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(54) **LIGHTING DEVICE FOR VEHICLES HAVING LIGHT GUIDES**

(57) A lighting device (1) including a housing (2), at least one light guide (3) housed in the housing so as to be visible from the outside, and at least one light source (5) arranged on a support element (6), which is coupled to the housing in a removable manner so as to close a through seat (8) of the housing; a first end (7) of the light guide is operatively associated with the light source and is housed in such a way that it goes through an interface element (9) and an adapter element (10), which are coupled so as to be integral to one another and are housed in the through seat of the housing; wherein a screw (11) and a threaded nut (12) constrain the adapter element to the interface element so that the screw (11) and the interface element (9) are movable relative to one another, the screw including an activation head (13), a first threaded stretch (15), which is screwed into a reception seat (18) of the interface element (9), and a second threaded stretch (16), which receives the threaded nut (12) so that it axially strikes against a bottom wall (21) of the adapter element.

FIG. 2

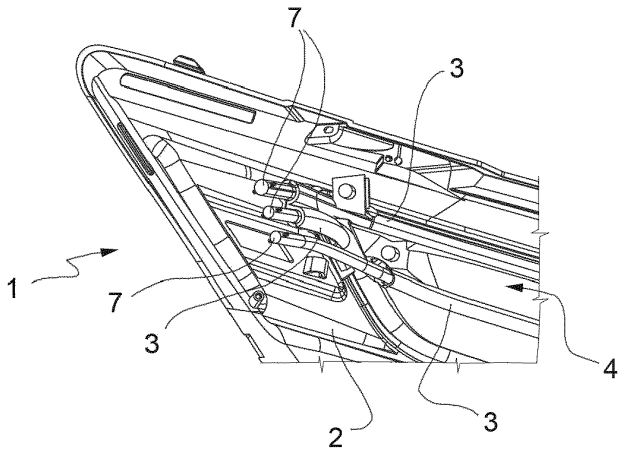

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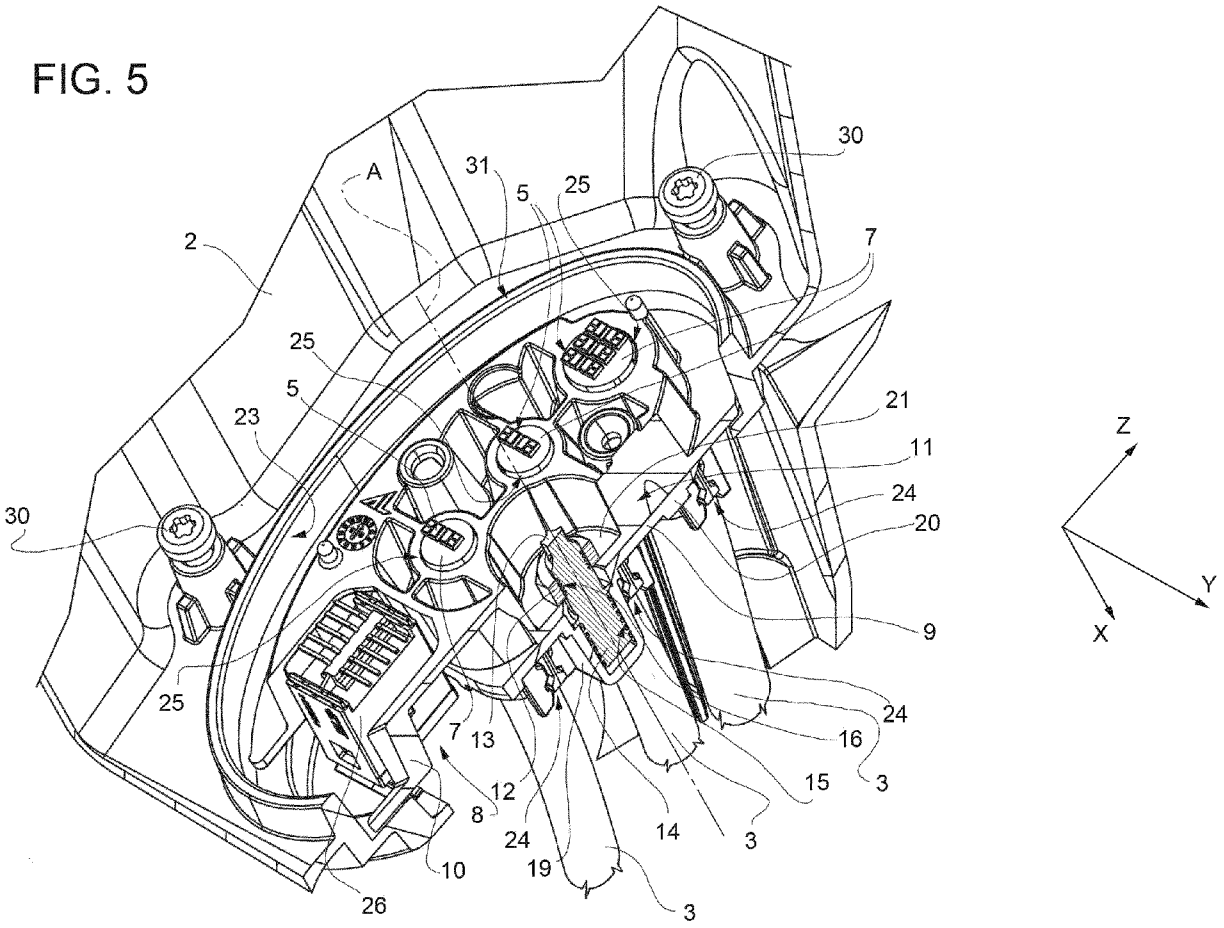
FIG. 5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Description

Cross-reference to related applications

[0001] This patent application claims priority from Italian patent application no. 102018000010248 filed on 12/11/2018.

Technical field of the invention

[0002] The invention relates to a lighting device for vehicles, in particular a headlight for a vehicle, such as a motor vehicle, wherein one or more light guides are used, which are preferably lit by LEDs and are designed to carry out signalling functions (for example: position, direction, DRL) or aesthetic functions.

Prior art

[0003] As it is known, a vehicle lighting device comprises a cup-shaped body or housing, which is generally manufactured by moulding of a synthetic plastic material, at least one lighting element, which is housed in the cup-shaped body, and a transparent element, which closes a front opening of the cup-shaped body and, in use, faces the driving direction of the vehicle.

[0004] More and more often, light guides, which are lit by means of one or more LEDs (or by means of other different light sources), are used as lighting elements, in particular in order to carry out signalling functions, as position lamps, direction lights, DRL, etcetera.

[0005] In modern headlights, the transparent element or lens closing the front opening of the headlight body is optically neutral and different light guides are placed inside the headlight body so as to be visible through the transparent element.

[0006] According to these configurations, the LEDs (or other different lighting sources) used to light the light guides are carried at the back by the cup-shaped housing or body, in the area of a rear through seat thereof, which is not necessarily aligned with the front opening, or in the area of a lateral through seat thereof, since the light guides usually consist of elongated rod-shaped elements, which are flexible or anyway curved and receive the light at a first end of theirs in order to be then party or entirely lit over their length or in order to be lit only in the area of a second end of theirs, which is opposite the first one.

[0007] Said rear or lateral through seat of the cup-shaped body is closed by a plate-shaped support element carrying the LED/s and externally fixed, in a removable manner, to the cup-shaped body or housing.

[0008] The plate-shaped support element is usually provided with the necessary electrical connections and with heat dissipators used to dispose of the heat produced, in use, by the LEDs.

[0009] Since the light guides are assembled on the headlight body or housing before mounting the plate-shaped support with the LEDs already assembled on it, there is the problem of ensuring a correct placing of the first ends of the light guides relative to the respective lighting LEDs, which are all carried by the same plate-shaped support.

[0010] The solution of this problem is complicated by the necessary assembling tolerances for the light guides, which are relatively wide.

[0011] In order to solve this problem, the light guides are assembled, on the side of their first end, on an interface element, which is preferably provided with elastically deformable seats, which are configured to receive, in a through manner, the first ends of the light guide or of the bundle of light guides to be lit.

[0012] The interface element is configured to be housed in the aforesaid rear or lateral through seat of the cup-shaped housing or body with a radial clearance.

[0013] Subsequently, an adapter element is fixed on the interface element in an integral manner, on the opposite side relative to the light guides, and is coupled, substantially without clearances, within the through seat, said adapter element being provided with through seats, which are designed to be coupled, substantially without clearances, to the first ends of the light guides, which, therefore, are forced to assume a correct position relative to the housing.

[0014] Finally, on top of the adapter element there is fixed the plate-shaped support element carrying the LEDs, which, hence, are aligned with the light guides to be lit.

[0015] The known solution described above, despite being extremely functional in order to recover the assembling tolerances along the Y and Z axes of the vehicle, namely those axes that are parallel to the lying plane of the plate-shaped support element, does not solve the problem of recovering the assembling tolerances of the light guides also along the X axis of the vehicle, namely along a direction that is perpendicular to the lying plane of the plate-shaped support element and is generally aligned with or parallel to the optical axis of the lighting device.

[0016] This drawback can turn out to be particularly serious because a wrong distance between the first end of the light guide and the respective LED (or other lighting source) strongly affects the photometric performances of the lighting device.

Summary of the invention

[0017] The object of the invention is to provide a lighting device for vehicles, in particular a headlight or lamp for motor vehicles, which is not affected by the drawbacks of the prior art and, in particular, allows, in a simple, economic and compact fashion, for the recovery of assembling clearances of the light guides along all the three axes defining the position thereof relative to the lighting LED/s (or other light source).

[0018] Therefore, according to the invention, there is

provided a lighting device for vehicles, in particular a headlight or lamp for motor vehicles, according to the appended claims.

Brief Description of the Drawings

[0019] Further features and advantages of the invention will be best understood with reference to the following description of a non-limiting embodiment thereof, given merely by way of example and with reference to the figures of the accompanying drawings, wherein:

- figure 1 shows a partial, three-quarter, perspective, front view of a headlight for a vehicle, in particular a motor vehicle, according to the invention;
- figure 2 shows a partial, three-quarter, perspective, rear view of the headlight of figure 1, with parts removed for sake of simplicity;
- figure 3 shows, on a larger scale, a sectional view of a detail of a rear part removed from figure 2 of the headlight of figure 1;
- figures 4 and 5 show two perspective views, namely a front and a rear three-quarter views, respectively, the one of figure 5 being a partly sectional view, of the detail of figure 3 concerning the rear part removed from figure 2 of the headlight of figure 1;
- figures 6 and 7 show two three-quarter, perspective, rear views, the one of figure 7 in an exploded configuration, of the same detail of figures 4 and 5.

Detailed description

[0020] With reference to figure 1, reference number 1 indicates, as a whole, a front headlight for motor vehicles, which is configured to be fixed in a known manner, which is not shown herein for the sake of simplicity, to the body of a vehicle (which is also known and not shown).

[0021] Hereinafter reference will be made to a vehicle front headlight, but the description also applies to any lighting device for vehicles, headlight or lamp, which uses light guides as lighting element.

[0022] The lighting device 1 comprises a housing 2, at least one lighting element 3, which is at least partly housed in the housing 2 so as to be at least partly visible from the outside through a front opening 4 of the housing 2, and at least one light source 5, which is arranged on a support element 6, well shown in figure 3, and is configured to at least partly light the lighting element 3.

[0023] The lighting element, according to an aspect of the invention, consists of at least one known light guide 3, which has an elongated shape and includes a first end 7 facing away from the front opening 4.

[0024] In the non-limiting example shown herein, the lighting element consists of a bundle of light guides 3 beside one another, whose respective first ends 7 are each operatively associated with a respective LED or group of LEDs 5 carried by the support element 6.

[0025] The support element 6 is coupled to the housing 2 in a removable manner so as to close a through seat 8 of the housing 2 arranged at the back or on the side thereof.

[0026] The end 7 of each light guide 3 is housed so as to go through an interface element 9 and an adapter element 10, which, in turn, is coupled to the interface element 9 in an integral manner and is arranged between the latter and the support element 6 for the LEDs 5, facing them.

[0027] The adapter element 10 and the interface element 9 are both housed, in the way described below, within the through seat 8 of the housing 2.

[0028] The adapter element 10 is constrained to the interface element 9 by means of a screw 11 and a threaded nut 12.

[0029] According to a feature of the invention, the screw 11 comprises (figure 5) an activation head 13 and a shank 14 having a first threaded stretch 15 and a second threaded stretch 16 arranged between the activation head 13 and the threaded stretch 15.

[0030] The first threaded stretch 15 is screwed into a reception seat 18 of the interface element 9 so that the screw 11 and the interface element 9 are movable relative to one another along an axis of symmetry A of the screw 11.

[0031] According to an aspect of the invention, the first threaded stretch 15 is self-tapping and the reception seat of the interface element 9 designed to receive it, into which the first threaded stretch 15 is screwed with the possibility of making a predetermined axial movement, is defined by a smooth lateral wall of a recess defined by a cup-shaped portion 19 of a bottom wall 20 of the interface element 9.

[0032] The cup-shaped portion 19 of the bottom wall 20 projects from the bottom wall 20, on the opposite side relative to the first ends 7 of the light guides 3 and, hence, towards the front opening 4.

[0033] According to another aspect of the invention, the threaded nut 12 is screwed onto the second threaded stretch 16 so as to axially strike against a bottom wall 21 of the adapter element 10.

[0034] The adapter element 10, furthermore, has a peripherally outer edge 22, which is coupled to an annular lateral wall 23 of the through seat 8 of the housing 2.

[0035] Preferably, the interface element 9 is provided with elastically deformable seats 24, which are configured to receive, in a through manner, the respective first ends 7 of the light guides 3 of the bundle of light guides to be lit. In the example shown herein, the seats 24 are defined by elastically deformable wings, which are manufactured as one single piece together with, and axially project from, the bottom wall 20, on the same side as the cup-shaped portion 19.

[0036] Furthermore, the interface element 9 is configured to be housed in the through seat 8 of the housing 2 with a radial clearance.

[0037] The adapter element 10, on the other hand, is fixed on the interface element 9 in an integral manner,

on the opposite side relative to the light guide/bundle of light guides 3 as well as to the cup-shaped portion 19, and is coupled within the through seat 8 of the housing 2 substantially without clearances.

[0038] The adapter element 10 is also provided with through seats 25, which are designed to be coupled to the first end 7 of the light guide 3 / of the bundle of light guides 3 substantially without clearances.

[0039] According to a further aspect of the invention, the support element 6 for the LEDs 5, the interface element 9 and the adapter element 10 are shaped like plates and are coupled superimposed to one another in overlapped positions.

[0040] The LEDs 5 constituting said at least one light source or a plurality of light sources to light the light guides 3 are powered by an electric connector 26, which is integrated with the support element 6 and projects from the latter on the opposite side relative to the ends 7 of the light guides or of the bundle of light guides 3.

[0041] The support element 6 is further provided with an annular collar 27 (figure 3), which projects towards the light guide 3 or the bundle of light guides 3 and is coupled in contact, substantially without clearances and in a fluid-tight manner, to the annular lateral wall 23 of the through seat 8 of the housing 2.

[0042] On the opposite side relative to the annular collar 27, the support element 6 is also provided with a flange 28, which is fixed by means of removable connection means, preferably, like in the example shown herein, consisting of screws 30, against a peripheral front edge 31 of the through seat 8 of the housing 2.

[0043] In use, the light guides 3 are fitted in position on the housing 2 with their ends 7 bent on the opposite sides relative to the front opening 4; the ends 7 are then inserted, one at a time, into the seats 24 of the interface element 9 and the latter is introduced into the through seat 8, where it is housed with a radial clearance.

[0044] Subsequently, the adapter element 10 is fitted against the interface element 9, inserting the ends 7 of the light guides 3 into the through seats 25 and the screw 11, without the threaded nut 12 and already at least partially screwed into the reception seat 18, into a through hole 32 made through the bottom wall 21 of the adapter element 10. During this mounting operation, the adapter element 10 is also inserted into the through seat 8, coupling its radially outer peripheral edge 22 to the lateral wall 23.

[0045] This operation causes the interface element 9 to be repositioned in the seat 8 and, especially, the single ends 7 of the light guides 3 to be repositioned relative to the lateral wall 23 and in the elastically deformable through seats 24 of the interface element 9, thus recovering the assembling tolerances of the light guides 3 along the axes Y and Z of the X,Y,Z reference system schematically shown in figure 5.

[0046] Finally, the nut 12 is fitted on the threaded stretch 16 until it strikes against the bottom wall 21 and, subsequently, by acting, with suitable tools, both upon the activation head 13 and upon the nut 12, the threaded stretch 15 is further screwed into or unscrewed from the reception seat 18, always causing the nut 12 to strike again against the bottom wall 21.

[0047] By so doing, it is possible to also recover the assembling tolerances of the light guides 3 along the axis X, without for this reason altering or complicating the operations for the recovery of the assembling tolerances along the axes Y and Z.

[0048] Finally, it is clear that the invention also applies to a vehicle comprising a lighting device 1, headlight or lamp, of the type described above, thus allowing, in use, for a better lighting of the road.

[0049] Therefore, all the objects of the invention are reached.

Claims

1. A lighting device (1) for a vehicle, in particular a headlight for a motor vehicle, comprising a housing (2), at least one lighting element (3) housed at least partially inside the housing so as to be at least partially visible from the outside via a front opening (4) of the housing (2), and at least one light source (5) arranged on a support element (6) coupled to the housing, in a detachable manner, to close a through seat (8) of the housing arranged at the rear or at the sides thereof, said at least one light source being configured to illuminate said at least one lighting element, which consists of a light guide (3) having an elongated shape and including a first end (7) operatively associated with said at least one light source; wherein the first end (7) of the light guide (3) is housed passing through an interface element (9) and an adapter element (10), which in turn is coupled integral with the interface element (9) and interposed between the latter and the support element (6) of said at least one light source facing thereto, the adapter element and the interface element both being housed inside said through seat (8) of the housing; **characterised in that** the adapter element (10) is constrained to the interface element (9) by a screw (11) and a threaded nut (12); the screw comprising an activation head (13) and a shank (14) having a first threaded stretch (15) and a second threaded stretch (16) arranged between the activation head (13) and first threaded stretch (15), the first threaded stretch (15) being screwed inside a reception seat (18) of the interface element (9) so that the screw (11) and the interface element (9) are relatively mobile along an axis of symmetry (A) of the screw; the threaded nut (12) being screwed on the second threaded stretch (16) in such a manner it couples in axial abutment against a bottom wall (21) of the adapter element (10).

2. The lighting device according to claim 1, **character-**

ised in that said adapter element (10) has a peripheral outer edge (22) which couples with an annular lateral wall (23) of the through seat (8) of the housing.

3. The lighting device according to claim 1 or 2, **characterised in that** it comprises a plurality of lighting elements consisting in a bundle of elongated light guides (3); said interface element (9) being provided with elastically deformable seats (24) configured to receive in through-manner respective first ends (7) of the light guides (3) of said bundle of light guides to be illuminated.

4. The lighting device according to one of the preceding claims, **characterised in that** said interface element (9) is configured to be housed with radial play inside said through seat (8) of the housing.

5. The lighting device according to one of the preceding claims, **characterised in that** the adapter element (10) is fixed integral onto the interface element (9) on the opposite side to the at least one light guide (3) or to a bundle of light guides and is substantially coupled without radial play inside the through seat (8) of the housing.

6. The lighting device according to claim 5, **characterised in that** the adapter element (10) is provided with through seats (25) designed to couple without radial play to the first end (7) of the at least one light guide (3) or of the bundle of light guides.

7. The lighting device according to one of the preceding claims, **characterised in that** the first threaded stretch (15) is of the self-threading type, the reception seat (18) of the interface element, within which the first threaded stretch (15) is screwed, being defined by a smooth lateral wall of a recess defined by a cup-shaped portion (19) of a bottom wall (20) of the interface element (9) protruding in a cantilever fashion from the bottom wall (20) on the side opposite to the first end (7) of the at least one light guide (3).

8. The lighting device according to one of the preceding claims, **characterised in that** said support element (6) for the at least one light source, said interface element (9) and said adapter element (10) are shaped as plates and are coupled superimposed to one another in overlapped positions; said at least one light source being formed by an LED or by an LED assembly (5) powered by an electric connector (26) integrated with the support element (6) and protruding from the same on the side opposite to the first end (7) of the light guide or the bundle of light guides.

9. The lighting device according to one of the preceding claims, **characterised in that** said support element (6) is provided in a cantilever fashion towards the light guide or the bundle of light guides (3) of an annular collar (27) which is coupled in contact with an annular lateral wall (23) of the through seat (8) of the housing and, on the side opposite to said annular collar (27), of a flange (28), which is fixed by means of removable connection means, preferably screws (30), against a peripheral front edge (31) of the through seat (8) of the housing.

10. The vehicle comprising a lighting device (1), headlight or lamp, according to one of the preceding claims.

FIG. 1

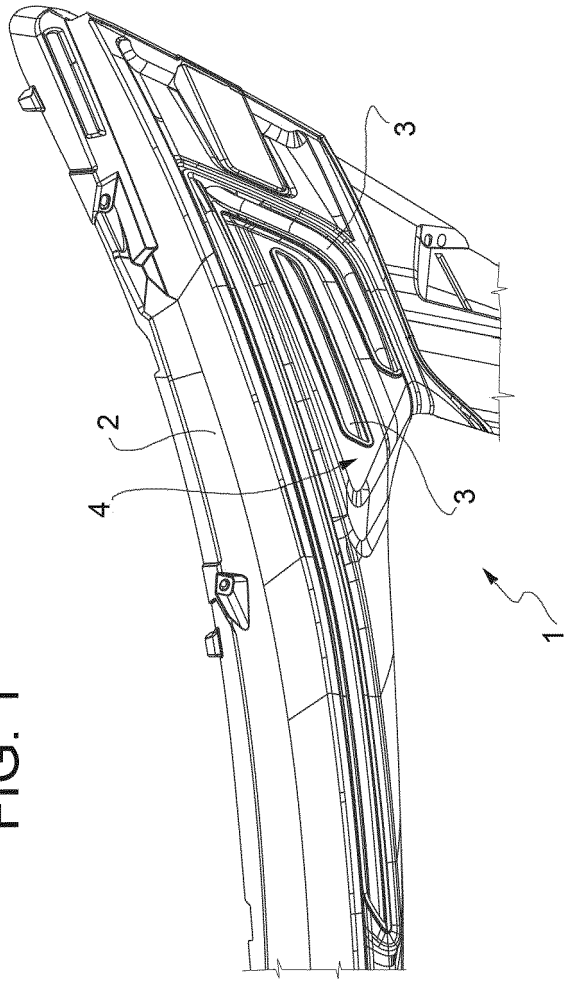


FIG. 2

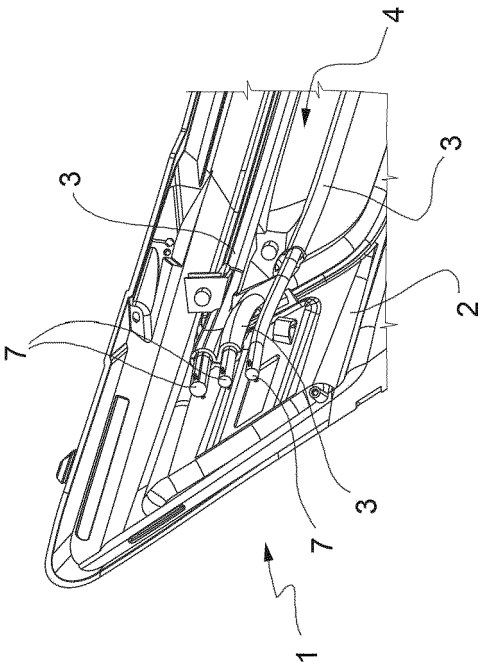
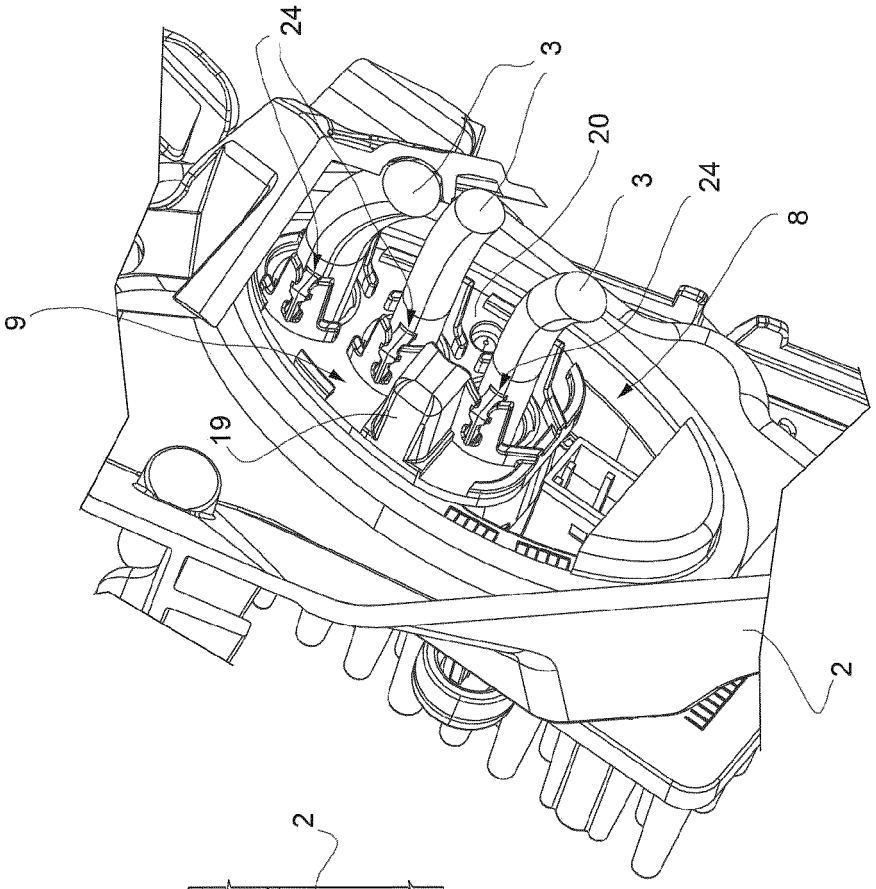


FIG. 4



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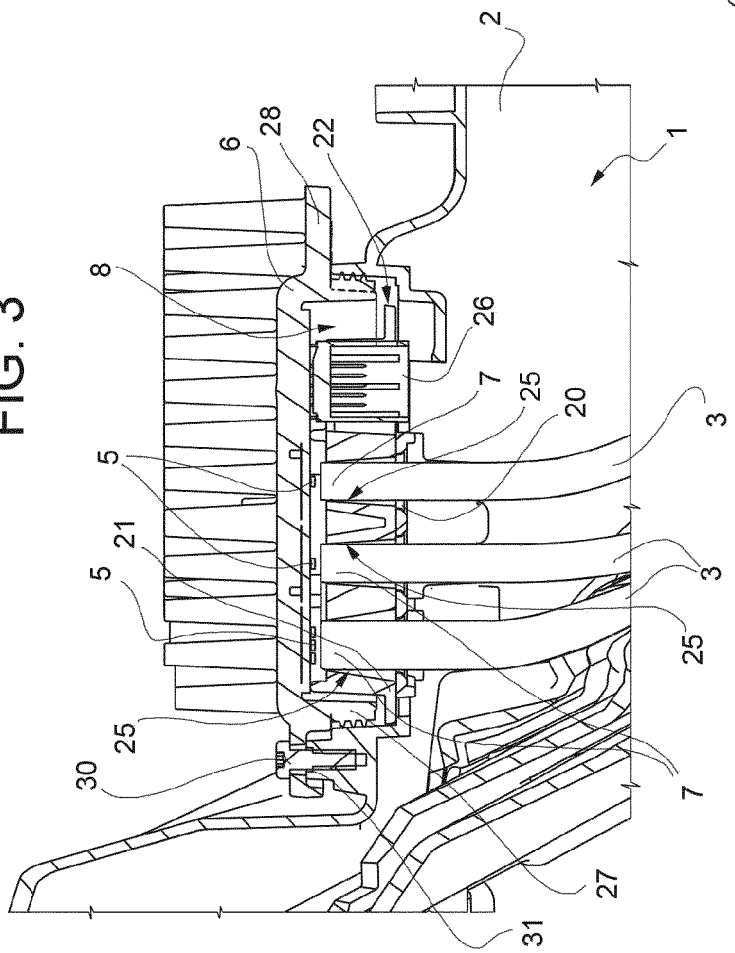

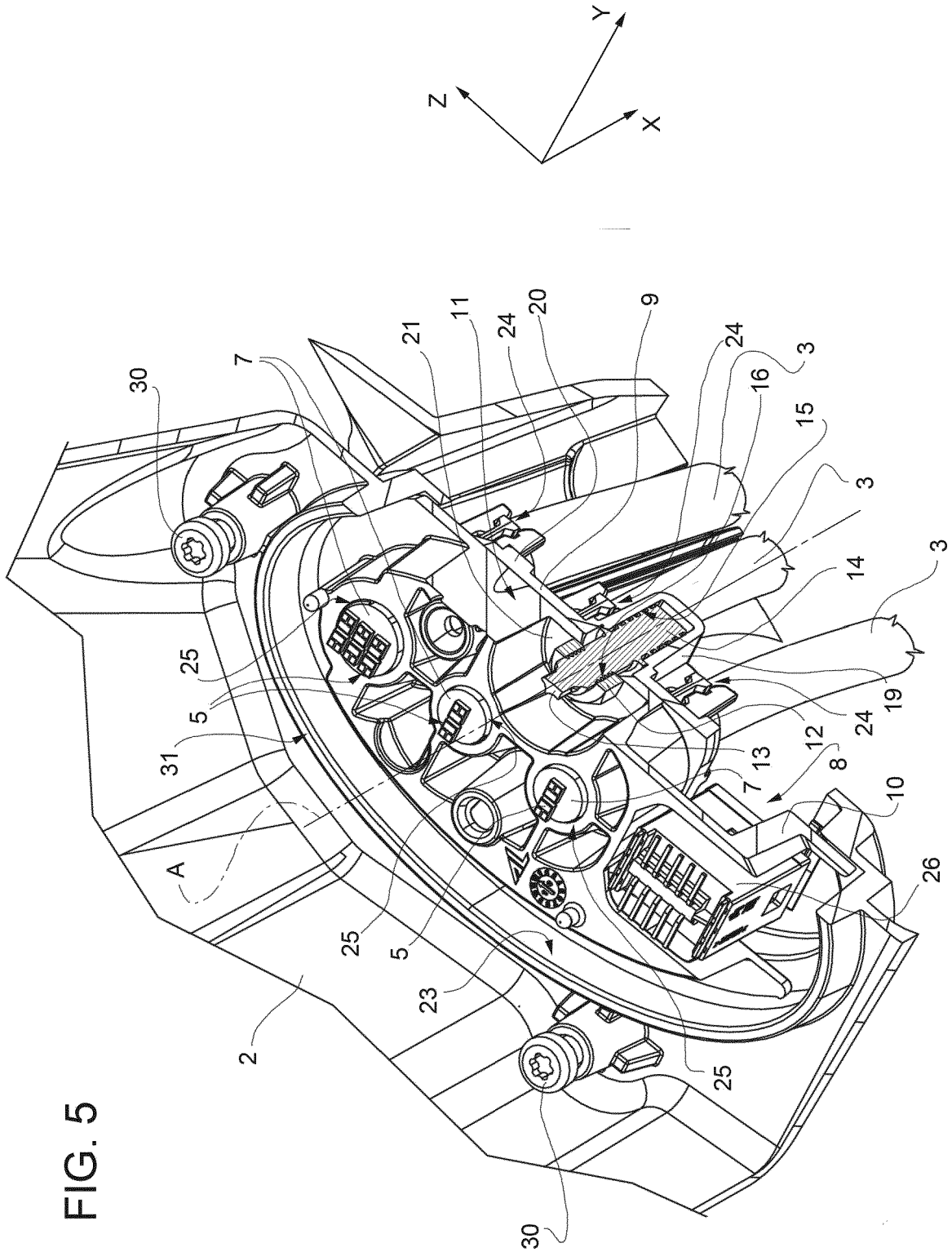
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FIG. 5

FIG. 6

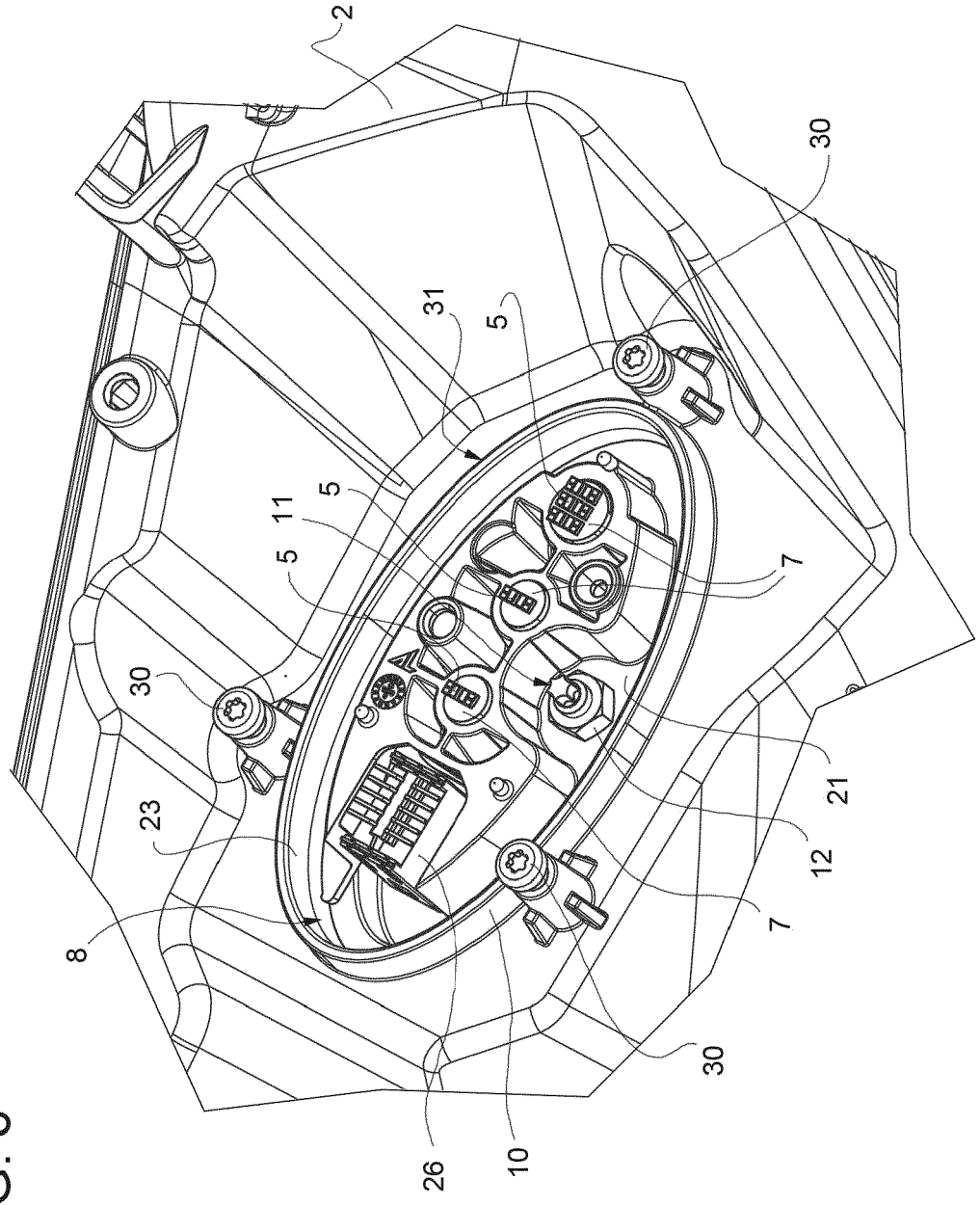
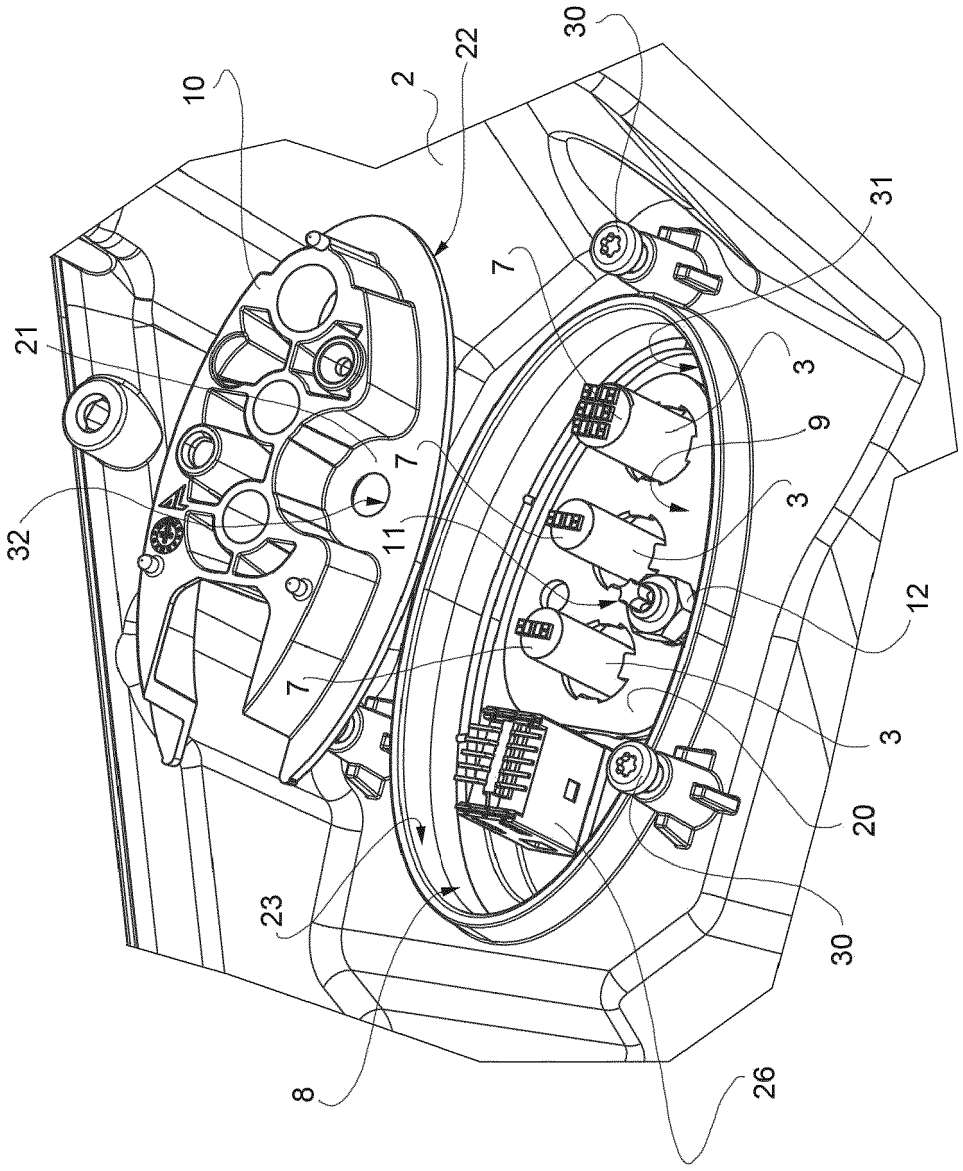


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2016/281954 A1 (MOISY ERIC [ES] ET AL) 29 September 2016 (2016-09-29) * paragraphs [0065] - [0092], [0116] - [0156]; figures 1,2,5-10 *	1-3,5,6, 8,10	INV. F21S43/237 F21S43/27 F21S43/14 F21S43/19
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 February 2020	Goltes, Matjaz

CATEGORY OF CITED DOCUMENTS

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