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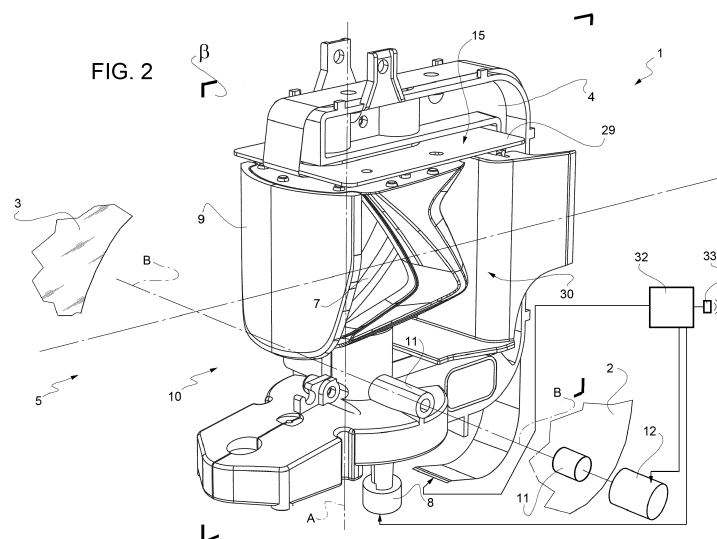
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(54) **ROTATING LIGHTING MODULE WITH WELCOME FUNCTION AND LIGHTING DEVICE FOR VEHICLES**

(57) Rotating lighting module (5) designed to equip a lighting device (1) for vehicles, including a first light source (6), a reflector (7) and an actuator (8) to rotate the reflector relative to the first light source around a first axis (A); wherein the reflector is bore idly by a framed support (4) with an associated lens (9) forming with the reflector a rotating unit (10); the framed support holds

rigid in a fixed position a second light source (14) arranged above and behind the first reflector (7), on the side opposite to the lens (9) and a second reflector (30) operatively associated with the second light source (14) and arranged on the rear of the first reflector (7), spaced apart therefrom, on the side opposite to said lens (9).

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Description

Technical field of the invention

[0001] The present invention relates to a lighting device equipped with one or more lighting modules having rotation capabilities in order to provide selectively, other than a plurality of different optical functions (e.g. DRL - Daytime Running Light, AFS - Adaptive Function System, etc.) also an animated welcome function.

Technical Background

[0002] Lighting devices for vehicles provided with rotating elements, like a rotating reflector, are known in the art.

[0003] US4868721 discloses a lighting module comprising a light source and at least one reflector, wherein the reflector is motorized and is designed to intercept a concentrated unidirectional pencil of light produced by the light source, which is fixed with respect to the reflector, causing, due to its rotation around a fixed axis, a continuous rapid scanning of the pencil of light within a predetermined solid angle.

[0004] EP2957822 discloses a lighting device including a fixed reflector and a fixed light source; the light source is aligned with an axis, around which a couple of opposite screens may rotate under the action of a motor actuator; the two screens embody two lenses, e.g. one provided with prisms and one neutral, in order to change the light distribution provided by the light source and the reflector when each of the screens is selectively rotated in front of the reflector.

[0005] EP2902701 discloses a device of the kind of that of US4868721, but wherein the light source is a LED and the reflector consists of a rotating support having two opposite faces, one constituting the reflector and the other realizing a second function, e.g. an aspect function; a fixed motor rotates the support with respect to the fixed light source in order to bring selectively the two faces on the front side of the device facing toward the direction of motion of the vehicle; the support also bears at its opposite faces two light guides operatively associated with a second LED.

[0006] The lighting device according to US4868721 is generally expensive to be produced and may be of complex operation; moreover it may be incapable to meet the modern lighting requirements.

[0007] EP2902701 and EP2957822 disclose lighting devices which may generate only two different main light functions, each by means of one of the two reflective surfaces of the support.

[0008] Anyway, none of the lighting devices known in the art are able to generate an animated welcome light distribution, e.g. when the vehicle locks are opened or closed by means of a remote control; in the known lighting devices one or more lights or lighting modules are merely switched on, maybe for a short time, and merely to gen-

erate a static light distribution, which moreover correspond to the normal lighting function assigned to the light/lighting module, e.g. position light, DRL, etc..

Summary of the invention

[0009] The object of the present invention is to provide a rotating lighting module for equipping a lighting device for vehicles that is compact, simple and cost-effective in construction and highly reliable, while ensuring at the same time an innovative welcome light function, which has a light distribution different from that one the lighting module is normally designed to provide for and which is not static but may vary during the switching on of the module.

[0010] According to the invention, therefore, a lighting module and a device for vehicles are provided having the features set out in the appended claims.

Brief description of the drawings

[0011] Further features and advantages of the present invention will become more apparent from the following description of one non-limiting embodiment thereof, made with reference to the figures in the accompanying drawings, in which:

- figure 1 shows schematically a front elevation view of a rotating lighting module according to the invention;
- figure 2 shows schematically a three quarter front perspective view of the lighting module of figure 1;
- figure 3 shows schematically a front elevation view of a lighting device for a vehicle, with parts removed for simplicity, incorporating a plurality of lighting modules identical to that one of figures 1 and 2; and
- figure 4 shows a side elevation view of the rotating lighting module according to the invention wherein the bottom part is missing for sake of simplicity.

Detailed description

[0012] With reference to figure 3, reference numeral 1 indicates as a whole a lighting device consisting, in the non-limiting embodiment shown, in a vehicle headlight, which is only in part and only schematically shown. It is however to be intended that what will be described can be applied to any vehicle lighting device.

[0013] The lighting device 1 comprises a generally cup-shaped housing 2 designed to be mounted on a vehicle, known and shown only in part for sake of simplicity. Housing 2 is made of synthetic plastic material by injection molding and has a front inlet opening in use facing opposite to the vehicle and along a driving direction of the vehicle, closed by a transparent cover 3 (figure 2).

[0014] According to the present invention, housing 2 carries at the interior thereof at least one lighting module 5. Preferably, housing 2 carries within it more than one

lighting module 5 (in the embodiment shown three, arranged side by side) that may be visible from the outside through the transparent cover 3.

[0015] The three lighting modules 5 are identical and one module 5 is shown in more details in figures 1, 2 and 4; the modules 5 are arranged facing the front transparent screen/cover 3 closing the cup-shaped housing 2.

[0016] Each lighting module 5 is of the rotating type and is designed to specifically equip a lighting device for vehicles like lighting device 1.

[0017] The rotating lighting module 5 comprises at least one first light source 6, at least one first reflector 7 and at least one first actuator 8 (Figure 2) to rotate the first reflector 7 relative to the first light source 6 (figures 1 and 4) around a first axis A.

[0018] The rotating lighting module 5 further comprises a framed support 4 holding rigid in a fixed position the first light source 6 and bearing in idling manner the first reflector 7; the framed support 4 also bears the first actuator 8, which consists, in the non-limiting embodiment shown, in a rotating electric motor illustrated only in a schematic way in figure 2.

[0019] The rotating lighting module 5 further comprises a lens 9 placed in front of the first reflector 7 and assembled angularly rigid therewith to rotate rigid with the first reflector 7 and eccentrically to axis A, so that both lens 9 and first reflector 7 forms together a rotating unit 10 powered by the first actuator 8.

[0020] Preferably, the framed support 4 is also provided with a hinge connector 11 (Figure 3) which is operatively associated with a second actuator 12 (Figure 2), embodied in the non-limiting embodiment shown by a second rotating electric motor, designed rotate the framed support 4, and the rotating unit 10 therewith, around a second axis B substantially perpendicular to the first axis A and coaxial with the hinge connector 11 in order to tilt up and down by a predetermined angle the rotating unit 10 around axis B (figure 2).

[0021] The second axis B is moreover always transversal to a middle plane β (figure 2) of the rotating unit 10, which middle plane β passes through lens 9 and the first axis A and is perpendicular to axis B when the rotating unit 10 is not rotated relative to the framed support 4.

[0022] According to the preferred embodiment of the invention, the first light source 6 is a LED; moreover, the lighting module 5 further comprises a second light source 14 and a couple of third light sources 13, all constituted by different LEDs; preferably, as in the embodiment shown, the LEDs constituting the first, second and third light sources 6, 14 and 13 are assembled on a printed circuit board 15 in specific positions and the printed circuit board 15 is carried in a fixed manner by the framed support 4 directly above the rotating unit 10 and on the side opposite to the first actuator 8.

[0023] The first light source 6 is arranged substantially aligned with the first axis A and faces the first reflector 7, this latter being designed to collect the light emitted by the first light source 6 and to deviate it as a shaped

light beam 16 (shown schematically in dotted lines in figure 4) through the lens 9. The direction of propagation of the light beam 16 defines an optical axis OA of the lighting module 5 (figure 4) and of the whole lighting device 1 (figure 3), which optical axis OA is directed parallel to the running forward direction of the vehicle on which the lighting device 1 is mounted and lies on the middle plane β .

[0024] According to one aspect of the invention, therefore, by activating the first actuator 8 (e.g. electric motor) the rotating unit 10 may be rotated by a first, predetermined angle around axis A in a plane parallel to a plane perpendicular to plane β , and by activating the second actuator 12 (e.g. an independent electric motor), the rotating unit 10 may be rotated by a second, predetermined angle around axis B in the plane β , so as, e.g. to raise or lower the light beam 16 in front of the vehicle when the light source 6 is switched on. These two rotation movements may be activated independently of each other, one at a time, in sequence, or simultaneously.

[0025] According to the main aspect of the present invention, the framed support 4 holds rigid in a fixed position the second light source 14 arranged above and behind the first reflector 7, on the side opposite to lens 9; and, in combination, the framed support 4 further bears a second reflector 30 operatively associated with the second light source 14 and arranged on the rear of the first reflector 7, spaced apart therefrom, on the side opposite to the lens 9.

[0026] The lens 9 is optically neutral so as the light beam 16 is shaped according to the required photometric characteristics solely by the reflector 9.

[0027] Lens 9 preferably bears a U-shaped light guide 24 (figure 1) having micropisms and arranged peripherally around respective lateral sides 19, 20 of the lens 9 and around a bottom end 26 of the lens 9 facing opposite to the printed circuit board 15.

[0028] The light guide 24 is operatively associated with the couple of third light sources 13, which are arranged on the printed circuit board 15, which has in a plan view a rectangular shape, forward to the first light source 6 in relation to the lens 9 (i.e. closer to lens 9 than the light source 6) and on opposite lateral sides of the printed circuit board 15 close to respective opposite lateral edges of the printed circuit board.

[0029] In this manner, the two LEDs 13 face opposite ends of the light guide 24 when the rotating unit 10 assumes a first operative position (shown in figure 2) in which the rotating unit 10 is not rotated relative to the framed support 4.

[0030] In such a position the axis B, which is arranged substantially perpendicular to the lateral edges of the rectangular printed circuit board 15, is also substantially perpendicular to the middle plane β .

[0031] According to one aspect of the invention, the second light source 14 is an RGB LED and is arranged at a rear end 29 of the printed circuit board 15 opposite to the couple of light sources 13.

[0032] The framed support 4 bears the second reflector 30 at a middle portion thereof, so that the reflector 30 is fixed in relation to the rotating unit 10 and is rigid with the framed support 4.

[0033] The second reflector 30 is arranged in such a position to be operatively associated with the second light source 14; in particular, the second reflector 30 is arranged on the rear of the first reflector 7 and spaced apart thereof, on the side opposite to the lens 9. Moreover, reflector 30 is laterally quite wider than lens 9, in order to laterally project beyond the lateral sides 19 and 20 of lens 9.

[0034] According to a further aspect of the invention, each lighting module 5 comprises also a control unit 32 (figure 2) configured to switch on the second light source 14 while simultaneously maintaining the first light source 6 switched off and simultaneously activating at least the first actuator 8 to rotate the first reflector 7 and the associated lens 9 around the first axis A.

[0035] The control unit 32 is preferably connected with a remote control receiver 33.

[0036] When the lighting module comprises the second actuator 12 designed to tilt the whole framed support 4 and the rotating unit 10 therewith around the second axis B, the control unit 32 is preferably configured to activate the second actuator 12 too together with the switching on of the second light source 14.

[0037] The control unit 32 may be configured to activate selectively one only or both of the actuator 8, 12, all together or separately and in a time sequence.

[0038] The light distribution and aesthetic appearance of the lighting device 1 obtainable when the control unit 32 activates the welcome light function is shown schematically in figure 3: respectively front illuminated areas 34, i.e. the areas of the device 1 which result to be illuminated by the light source 14 of each module 5 are shown as hatched areas.

[0039] Firstly, the welcome light function leaves the lens 9 unlighted generating a desired, U-shaped in the embodiment shown, light design defined by the illuminated areas 34, since the back of the first reflector 7 of each module 5 shields the light emitted by the light source 14 and reflected towards lens 9 by the second reflector 30.

[0040] The plurality of modules 5 are arranged side by side and spaced apart laterally to an extent sufficient to allow the free rotation of the reflectors 7 of all the modules 5 independently of one another but are sufficiently close to each other that the illuminated areas 34 of each device 5 are joined together to generate a substantially continuous whole illuminated area 34' at the front of the lighting device 1.

[0041] Secondly, by simultaneously activating either actuator 8 or actuator 12, or both, of each module 5 it is obtained an animated (instead of static) welcome light effect: in fact by turning around axis A each rotating unit 10, the extent of the area of the reflector 30 of each module 5 which is shielded by the rear face of the reflector 7 varies: accordingly, e.g. turning the rotating unit 10 alter-

natively in opposite directions, e.g. clockwise and anti-clockwise, the front illuminated area 34 of each module 5 becomes alternatively wider and narrower, giving rise to a sort of flashing effect.

[0042] This effect may be eventually further improved by rotating the modules 5 around axis B too.

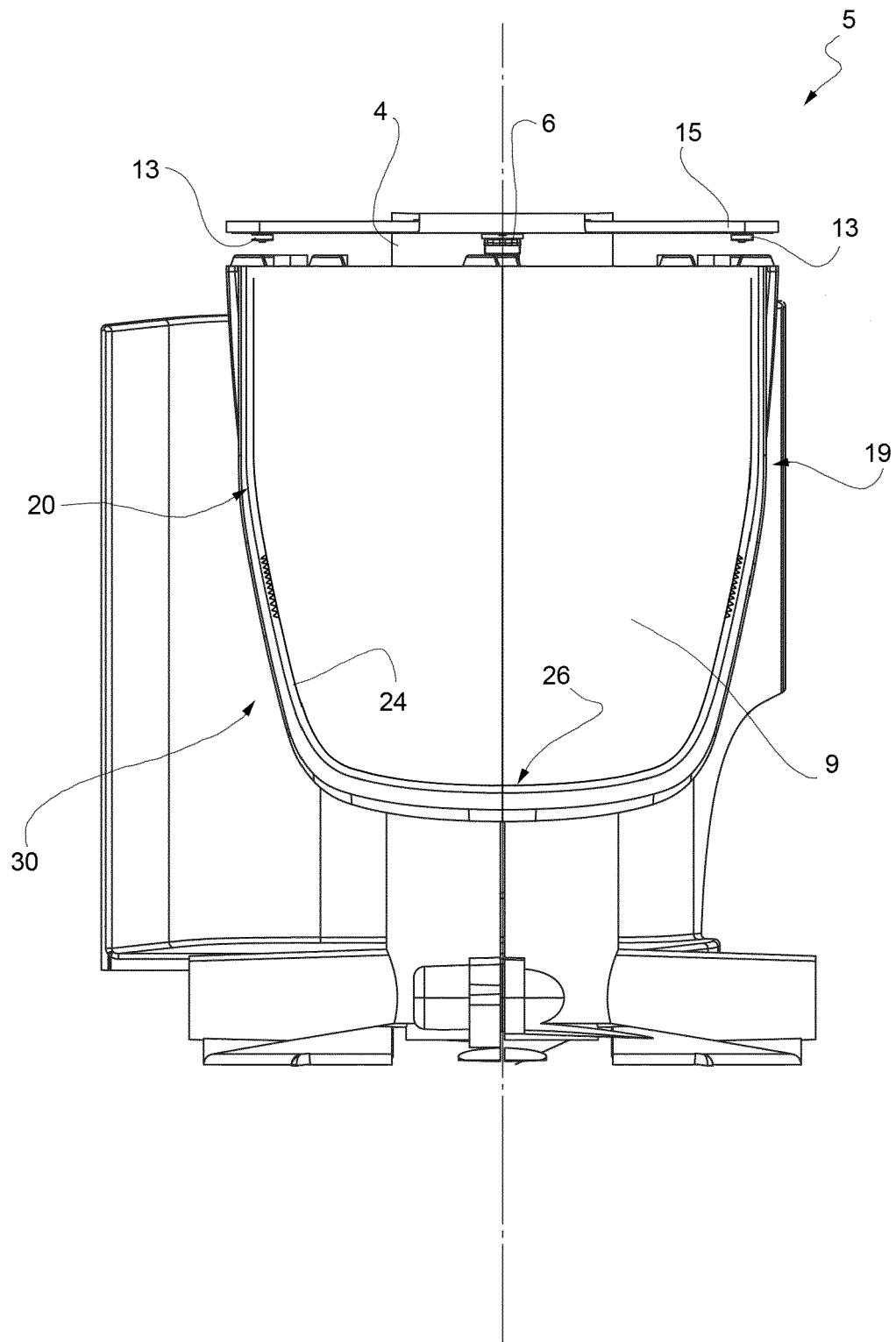
[0043] All the aims of the invention are therefore accomplished.

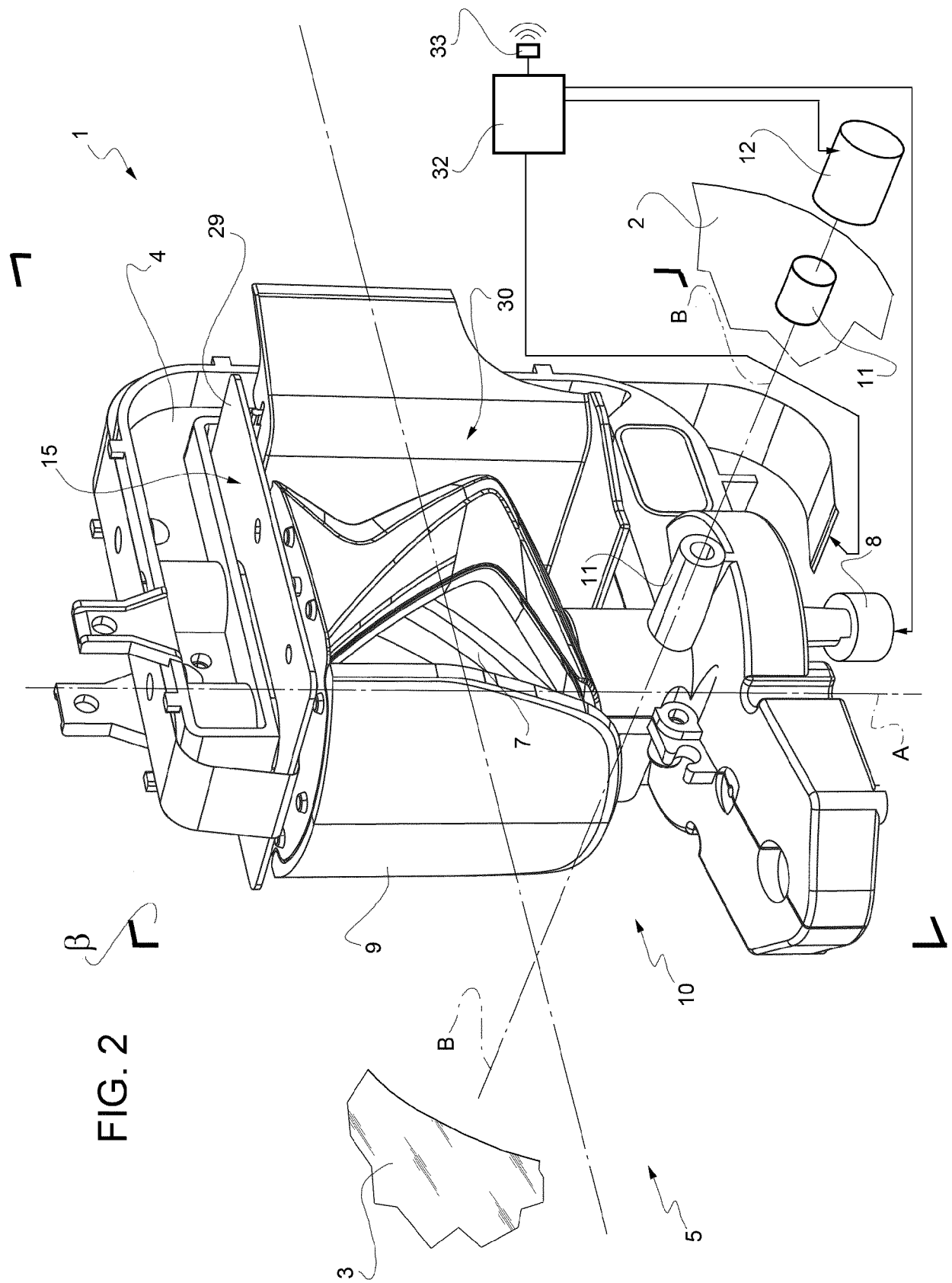
Claims

1. A rotating lighting module (5) designed to equip a lighting device (1) for vehicles, comprising at least one first light source (6), at least one first reflector (7) and at least one first actuator (8) to rotate the first reflector relative to the first light source around a first axis (A); and further comprising: a framed support (4) holding rigid in a fixed position said first light source (6) and bearing in idling manner said first reflector (7), the framed support also bearing the first actuator (8); and a lens (9) placed in front of the first reflector (7) and assembled angularly rigid therewith to rotate rigid with the first reflector and eccentrically to said first axis (A); said lens (9) and said first reflector (7) forming together a rotating unit (10) powered by said first actuator; **characterized in that** the framed support holds rigid in a fixed position a second light source (14) arranged above and behind the said first reflector (7), on the side opposite to said lens (9); the framed support (4) further bearing a second reflector (30) operatively associated with the second light source (14) and arranged on the rear of the first reflector (7), spaced apart therefrom, on the side opposite to said lens (9).
2. Lighting module according to claim 1, **characterized in that** said first and second light sources (6, 14) are LEDs; said lighting module further comprising a couple of third light sources (13) also constituted by different LEDs, said first, second and third light sources (6, 13, 14) being assembled on a printed circuit board (15) which is carried in a fixed manner by said framed support (4) directly above the rotating unit (10) and the second reflector (30).
3. Lighting module according to claim 2, **characterized in that** the first light source (6) is arranged substantially aligned with said first axis (A) and facing said first reflector (7), this latter being designed to collect the light emitted by the first light source (6) and to deviate it as a shaped light beam (16) through the lens (9).
4. Lighting module according to anyone of the preceding claims, **characterized in that** said lens (9) is optically neutral.

5. Lighting module according to anyone of the preceding claims, **characterized in that** said framed support (4) is provided with a hinge connector (11) and is operatively associated with a second actuator (12) designed to tilt the whole framed support (4) and the rotating unit (10) therewith around a second axis (B) substantially perpendicular to the first axis (A) and coaxial with said hinge connector (11); said second axis (B) being always transversal to a middle plane (β) of said rotating unit (10) passing through said lens (9) and said first axis (A). 5 10
6. Lighting module according to anyone of the preceding claims, **characterized in that** the lens (9) bears a U-shaped light guide (24), said light guide (24) being operatively associated with a couple of third light sources (13), which are arranged forward to the first light source (6) in relation to the lens (9). 15
7. Lighting module according to anyone of the preceding claims, **characterized in that** the second light source (14) is an RGB LED and is arranged at a rear end (29) of a printed circuit board (15) spaced apart from the first light source and beyond the first reflector (7); the framed support (4) bearing the second reflector (30) at a middle portion thereof, spaced apart from the first reflector, on the side opposite to said lens (9). 20 25
8. Lighting module according to anyone of the preceding claims, **characterized in that** it further comprises a control unit (32) configured to switch on the second light source (14) while simultaneously maintaining the first light source (6) switched off and simultaneously activating at least the first actuator (8) to rotate the first reflector (7) and associated lens (9) around the first axis (A). 30 35
9. Lighting module according to claim 8, **characterized in that** the control unit (32) is connected with a remote control receiver (33). 40
10. Lighting module according to claim 8 or 9, **characterized in that** it further comprises a second actuator (12) designed to tilt the whole framed support (4) and the rotating unit (10) therewith around a second axis (B) substantially perpendicular to the first axis (A); the control unit (32) being configured to activate the second actuator (12) together with the switching on of the second light source (14). 45 50
11. Lighting device (1) for a vehicle such as a headlight or a headlamp, **characterized in that** it comprises at least one lighting module (5) according to anyone of the preceding claims arranged within a cup-shaped housing (2) designed to be mounted on a vehicle body and facing a front transparent screen (3) closing the cup-shaped housing. 55
12. Vehicle provided with a lighting device (1) according to claim 11.

FIG. 1





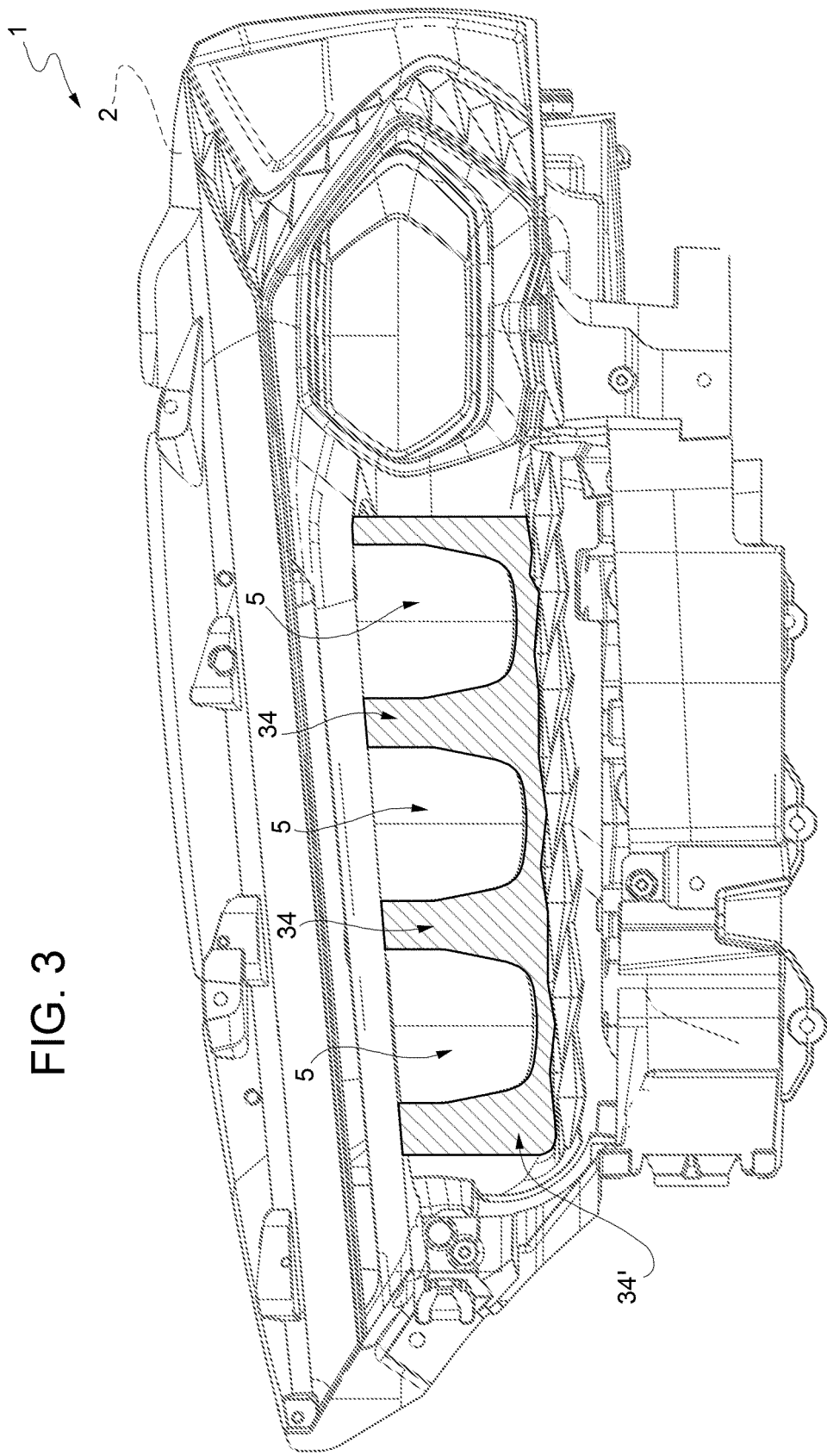
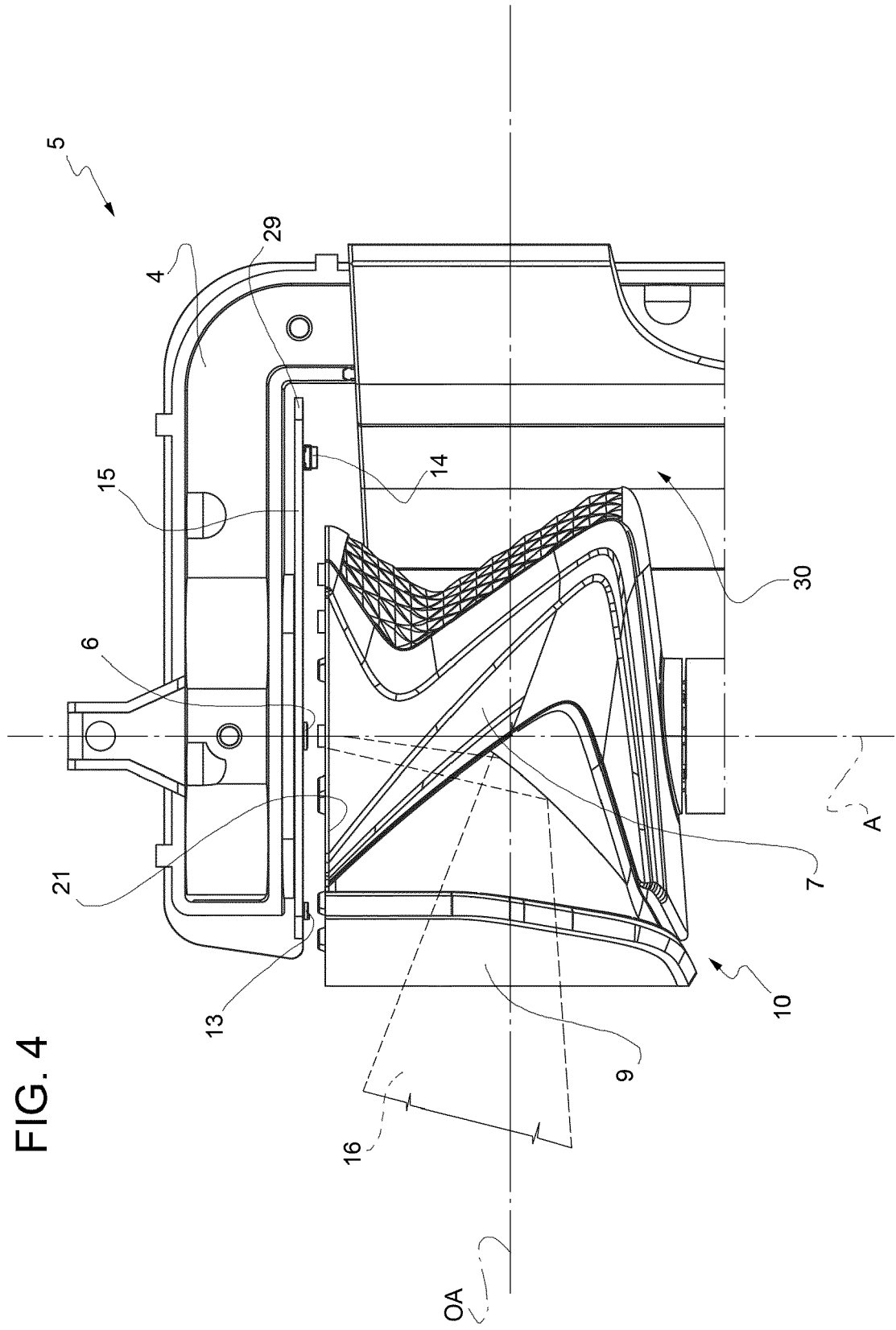


FIG. 3

FIG. 4





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 EP 17 15 4073

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Place of search Munich		Date of completion of the search 30 June 2017	Examiner Schulz, Andreas
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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