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(54) **ROTATING LIGHTING MODULE FOR VEHICLES AND ASSOCIATED LIGHTING DEVICE FOR VEHICLES**

(57) Lighting module (5) for vehicles including a light source (6), a reflector (7) and an actuator (8) to rotate the reflector relative to the light source around a first axis (A); wherein the reflector forms, together with a lens (9) assembled angularly rigid therewith, a rotating unit (10) powered by the actuator and wherein the light source, the actuator and the rotating optical unit are operatively associated with a framed support (11) formed by a rigid metallic structure; the rotating optical unit (10) is supported in idly manner solely by a bottom portion (14) of the framed support (11) as a first sub-assembly (15) completely independent of an upper portion (16) of the framed support (11) bearing the light source (6), which forms, with a printed circuit board (12) and electronic components (13) a second sub-assembly (18) supported solely by the upper portion (16) of the framed support (11), the first sub-assembly (15) being mechanically disconnected in rotation from the second sub-assembly (18).

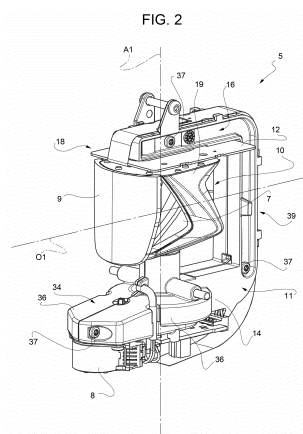
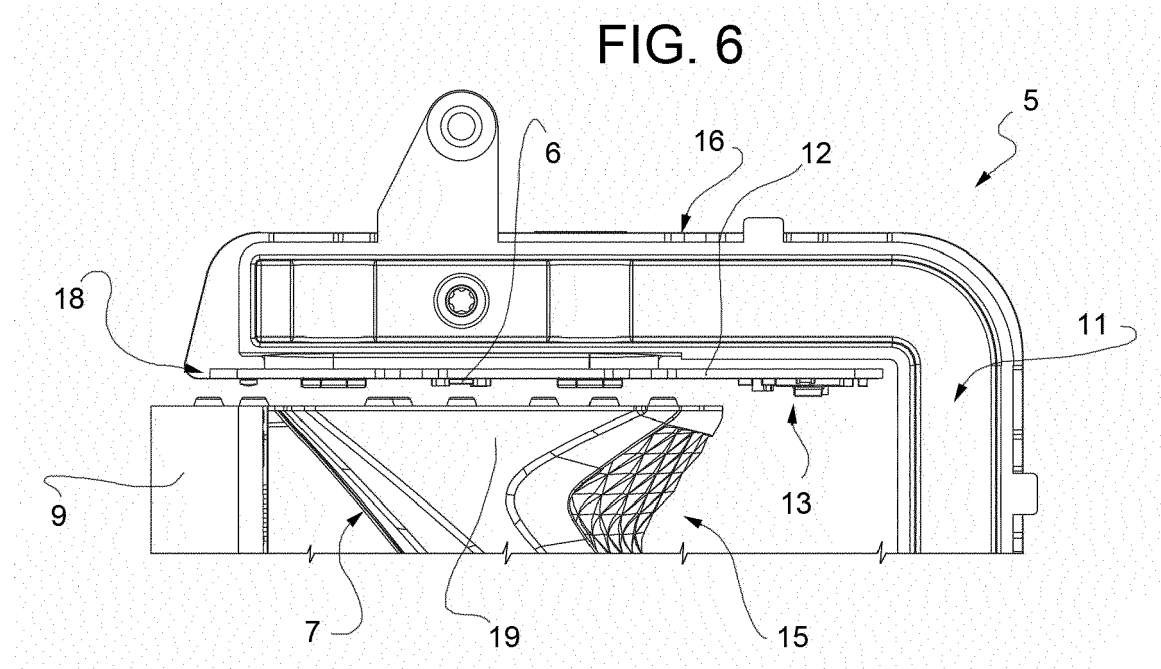


FIG. 6



Description

Technical field of the invention

[0001] The present invention relates to a rotating lighting module for vehicles and to a lighting device equipped with a plurality (i.e. at least two) of such lighting modules having rotation capabilities, preferably associated with a main non-rotating lighting module, in order to provide selectively a plurality of lighting distributions by means of the same lighting device.

Technical Background

[0002] Lighting devices for vehicles comprising a plurality of individual lighting modules, some of which are provided with rotating elements, like e.g. a rotating reflector, are known in the art.

[0003] EP2902701 and FR3022322A1 disclose a lighting module having a fixed light source consisting of a LED and a rotating support having two opposite faces, one constituting a 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.

[0004] In the device of EP2902701 the light source is a LED mounted on a printed circuit board and the rotating reflector is pivoting on a couple of opposite coaxial pins, a first of which is idly housed in a through seat provided in the printed circuit board and in a supporting structure thereof, and a second of which is idly housed in a second seat provided in a base of the supporting structure.

[0005] Such solution guarantees on one side a reliable pivoting of the rotating part of the lighting module, but on the other side is difficult to be implemented, is bulky, renders the assembly operation of the lighting module complex, slow and costly and above all, does not allow to standardize the component elements of the lighting module, so that lighting modules apparently identical but designed to be arranged in different positions in the overall lighting device have in reality components which differ, even if slightly, from each other so increasing the production costs.

[0006] Finally, especially the rotation of the upper pin within its seat provided through the printed circuit board may wear out the rotation seat causing noise and in some cases the generation of dust that may deposit onto the optical parts of the module and so impair its lighting performances.

Summary of the invention

[0007] The object of the present invention is to provide a rotating lighting module and a lighting device for vehicles comprising a plurality of such rotating lighting modules, which are of simple and compact construction and

assembly, are cost-effective and, at the same time, are highly reliable, are not noising and maintain their optical performances along time.

[0008] According to the invention, therefore, a rotating lighting module and an associated lighting device for vehicles including a plurality of such rotating lighting modules are provided, having the features set out in the appended claims.

Brief description of the drawings

[0009] 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 three-quarter front perspective view of a lighting device for vehicles according to the present invention, represented facing a forward driving direction of a vehicle;
- figure 2 shows in an enlarged scale a three-quarter front perspective view of one rotating lighting module of the invention pertaining to the lighting device of figure 1;
- figure 3 shows the same rotating lighting module of figure 2, with parts removed in order to show the inner structure thereof;
- figure 4 shows a detail of one rotating unit of the rotating lighting module of figures 2 and 3;
- figure 5 shows a sectioned side elevation view of the lighting module of figure 2; and
- figure 6 and 7 show in a further enlarged scale respective side elevation views, figure 7 in section, of a same detail of the lighting module of figure 2.

Detailed description

[0010] With reference to figure 1, reference number 1 indicates as a whole a lighting device consisting, in the non-limiting embodiment shown, in a vehicle headlight assembly, which is only schematically shown from the front, with parts, which are not essential for describing the invention, removed for sake of simplicity.

[0011] The lighting device 1 comprises a generally cup-shaped housing body 2 designed to be mounted on a vehicle, known and not shown for sake of simplicity. Housing body 2 is made of synthetic plastic material by injection molding and has a front inlet opening 3 in use facing opposite to the vehicle and toward a forward driving direction FD of the vehicle, indicated by an arrow; the front inlet opening is closed by a transparent cover, normally constituted by a terse lens (i.e. a transparent lens not provided with optical functions), known and not shown (removed) for sake of simplicity.

[0012] According to the present invention, the lighting device 1 comprises a stationary main lighting module 4 and a plurality (e.g. at least two or more than two) of

secondary lighting modules 5, each rotating around a respective axis, arranged generally vertical. The lighting modules 4, 5 are arranged side by side within the housing body 2, facing the inlet opening 3 and the rotating lighting modules 5 are arranged within the housing body 2, as it will be seen in greater details herein below, pivoting around respective first axes A1, A2 and A3, arranged all parallel to each other.

[0013] The main lighting module 4 has an optical axis O arranged parallel to the forward march direction FD and along which the light beam generated in use by the lighting module 4 is delivered. Likewise, each rotating lighting module 5 has its own optical axis O1, which may be rotated in use around the respective pivoting axes A1, A2 and A3.

[0014] A rotating lighting module 5 for vehicles according to the invention is shown in an enlarged scale and in details in figures 2, 3 and 5-7.

[0015] For sake of simplicity it is shown and it will be described the lighting module 5 closer to the main lighting module 4, i.e. that one rotating around a pivoting axis A1; it is clear, however, that, according to one feature of the invention, the other lighting modules 5 in the same lighting device 1 are identical to that one closer to the main lighting module 4, i.e. all the rotating lighting modules 5 are identical to one another.

[0016] Each rotating lighting module 5 comprises at least one light source 6, at least one reflector 7 and at least one actuator 8 to rotate the reflector 7 relative to the light source 6 around a first pivoting axis A, in the example shown the axis A1.

[0017] According one feature of the invention, each lighting module 5 further comprises a lens 9, which is assembled angularly rigid with the reflector 7 and forms, together with the reflector 7, a rotating optical unit 10 powered by the actuator 8.

[0018] The at least one light source 6, the actuator 8 and the rotating optical unit 10 are operatively associated with a framed support 11 holding rigid in a fixed position the light source 6 and bearing in idling manner the rotating optical unit 10.

[0019] Preferably, the light source 6 is borne by a printed circuit board 12, also bearing electronic components 13, known in the art, to control the light source 6.

[0020] If necessary or preferred, the printed circuit board 12 bears more than one light source, e.g. further two or three, to perform different lighting functions. The light source 6 is preferably a LED.

[0021] According to a first main feature of the invention, the framed support 11 is formed by a rigid metallic structure, generally C-shaped, e.g. realized in a press-molded, aluminum based, light alloy.

[0022] According to a further main feature of the invention, in combination with the above first main feature, each lighting module 5 is configured so that the corresponding rotating optical unit 10 is supported in idling manner solely by a bottom portion 14 of the framed support 11 of each module 5. Moreover, the rotating optical unit

10 is self-supporting and is configured (figures 3,4) to form within the corresponding lighting module 5 a first sub-assembly 15, which is completely independent of an upper portion 16 of the framed support 11 bearing the at least one light source 6, in the case in point bearing the whole printed circuit board 12 with the at least one (or more) light source 6 and the electronic components 13.

[0023] In particular, the at least one light source 6 with the printed circuit board 12 and the electronic components 13 form within the corresponding lighting module 5 a second sub-assembly 18 supported solely by the upper portion 16 of the framed support 11.

[0024] In this manner, according to a feature of the invention and contrary to the prior art, the first sub-assembly 15 is mechanically disconnected in rotation from the second sub-assembly 18.

[0025] At this purpose, the first sub-assembly 15 (figures 3,4) comprises a rigid box-like structure 19 connecting the reflector 7 with the lens 9, facing to each other, and a shaft 20 having a symmetry axis coinciding with the first axis A (axis A1 in the embodiment shown); the shaft 20 is configured such as to project in cantilever fashion from the rigid box-like structure 19, in particular from the bottom thereof, namely on the side thereof facing away from the printed circuit board 12 and the respective sub-assembly 18.

[0026] According to the invention, the shaft 20 is housed entirely within a first through seat 21 (figures 3 and 5) provided in the bottom portion 14 of the framed support 11 and is supported by a first rolling bearing 22 and by a second rolling bearing 23 housed within opposite ends 24,25 of the first through seat 21.

[0027] The rolling bearings 22,23 are coupled idly with the shaft 20 at respective opposite ends 26,27 thereof; accordingly, the shaft 20 with the bearings 22,23 are configured so that the shaft 20 is the sole, unique, single support and rotational guide for the rotating optical unit 10.

[0028] According to a non-secondary feature of the invention, the shaft 20 is of a tubular shape (see figure 5), being axially crossed by a second through seat 28 so as to be delimited laterally by an annular wall 29.

[0029] Moreover, the shaft 20 is configured such as to be elastically deformable in radial direction at least at the opposite ends 26,27 thereof.

[0030] This is obtained in the non-limitative embodiment shown by providing both ends 26,27 with at least a couple of radial slots 30 extending axially; the radial slots 30 are open-ended at respective terminal edges of the ends 26,27.

[0031] According to a feature of the invention, the first sub-assembly 15 further comprises (figure 5) a rod 31 designed to be removably inserted axially within the second through seat 28 in order to prevent, when inserted, any radial deformation of the shaft 20 and so rendering it completely rigid.

[0032] In the non-limitative embodiment shown the rod 31 is threaded and is screwed into the seat 28. Another

way of coupling, e.g. a snap-coupling, may be used in alternative, even if the screw coupling is safer and is preferred.

[0033] According to a feature of the invention, the shaft 20 has to have in axial direction a length comparable with the height of the box-like rigid structure 19 in the same axial direction. Here and below for "comparable" is intended that the length of shaft 20 is at least of the same order of magnitude of the height of the box-structure 19 and preferably that the two differ for less than the 20%.

[0034] According to a preferred feature of the invention, the shaft 20 has its side wall 29 provided radially outwards with at least one axial groove 32 (preferably at least three axial grooves 32 angularly spaced at 120° to each other).

[0035] The at least one axial groove 32 is engaged by a first transmission wheel 33 (figure 5 - a toothed wheel or gear 33, in the embodiment shown) fitted axially upon shaft 20; in fact, in the preferred embodiment shown, the bottom portion 14 of the framed support 11 is shaped as a box forming externally on the framed support 11 an internally hollow plate-like base 34 (figure 2).

[0036] The rotating optical unit 10 projects axially upwards in cantilever fashion from the bottom portion 14 of the framed support 11, namely from the internally hollow plate-like base 34, towards the upper portion 16 of the framed support 11, remaining spaced apart from the upper portion 16

[0037] The actuator 8 is carried externally by the bottom portion 14 of the framed support 11, in particular by the internally hollow plate-like base 34, on the side opposite to the rotating optical unit 10; the actuator 8 is moreover mechanically connected to the transmission wheel 33 by transmission elements, e.g. other two toothed gears 35 (figure 5); the transmission wheel 33 and the transmission elements 35 are housed idly within the plate-like base 34 formed by the bottom portion 14 of the framed support 11.

[0038] Of course, other means of transmission could be used, e.g. a transmission belt connecting directly the output shaft of the actuator 8 with the transmission wheel 33 keyed onto the shaft 20 in order to make the shaft 20 to rotate around axis A1.

[0039] As mentioned above, the framed support 11 is generally C-shaped and, according to a further feature of the invention, is formed (figure 2) by two specular-symmetrical half-shells 36, one of which is better shown alone in figure 3) mechanically coupled together side by side at a plane parallel to the half-shells 36, i.e. parallel to their laying plane, and containing the first axis A, in the example shown axis A1. The two half-shells 36 are coupled together in a removable manner, so as to be separable, in the embodiment shown by means of lateral screws 37.

[0040] Each half-shell comprises (figure 3): a L-shaped portion 38 configured as a solid, profiled element having a double T shape in cross-section and defining with its opposite wings, when the two half-shells 36 are coupled,

the upper portion 16 and a middle portion 39 of the framed support 11; and a bottom cup-shaped section 40 configured such as, when the two half-shells 36 are coupled, extends parallel to and facing with the upper portion 16 of the framed support 11, to which is connected by the middle portion 39.

[0041] The bottom cup-shaped sections 40 of the two half-shells 36 form, when the latter are coupled together, the plate-like hollow base 34 defining/delimiting at least part of the bottom portion 14 of the framed support 11.

[0042] In this manner, the assembly of each rotating lighting module 5 is extremely easy. Moreover, the rotating optical unit 10 is guided with precision and without the risk of oscillations/vibrations by the combination of the partially hollow, rigid and metallic framed support 11 with the projecting shaft 20 borne rigid with the rotating optical unit 10 and with the supporting rolling bearing 22,23 thereof arranged at the opposite ends 26,27 of the shaft 20.

[0043] Moreover, since the rotating optical unit 10 is mechanically completely separated from the printed circuit board 12 as far as its rotation capability is concerned, both wear of the rotation seat through the printed circuit board (which exists no more according to the invention) and the formation of dust due to wear are avoided, so impeding both the possible generation of noise and the possible impairment of the optical performances of the lighting module in use.

[0044] All the aims of the invention are therefore accomplished.

Claims

1. A rotating lighting module (5) for vehicles, comprising at least one light source (6), at least one reflector (7) and at least one actuator (8) to rotate the reflector relative to the light source around a first axis (A); wherein the reflector (7) forms, together with a lens (9) assembled angularly rigid therewith, a rotating optical unit (10) powered by said actuator (8) and wherein the light source, the actuator and the rotating optical unit are operatively associated with a framed support (11) holding rigid in a fixed position the light source (6) and bearing in idling manner said rotating optical unit (10); the light source (6) being borne by a printed circuit board (12) also bearing electronic components (13) to control the light source; **characterized in that**, in combination:

- i)- the framed support (11) is formed by a rigid metallic structure;
- ii)- the rotating optical unit (10) is supported in idly manner solely by a bottom portion (14) of the framed support (11) and forms a first sub-assembly (15) which is completely independent of an upper portion (16) of the framed support (11) bearing the at least one light source (6) ;

- iii)- the at least one light source (6) with the printed circuit board (12) and the electronic components (13) forming a second sub-assembly (18) supported solely by the upper portion (16) of the framed support;
- iv)- such as the first sub-assembly (15) is mechanically disconnected in rotation from the second sub-assembly (18).
2. A lighting module according to claim 1, **characterized in that** the first sub-assembly (15) comprises a rigid box-like structure (19) connecting the reflector (7) with the lens (9) facing to each other, and a shaft (20) having a symmetry axis coinciding with the first axis and projecting in cantilever fashion from a bottom of the rigid box-like structure (19); the shaft (20) being housed entirely within a first through seat (21) provided in the bottom portion (14) of the framed support (11) and being supported by a first and a second rolling bearing (22,23) housed within opposite ends (24,25) of the first through seat (21), coupled idly with the shaft (20) at respective opposite ends (26,27) thereof; said shaft (20) being the sole support and rotational guide for the rotating optical unit (10).
3. A lighting module according to claim 2, **characterized in that** said shaft (20) is of a tubular shape, being axially crossed by a second through seat (28) so as to be delimited laterally by an annular wall (29); said shaft (20) being configured such as to be elastically deformable in radial direction at least at the said opposite ends (26,27) thereof.
4. A lighting module according to claim 3, **characterized in that** the first sub-assembly (15) further comprises a rod (31) designed to be removably inserted axially within said second through seat (28) in order to prevent any radial deformation of the shaft (20).
5. A lighting module according to anyone of claims from 2 or 4, **characterized in that** said shaft (20) has in axial direction a length comparable with the height of said rigid box-like structure (19).
6. A lighting module according to anyone of claims from 2 or 5, **characterized in that** said shaft (20) has a side/lateral wall (20) provided radially outwards with at least one axial groove (32); said axial groove (32) being engaged by a first transmission wheel (33) fitted axially upon said shaft (20); said bottom portion (14) of the framed support (11) being shaped as a box forming an internally hollow plate-like base (34); said rotating optical unit (10) projecting axially upwards in cantilever fashion from the internally hollow plate-like base (34) of the bottom portion (14) of the framed support (11) and towards the upper portion (16) of the framed support, remaining spaced apart from the upper portion (16) of the framed support; and said actuator (8) being carried externally by the bottom portion (14) of the framed support on the said opposite to the rotating optical unit (10) and being mechanically connected to the transmission wheel (33) by transmission elements (35), the transmission wheel (33) and the transmission elements (35) being housed idly within the plate-like base (34) formed by said bottom portion (14) of the framed support.
7. A lighting module according to anyone of the preceding claims, **characterized in that** the framed support (11) is generally C-shaped and is formed by two half-shells (36) mechanically coupled together side by side in a removable manner at a plane parallel to the half-shells and containing the first axis (A); each half-shell (36) comprising: a L-shaped portion (38) configured as a solid, profiled element having a double T cross-section and defining said upper portion (16) and a middle portion (39) of the framed support (11) when the two half-shells (36) are coupled; and a bottom cup-shaped section (40) extending parallel to and facing with the upper portion (16) and connected thereto by the middle portion (39) with the half-shells (36) coupled; the bottom cup-shaped sections (40) of the two half-shells (36) forming, when the latter are coupled together, a plate-like hollow base (34) defining at least part of said bottom portion (14) of the framed support (11).
8. A lighting device (1) for a vehicle comprising a plurality of lighting modules (5) according to anyone of the preceding claims, arranged side by side within a cup-shaped housing body (2).
9. Vehicle provided with a lighting device (1) according to claim 8.

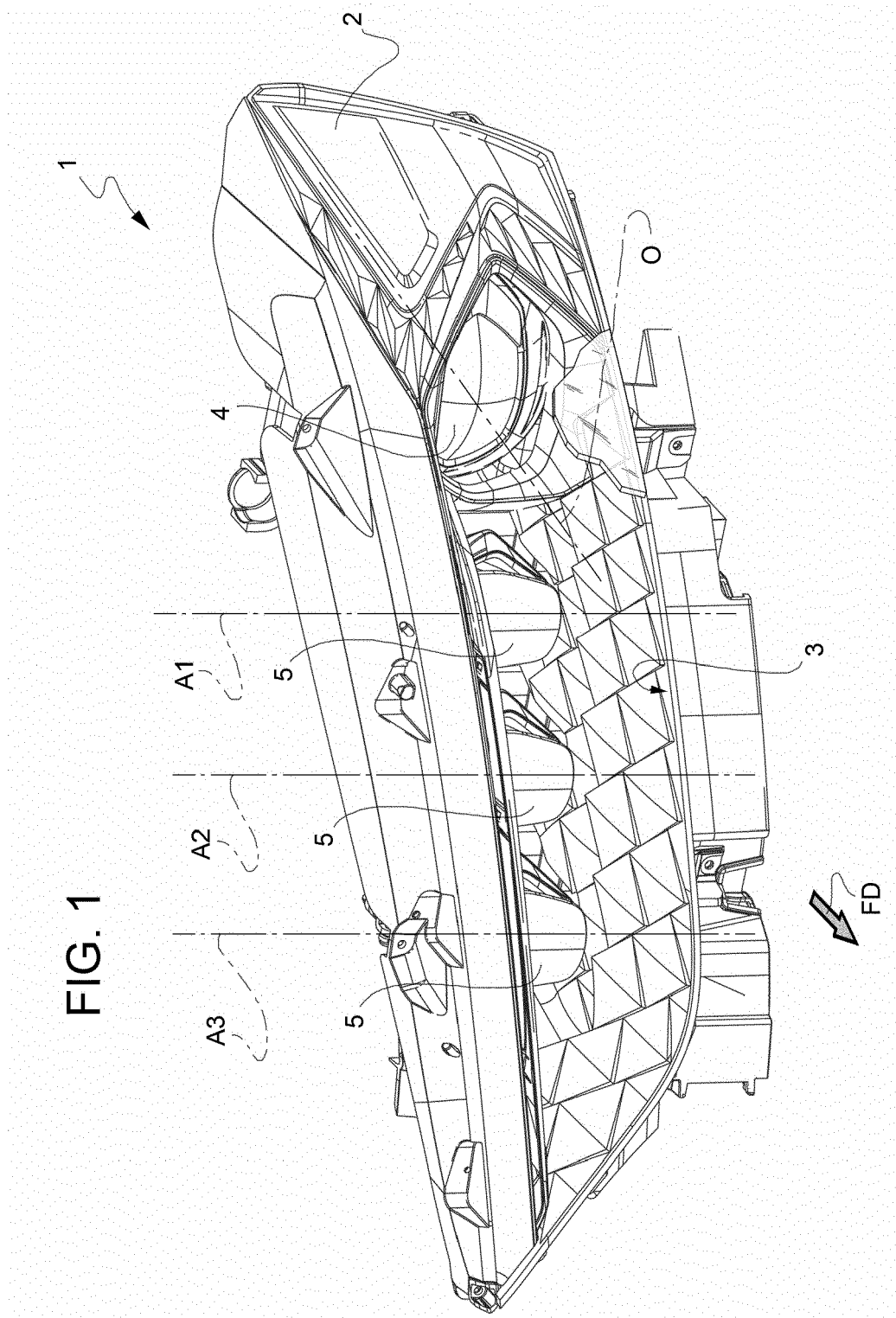


FIG. 2

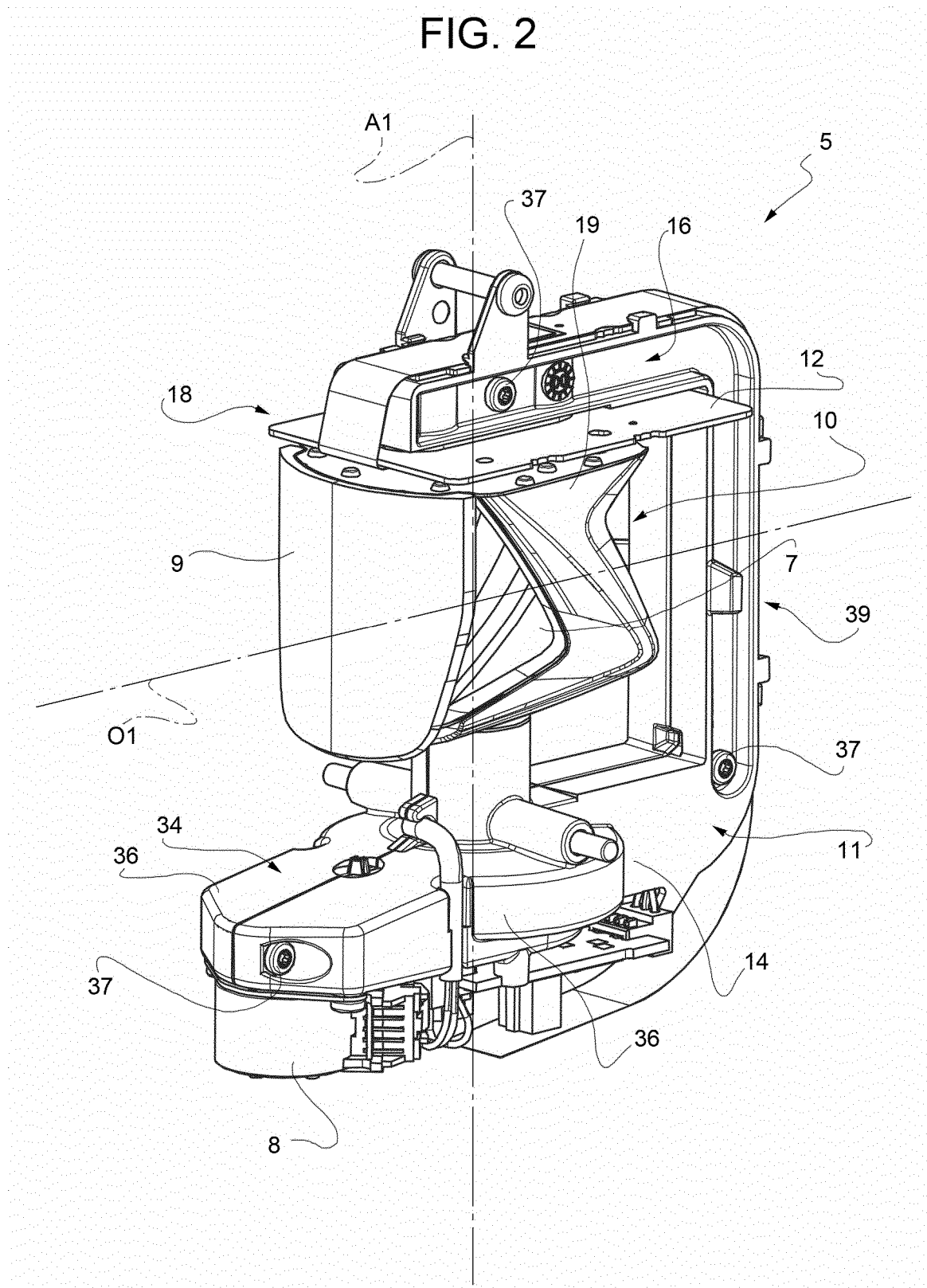


FIG. 3

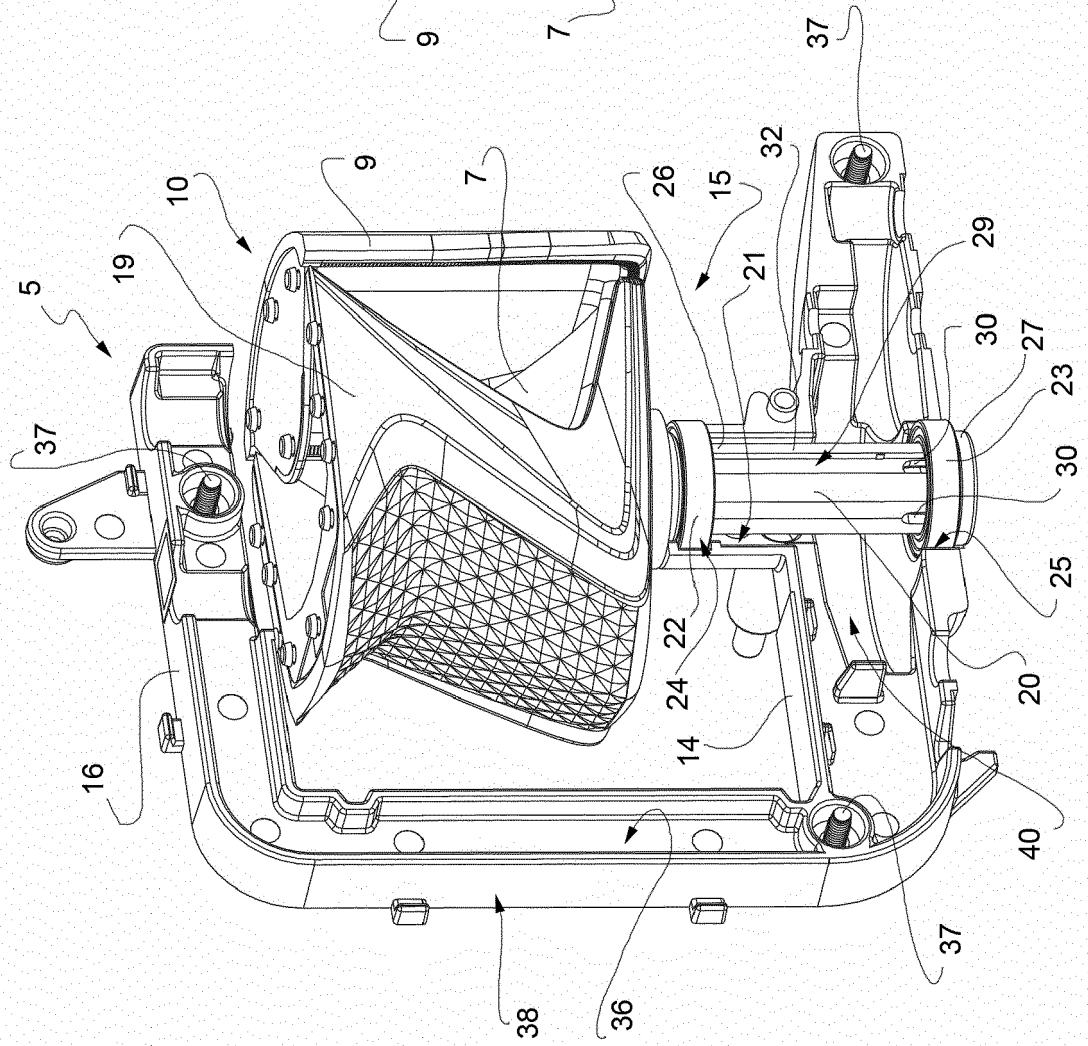


FIG. 4

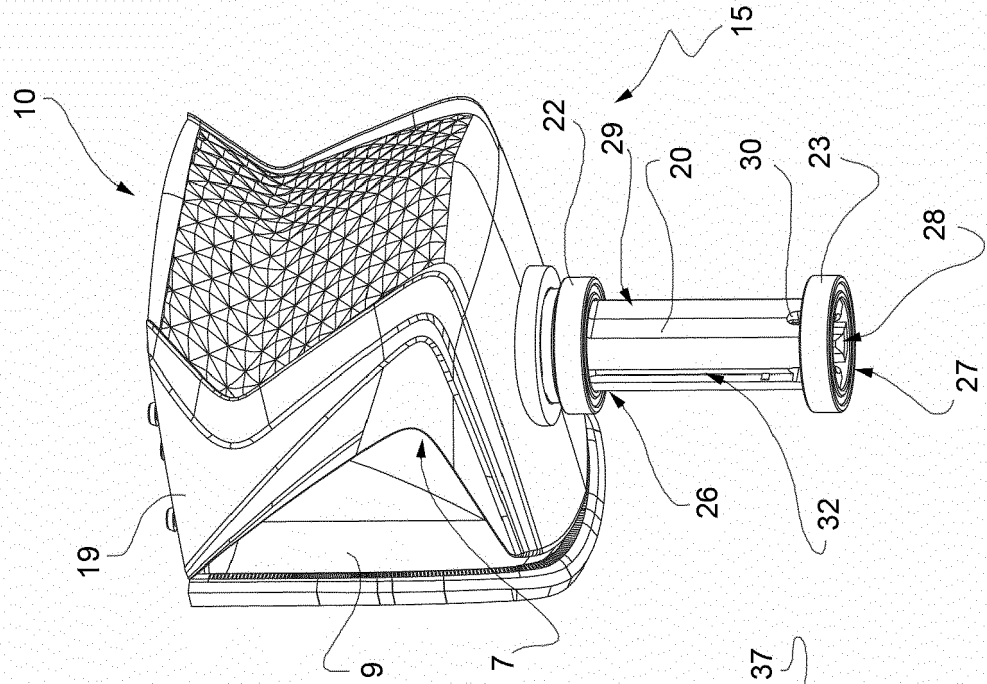


FIG. 5

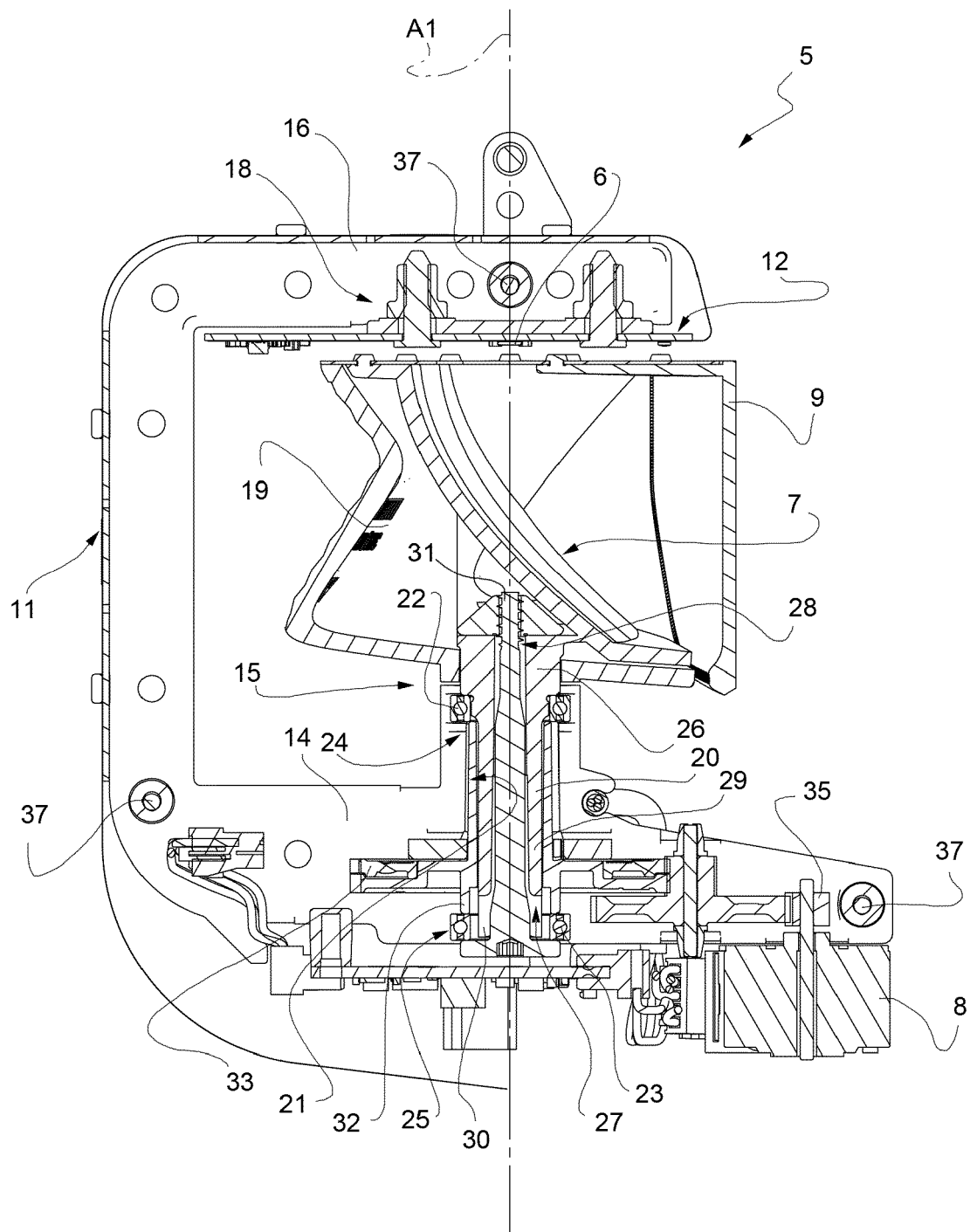


FIG. 6

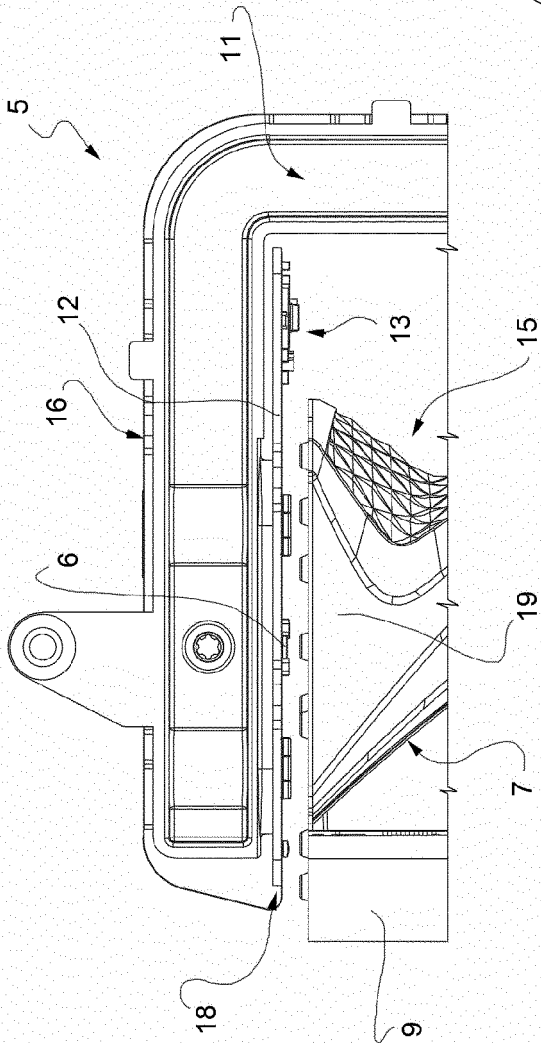
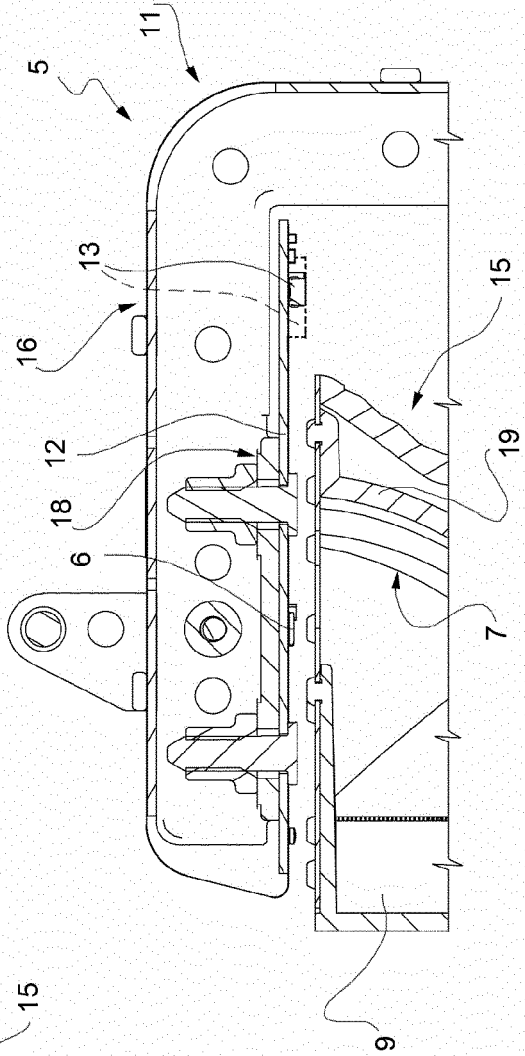


FIG. 7





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