 10 is connected to a predetermined position within the lamp compartment 216 and is able to change its posture with respect to about the pivot mechanism 218a, for example, to a forward tilting posture or a rearward tilting posture.

[0013] In addition, a rotating shaft 222a of a swivel actuator 222 is fixed to a lower surface of the lamp unit 10, and this swivel actuator 222 makes up an adaptive front-lighting system (AFS) to illuminate a road surface ahead in a traveling direction of a vehicle when the vehicle is driving on a curved road. The swivel actuator 222 swivels the lamp unit 10 about the pivot mechanism 218a in the traveling direction based on steering amount data, the shape of the road on which the vehicle is driving which is provided from a navigation system and a relative positional relationship between a preceding or oncoming vehicle and the subject vehicle. As a result of this, the illumination area of the lamp unit 10 is not directed to the front of the vehicle but is directed to a position farther along the curved road so as to improve the forward visibility of the driver. The swivel actuator 222 can include a stepping motor, for example. When the swivel angle is fixed to a predetermined value, a solenoid can also be used.

[0014] A unit bracket 224 is fixed to the swivel actuator 222. A leveling actuator 226, which is disposed outside the lamp body 212, is connected to the unit bracket 224. The leveling actuator 226 includes, for example, a motor which extends or contracts a rod 226a in a direction indicated by an arrow M or a direction indicated by an arrow N. When the rod 226a is extended in the direction indicated by the arrow M, the lamp unit 10 oscillates to take a rearward tilting posture about the pivot mechanism 218a. Conversely, when the rod 226a is contracted in the direction indicated by the arrow N, the lamp unit 10 oscillates to take a forward tilting posture about the pivot mechanism 218a. When the lamp unit 10 is tilted to the rear, a leveling control can be executed in which the optical axis is directed upwards. In contrast, when the lamp unit 10 is tilted to the front, a leveling control can be executed in which the optical axis is directed downwards. By executing the leveling control in the way described above, the optical axis can be controlled so as to match the posture of the vehicle. As a result of this, a forward reaching distance of light emitted from the vehicle headlamp 210 can be controlled to an optimum distance.

[0015] The leveling control can also be executed in accordance with a posture of the vehicle while driving. For example, when the vehicle is accelerated while driving, the vehicle is tilted toward the rear, whereas when the vehicle is decelerated, the vehicle is tilted toward the front. Consequently, the light shining direction of the vehicle headlamp 210 also changes vertically as the vehicle is tilted in the way described above, whereby the forward light shining distance is extended or shortened. Then, the leveling control of the lamp unit 10 is executed on a real time basis based on the posture of the vehicle while driving, whereby the forward light shining distance can be controlled to be the optimum distance even when the vehicle is driving. This may be referred to as "automatic leveling."

[0016] A light shining control unit 228 for controlling the turning on and off of the lamp unit 10 and controlling the formation of a light distribution pattern is disposed on an inner wall surface of the lamp compartment 216 in a position lying below the lamp unit 10, for example. In the case of Fig. 1, a light shining control unit 228R for controlling the vehicle headlamp 210R is disposed. This light shining control unit 228R also executes the control of the swivel actuator 222 and the leveling actuator 226.

[0017] The lamp unit 10 can include an aiming control mechanism. For example, an aiming pivot mechanism which constitutes a center of oscillation when an aiming control is executed is disposed at a connecting portion between the rod 226a of the leveling actuator 226 and the unit bracket 224. In addition, a pair of aiming control screws, which move back and forth in a front-to-rear direction of the vehicle, is disposed at intervals in the vehicle's width direction at a connecting portion between the body bracket 220 and the lamp bracket 218. For example, when two aiming control screws are moved to the front, the lamp unit 10 is tilted about the aiming pivot mechanism toward the front, whereby the optical axis is controlled to be directed downwards. Similarly, when the two aiming control screws are retracted to the rear, the lamp unit 10 is tilted toward the rear about the aiming pivot mechanism, whereby the optical axis is controlled to be directed upwards. When the left-hand side aiming control screw in the vehicle' s width direction is moved to the front, the lamp unit 10 swivels about the aiming pivot mechanism toward the right, whereby the optical axis is controlled to be directed in a rightward direction. When the right-hand side aiming control screw in the vehicle's width direction is moved to the front, the lamp unit 10 swivels to the left about the aiming pivot mechanism, whereby the optical axis is controlled to be directed in a leftward direction. This aiming control is executed when a vehicle is shipped from an assembly plant or is subjected to a legal periodical inspection or when vehicle

headlamps 210 are replaced. Then, the vehicle headlamp 210 is controlled so as to take a normal posture that is determined by the design of the headlamp, and the formation and control of a light distribution pattern according to the embodiment is executed based on that normal posture.

[0018] The lamp unit 10 includes a shade mechanism 18 which includes the rotary shade 12, a bulb 14 as a light source, a lamp housing 17 which supports a reflector 16 on an inner wall thereof and a projection lens 20.

[0019] An incandescent lamp, a halogen lamp, a discharge lamp and LEDs, for example, can be used as the bulb 14. In this embodiment, the bulb 14 is described as employing a halogen lamp. The bulb 14 is mounted in a bulb mounting portion 15. The reflector 16 reflects light emitte4d from the bulb 14. Then, light emitted from the bulb 14 and light reflected from the reflector 16 are partially guided to the projection lens 20 by way of the rotary shade 12.

[0020] The shade mechanism 18 includes the rotary shade 12, a shade support portion 13 which supports the rotary shade 12 and a motor (not shown) which rotates the rotary shade 12. The rotary shade 12 can form a plurality of light distribution patterns by use of light from the bulb 14.

[0021] The rotary shade 12 is a member which can rotate about a rotating shaft 12a and includes a cylindrical member 12b, which extends in the direction of the rotating shaft 12a and a plurality of shade plates 12c which are disposed circumferentially at intervals on an outer circumferential surface of the cylindrical member 12b.

[0022] In this embodiment, the rotary shade 12 includes three shade plates 12_{c1} to 12_{c3} which have different shapes. The shade plate 12_{c1} is a shade plate for forming a low-beam light distribution pattern, the shade plate 12_{c2} is a shade plate for forming a so-called left high-beam light distribution pattern, and the shade plate 12_{c3} is a shade plate for forming a so-called right high-beam light distribution. The rotary shade 12 has a cutout portion 12d which results from cutting part of the rotary shade 12 in the direction of the rotating shaft 12a for forming a high-beam light distribution pattern. The three shade plates 12_{c1} to 12_{c3} and the cutout portion 12d function as a "light distribution pattern forming portion."

[0023] The rotary shade 12 is driven to rotate by the motor so as to move any one of the cutout portion 12d and the three shade plates 12_{c1} to 12_{c3} to the position of a rear focal plane FS, which includes a rear focal point of the projection lens 20. Then, a light distribution pattern which matches the shape of a ridge portion of the shade plate 12, which is situated on the rear focal plane, is formed. For example, a low-beam light distribution pattern is formed by moving the shade plate 12_{c1} on to the rear focal plane so as to cut off part of light shone from the bulb 14. In addition, a high-beam light distribution pattern is formed by moving the cutout portion 12d on to the rear focal plane so as to allow light from the bulb 14 to pass by the rotary shade 12 and travel to the projection lens 20.

[0024] The projection lens 20 is made up of a plano-convex aspherical lens which is convex on a front surface and is plane on a rear surface and projects a light source image formed on the rear focal plane FS on to an imaginary vertical screen ahead of the vehicle headlamp 210 as an inverted image. The projection lens 20 is disposed so that the bulb 14 is situated on an optical axis O thereof.

[0025] Fig. 2 is a drawing depicting the rotary shade 12. In the rotary shade 12 according to this embodiment, portions 12e of the cylindrical member 12b which are located between the light distribution pattern forming portions are formed so that a vertical height of an area to which light is shone while light distribution patterns are being switched is not higher than a predetermined height. The predetermined height is set to a horizontal line, for example. In order to realize a configuration like this, the rotary shade 12 is configured so that a first distance D1 from the rotating shaft 12a to the portion between the light distribution pattern forming portions is not shorter than a second distance D2 from the rotating shaft 12a to the optical axis O of the projection lens 20. The portions 12e defined between the light distribution patterns include a portion 12_{e1} defined between the shade plate 12_{c1} and the shade plate 12_{c2}, a portion 12_{e2} defined between the shade plate 12_{c2} and the cutout portion 12d, a portion 12_{e3} defined between the cutout portion 12d and the shade plate 12_{c3}, and a portion 12_{e4} defined between the shade plate 12_{c3} and the shade plate 12_{c1}.

[0026] Next, the operation of the vehicle headlamp 210 will be described by use of Figs. 3A to 5B. Figs. 3A and 3B are drawings depicting a low-beam light distribution pattern. When a low-beam light distribution pattern 300 shown in Fig. 3B is formed, the rotary shade 12 is rotated so that the shade plate 12_{c1} is situated on the rear focal plane FS, as is shown in Fig. 3A.

[0027] Figs. 4A and 4B are drawings depicting a light distribution pattern which is produced when the light distribution patterns are switched. When the light distribution pattern is switched from the low-beam light distribution pattern to the left high-beam light distribution pattern, the rotary shade 12 is driven to rotate so that the shade plate situated on the rear focal plane FS is switched from the shade plate 12_{c1} to the shade plate 12_{c2}. As is shown in Fig. 4A, the portion 12_{e1} defined between the shade plate 12_{c1} and the shade plate 12_{c2} passes the rear focal plane FS while the shade plates are being switched. As has been described above, in this embodiment, the first distance D1 from the rotating shaft 12a to the portion defined between the light distribution pattern forming portions is made to be not shorter than the second distance D2 from the rotating shaft 12a to the optical axis O of the projection lens 20. Therefore, light from the bulb 14 and the reflector 16 which attempts to pass below the optical axis O is cut off by the portion 12_{e1}. Light that has passed the rotary shade 12 is projected inverted by the projection lens 20, and therefore, as is shown in Fig. 4B, a light distribution pattern 400 is formed in which the vertical height of the

area to which light is shone is not higher than the predetermined height, thereby making it possible to suppress the generation of glare which blinds the driver of an oncoming vehicle 402. Fig. 4B shows that the light unit 10 is disposed so that a forward extension point of the optical axis O coincides with an H-V point on the imaginary vertical screen. Consequently, an upper end of the light distribution pattern 400 is situated not higher than the horizontal line H.

[0028] Figs. 5A and 5B are drawings depicting a left high-beam light distribution pattern. When a left-hand high-beam light distribution pattern 500 is formed as shown in Fig. 5B, the rotary shade 12 is driven to rotate so that the shade plate 12c2 is situated on the rear focal plane FS as shown in Fig. 5A.

[0029] The left high-beam light distribution pattern 500 is a light distribution which is suitable for a case in which there is an oncoming vehicle 502 or a pedestrian on a lane for oncoming vehicles. In other words, the light distribution pattern 500 is a light distribution pattern which takes into consideration the avoidance of a risk of blinding the driver of the oncoming vehicle 502 or the pedestrian with glare.

[0030] Thus, the vehicle headlamp 210 according to the embodiment of the invention has been described heretofore. According to the vehicle headlamp 210, the first distance D from the rotating shaft 12a to the portions 12e defined between the light distribution pattern forming portions is made to be no shorter than the second distance D2 from the rotating shaft 12a to the optical axis O of the projection lens 20, thereby making it possible to suppress the generation of light which shines above the optical axis O, while the light distribution patterns are being switched. As a result of this, it becomes difficult to blind the driver of a preceding or oncoming vehicle with glare.

[0031] In addition, in the vehicle headlamp 210 according to the embodiment, the portions 12e of the rotary shade 12 defined between the light distribution pattern forming portions are made to be lower than the heights of the light distribution pattern forming portions. By adopting this configuration, light cut off by the portions 12e defined between the light distribution pattern forming portions can be reduced, thereby making it possible to increase the luminous intensity of the formed light distribution patterns.

[0032] Thus, the invention has been described based on the embodiment. The embodiment is merely an example, and hence, it is obvious to those skilled in the art to which the invention pertains that various modifications can be made to the embodiment with respect to combinations of the constituent elements and operation processes thereof and that these modified examples also fall within the scope of the invention.

Claims

1. A vehicle headlamp comprising:

a mounting portion with a light source mounted to the mounting portion;
a rotary shade for forming a plurality of light distribution patterns using light from the light source,
wherein the rotary shade is driven to rotate so as to select and form any one of the plurality of light distribution patterns, and
wherein the rotary shade comprises a cylindrical member, which extends in the direction of a rotating shaft and a plurality of light distribution pattern forming portions, which are disposed circumferentially at intervals on an outer circumferential surface of the cylindrical member; and
a projection lens for projecting light which passes through the rotary shade toward the front of a vehicle,
wherein portions of the cylindrical member which are located between the light distribution pattern forming portions are formed so that a vertical height of an area to which light is shone while the light distribution patterns are being switched is not higher than a predetermined height.

2. A vehicle headlamp according to Claim 1, wherein

a first distance from the rotating shaft to the portions of the cylindrical member located between the light distribution pattern forming portions is not shorter than a second distance from the rotating shaft to an optical axis of the projection lens.

Fig. 1

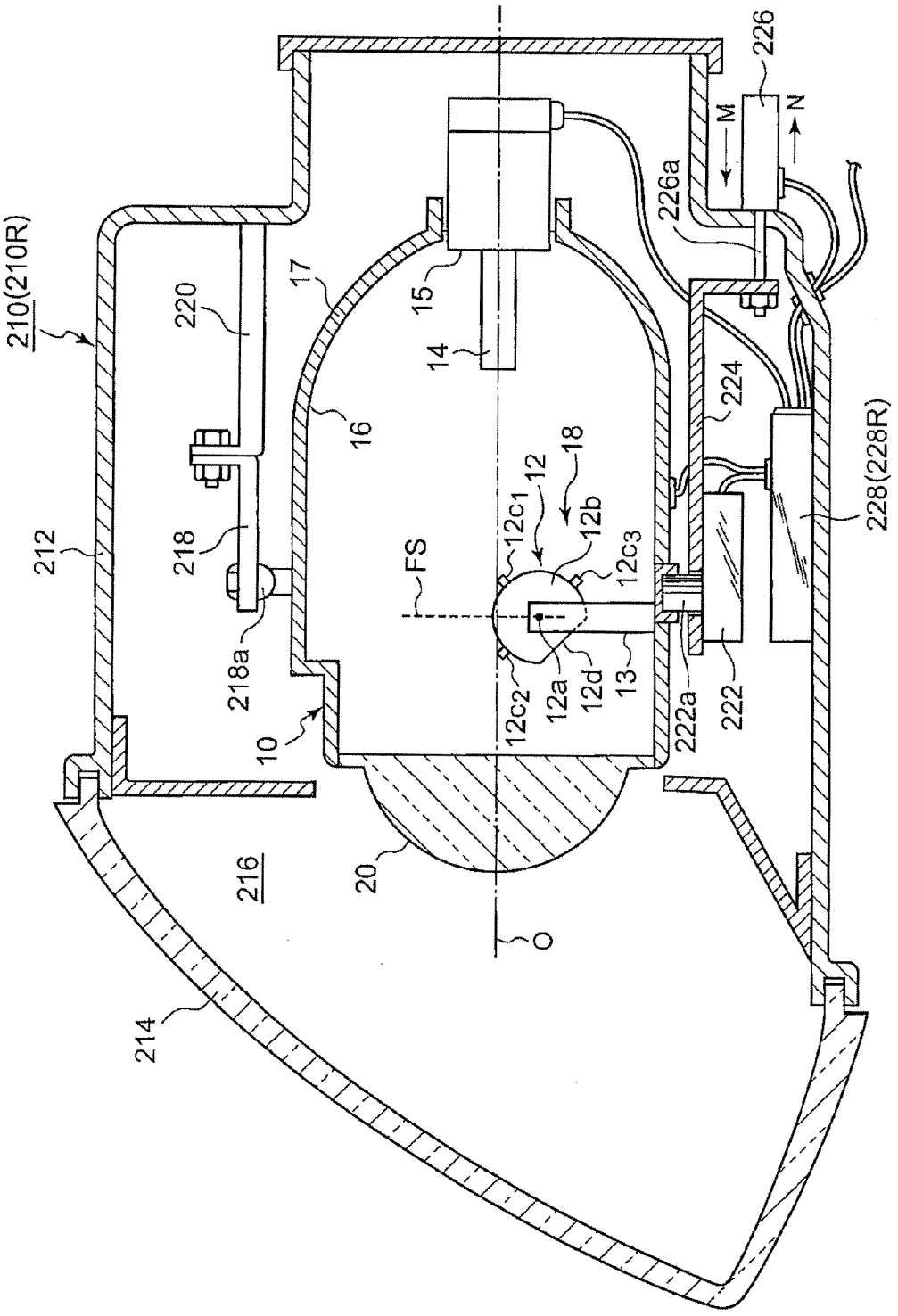
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Fig. 2

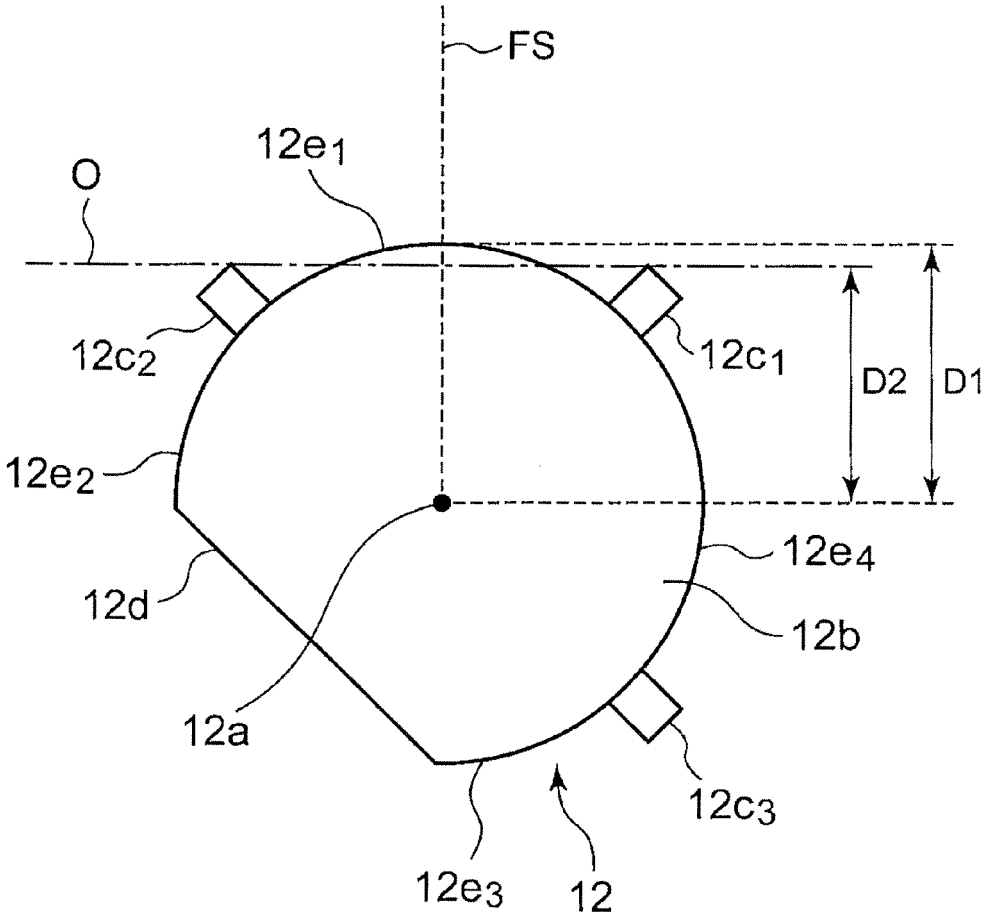


Fig. 3B

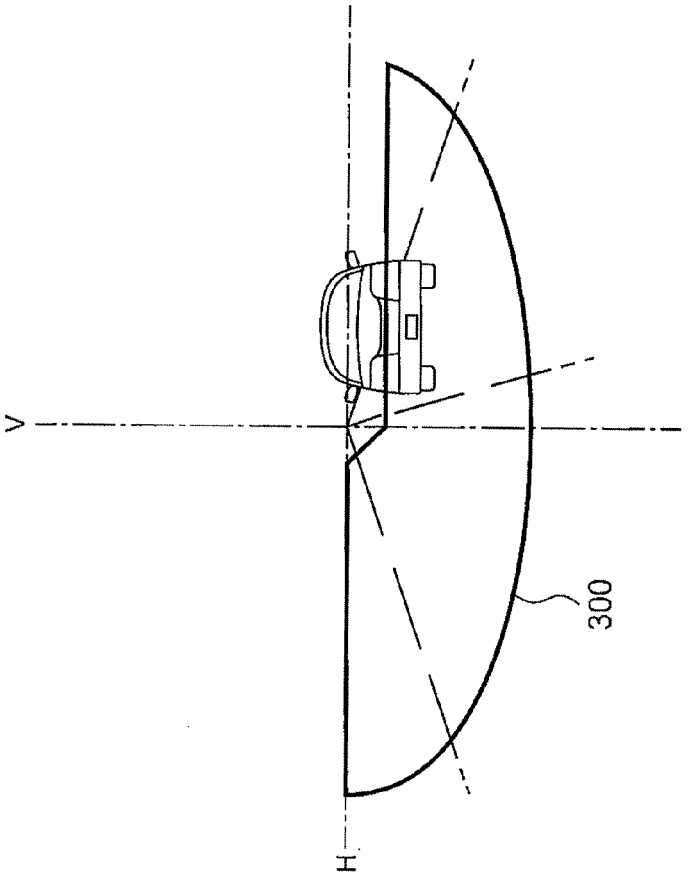


Fig. 3A

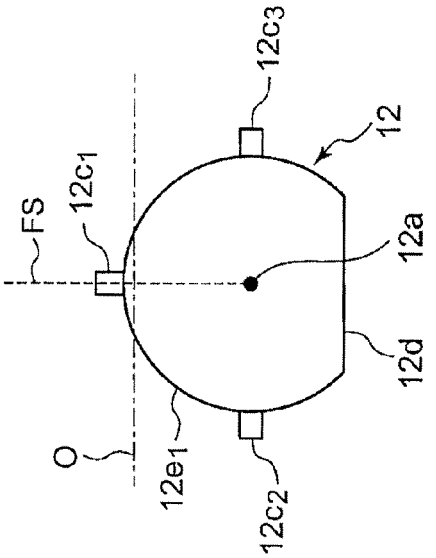


Fig. 4B

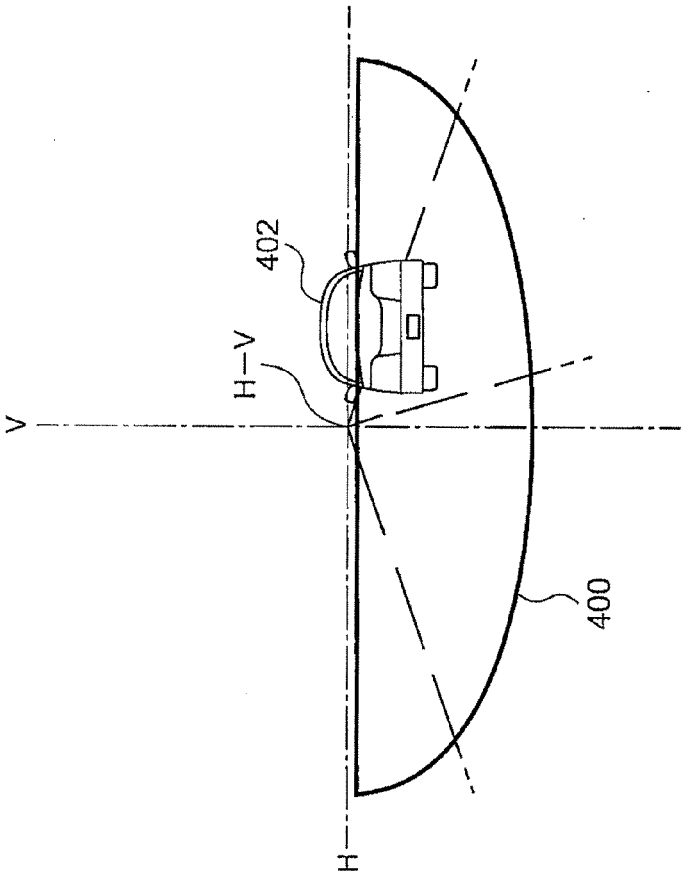


Fig. 4A

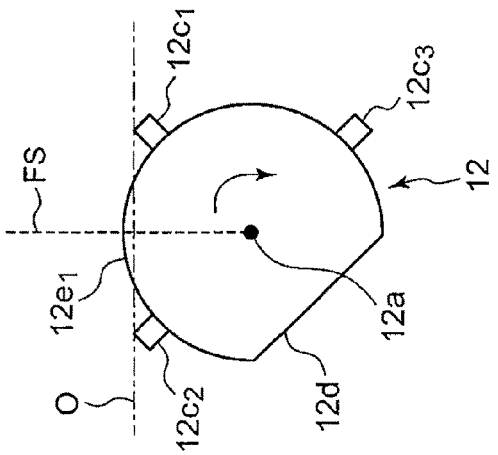


Fig. 5B

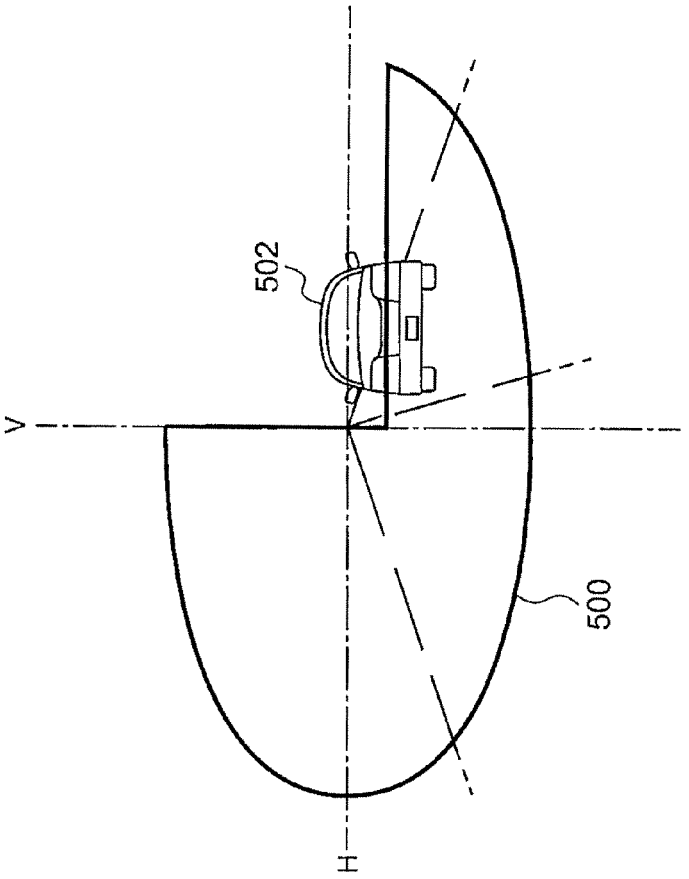
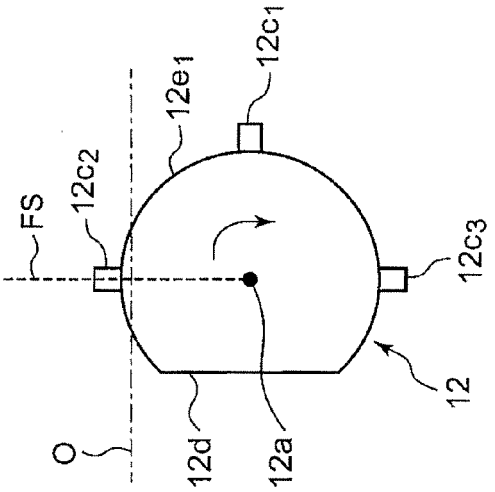


Fig. 5A



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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 0490

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

F21V

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 December 2011	Goltes, Matjaz

CATEGORY OF CITED DOCUMENTS

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