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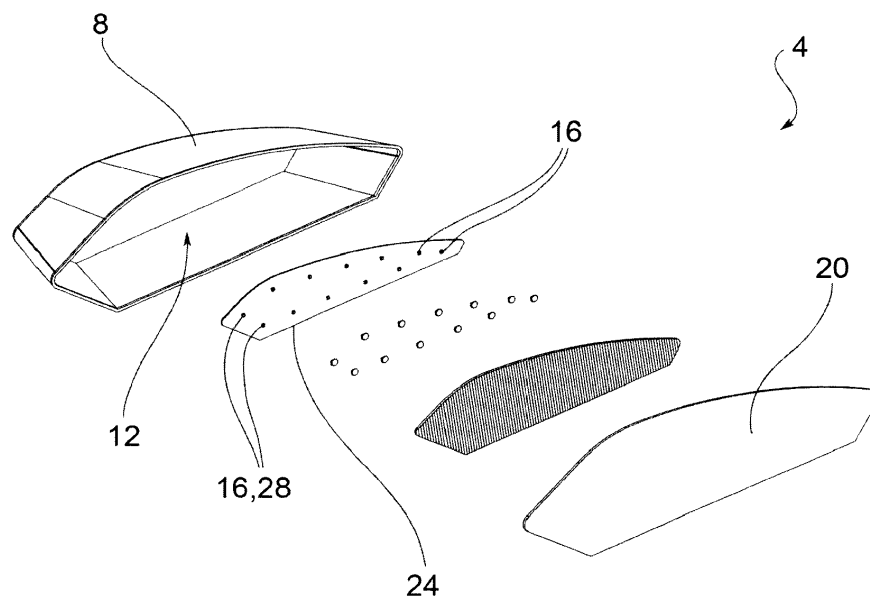
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35131 Padova (IT)**(54) **AUTOMOTIVE LIGHTING AND/OR SIGNALING DEVICE AND RELATED ASSEMBLY METHOD**

(57) A lighting and/or signaling device (4), in particular for the automotive field, comprising a container body (8) which delimits a containment seat (12) closed by a lenticular body (20), at least one LED light source (16) arranged to be supported on a printed circuit (24) in said containment seat (12), said LED light source (16) being configured to emit, through an emission head (28), a light beam comprising a plurality of light rays, at least one

directional lens (32) associated to at least partially cover said LED light source (16) so as to directionally affect said light rays according to a predefined direction or spatial distribution. Advantageously, said directional lens (32) is directly fastened on the LED light source (16) by shape coupling to said emission head (28) so as to cause the centering and orientation of the directional lens (32) with respect to the LED light source (16).

**FIG.2**

Description

FIELD OF APPLICATION

[0001] The present invention relates to an automotive lighting and/or signaling device and the related assembly method.

BACKGROUND ART

[0002] The term automotive lighting and/or signaling device here is used with a very broad meaning in order to comprehend an automotive light, whether a rear or front automotive light, the latter also called headlight or lamp.

[0003] Therefore, this comprises a position light, a turn signal light, a stop light, a rear fog light, a reverse light, a dipped-beam light, a high beam light and the like.

[0004] Moreover, the term also means to comprise a map light, an instrument panel or part thereof; thus, the automotive lighting and/or signaling device may be positioned both inside and outside the vehicle.

[0005] As is known, said automotive lighting and/or signaling devices may be used both for lighting and for sending visual signals.

[0006] For these purposes, said devices comprise a plurality of lighting portions comprising LED light sources which emit beams of light rays. An LED usually emits a light beam having a Lambertian distribution of the related light rays.

[0007] It is often required in lighting and/or signaling devices to deflect the light rays in a preferential direction, having for example a preferential angle: such a preferential distribution decidedly departs from the mentioned Lambertian distribution.

[0008] In order to obtain such a distribution, the use is known of lenses which are applied to the individual LED and which are capable of conveniently deflecting the light rays generated by the related LED in the required direction. Said solutions are also known in the field as VAM (variable angle mounted) LEDs.

[0009] Such lenses often have an asymmetrical configuration in order to conveniently deflect the natural Lambertian distribution of the light beam generated by the LED.

[0010] Therefore, it is required for the lens to be applied close to the LED to cover it, scrupulously following both an orientation and a distance from the LED. Indeed, the lens is arranged so as to laterally surround and cover the LED at the top. Therefore, not only is the orientation to be complied with, but also the Cartesian coordinates of the lens on the plane of the printed circuit with which the LED itself is associated are to be complied with.

[0011] The known solutions provide assembling the LEDs on the related printed circuits and also of assembling the lenses on the same printed circuits about each LED. In particular, the lenses are keyed and glued onto the printed circuit about each LED, for example with the

same SMT surface mount technology used for assembling LEDs on the printed circuit (PCB).

[0012] However, such an operation requires an accurate positioning of the lens on the printed circuit with respect to the LED; as seen, such a positioning provides both the orientation and the accurate centering between the lens and the LED itself. Even a small positioning error would risk compromising the performance, and therefore the deflection, of the light beam with respect to the pre-determined direction required.

PRESENTATION OF THE INVENTION

[0013] Therefore, the need is felt in the art to provide an automotive lighting and/or signaling device which allows the above-mentioned drawbacks of the known solutions in terms of accuracy, times and costs of positioning and fastening lenses with respect to LEDs, to be overcome in order to obtain specific distributions of the light beams emitted by the LEDs themselves.

[0014] Such a need is met by an automotive lighting and/or signaling device according to claim 1 and by an assembly method according to claim 14.

[0015] Other embodiments of the present invention are described in the dependent claims.

DESCRIPTION OF THE DRAWINGS

[0016] Further features and advantages of the present invention will be more comprehensible from the following description of preferred and non-limiting embodiments thereof, in which:

figure 1 shows a perspective view of a lighting and/or signaling device according to an embodiment of the present invention, in assembled configuration;
figure 2 shows a perspective view, in separate parts, of the lighting and/or signaling device in figure 1;
figure 3 shows a front view of the lighting and/or signaling device in figure 1;
figure 4 shows a sectional view of the lighting and/or signaling device in figure 1, along the sectional line IV-IV in figure 3;
figure 5 shows a perspective view of an assembly comprising a directional lens applied to an LED light source according to a possible embodiment of the present invention;
figure 6 shows a side view of the assembly in figure 5;
figure 7 shows a sectional view of the assembly in figure 5, along the sectional line VII-VII in figure 6;
figure 8 shows a perspective view of an assembly comprising a directional lens applied to an LED light source according to a further possible embodiment of the present invention;
figure 9 shows a perspective view of the LED light source of the assembly in figure 8;
figure 10 shows a side view of the assembly in figure 8;

figure 11 shows a sectional view of the assembly in figure 8, along the sectional line XI-XI in figure 10; figures 12 to 13 show perspective views, from different angles, of an assembly comprising a directional lens applied to an LED light source according to a further possible embodiment of the present invention; figure 14 shows a bottom plan view of the assembly in figures 12 to 13; figure 15 shows a perspective view of a directional lens applied to a printed circuit according to a further possible embodiment of the present invention.

[0017] The elements or parts of elements common to the embodiments described below will be indicated using the same numerals.

DETAILED DESCRIPTION

[0018] With reference to the aforesaid drawings, a lighting and/or signaling device, such as an automobile light, to which the following disclosure refers without however losing in generality, is indicated as a whole with 4.

[0019] As mentioned above, the term lighting and/or signaling device may indifferently mean a rear automotive light or a front automotive light, the latter also called a headlight or lamp, comprising an external vehicle light having a lighting and/or signaling function, such as for example a position light, which may be a front, rear, side position light, a turn signal light, a stop light, a rear fog light, a high beam light, a dipped-beam light and the like.

[0020] Moreover, the term lighting and/or signaling device also means an indoor map light, an instrument panel or part thereof, a display, etc.

[0021] Thus, as better described below, in the signaling function thereof, the device may comprise the possibility of sending light signals, logos, but also words and lit messages of any kind.

[0022] The lighting and/or signaling device 4 comprises a container body or housing 8, usually made of a polymer material, which typically allows to fasten the lighting and/or signaling device 4 to the related vehicle or to any type of support.

[0023] For the purposes of the present invention, the container body or housing 8 may have any shape and size, and also positioning: for example, the container body 8 may not be directly associated with the body or other external mountings of the associable vehicle.

[0024] As shown, the container body 8 may also be associated internally with the vehicle, for example on the dashboard, on the instrument panel, on the parcel shelf, and so on.

[0025] The container body 8 delimits a containment seat 12 which accommodates a plurality of components of said lighting and/or signaling device.

[0026] In particular, the containment seat 12 accommodates a plurality of light sources 16, preferably LED light sources, arranged to be supported in said contain-

ment seat 12.

[0027] For example, a lenticular body 20 may be at least partially associated with the container body 8 so as to close said containment seat 12 which accommodates the at least one light source 16.

[0028] For the purposes of the present invention, the lenticular body 20 may be external to the lighting and/or signaling device 4 so as to define at least an outer wall of the lighting and/or signaling device directly subjected to the atmosphere.

[0029] The lenticular body 20 closes the containment seat 12 and is adapted to be crossed by the light beam generated by the light sources 16 which is transmitted outside the containment seat 12.

[0030] In this regard, the lenticular body 20 is made with a material which is at least partially transparent or semitransparent or translucent, one or more opaque portions being able to be included as well, in any case so as to allow the at least partial crossing of the light beam generated by the light source.

[0031] According to possible embodiments, the material of the lenticular body 20 is a resin such as PMMA, PC and the like.

[0032] The at least one LED light source 16 is arranged to be supported on a printed circuit 24 in said containment seat 12.

[0033] Said LED light source 16 is configured to emit, through an emission head 28, a light beam comprising a plurality of light rays. The emission head 28 indeed includes a light emission chip enclosed in a casing, also called package. The casing gives the emission head a varied shape and serves to protect the chip. As is known, the casing comprises at least a transparent portion for the passage of the light emitted by the chip and may be provided with specific electric and optical elements connected to the chip itself.

[0034] At least one directional lens 32 is associated to at least partially cover said LED light source 16 so as to directionally affect said light rays according to a predefined direction or spatial distribution. It is herein implied that the factory LED light source 16 does not include the directional lens 32 and it has its own light distribution. The directional lens 32 is a further element which serves to modify the light distribution of the factory LED light source.

[0035] Said directional lens 32 advantageously is associated with the LED light source 16 by shape coupling to said emission head 28.

[0036] In a preferred embodiment, shape coupling means an elastic deformation of a fastening portion 40 of the directional lens 32, such as a pocket obtained in the directional lens 32, on the basis of a mold defined by the shape of the walls, for example side walls, of the casing of the emission head 28 so that such a pocket of the directional lens 32 and the side walls of the casing of the emission head 28 are pressed against one another, thus being mutually blocked.

[0037] Such a shape coupling prevents the related

movement of the directional lens 32 with respect to the emission head 28. A suitable glue may optionally be used to better seal the directional lens 32 on the emission head 28.

[0038] In particular, said shape coupling causes the centering and the orientation of the directional lens 32 with respect to the LED light source 16 during the connection thereof.

[0039] Centering and orientation mean that the directional lens 32 is to be positioned at an exact distance from the sides of the LED light source 16, with respect to a plane which is parallel to said printed circuit 24, in order to obtain the predetermined direction and/or spatial distribution of the light rays generated by the LED light source 16. Moreover, the orientation of the directional lens 32 with respect to a direction which is perpendicular to the same plane parallel to the printed circuit 24, is also to be complied with.

[0040] In greater detail, the directional lens 32 comprises an optical portion 36 shaped to deflect the light rays which are incident thereon according to a predetermined direction or pattern, and a fastening portion 40 provided with the pocket intended to obtain the shape coupling to the emission head 28 of the LED light source 16.

[0041] According to a preferred embodiment, at least the fastening portion 40 of the directional lens 32 is made of an elastically cold deformable material so as to obtain a shape coupling to the emission head 28 of the LED light source 16, i.e. to the side walls of the casing of the emission head 28. Elastically cold deformable material means a material which is elastically deformable at the assembly temperature of the lighting and/or signaling device, which normally is equal to room temperature.

[0042] Moreover, at least the fastening portion 40 of the directional lens 32 preferably is made of a deformable polymer material to allow the fastening by shape coupling.

[0043] According to a possible embodiment, at least the fastening portion 40 of the directional lens 32 is made of silicone.

[0044] A directional lens 32 may also be provided, which comprises the optical portion 36 and the fastening portion 40, which are co-molded to each other in different materials, in which the material of the optical portion 36 is more rigid than the material of the fastening portion 40.

[0045] Indeed, the optical portion 36 of the directional lens 36 usually is made of a rigid plastic (such as e.g. PMMA), while the fastening portion is made of an elastically yielding material to obtain the shape coupling to the emission head 28.

[0046] According to a possible embodiment, said shape coupling is a snap coupling. In a further embodiment, shape coupling may also mean a coupling element of the directional lens 32, such as a pocket of the directional lens 32 shaped so as to be fastened by interference to the walls of the casing of the emission head 28, for example snap fastened. A suitable glue may optionally

be used to better prevent the related movement of the directional lens 32 with respect to the emission head 28.

[0047] In greater detail, according to such a further embodiment, said shape coupling may comprise at least one undercut 44 between the walls, for example side walls, of the emission head 28 of the LED light source 16 and the pocket shaped in the fastening portion 40 of the directional lens 32, with respect to a coupling or insertion direction of the directional lens 32 on the emission head 28.

[0048] Such an undercut may be shaped by taking advantage of a particular projection or groove or geometrical shape, of the walls of the casing, or by conveniently modifying/treating such walls of the casing, for example by means of a laser incision.

[0049] For example, said insertion or coupling direction may be perpendicular to a support plane P on the printed circuit 24.

[0050] A geometrical shape may also be provided, in which said insertion or coupling direction is parallel to a support plane P on the printed circuit 24.

[0051] According to a possible embodiment, said shape coupling comprises at least one pin 48 of the fastening portion 40 which is engaged in a related hole in the printed circuit 24. Such a fastening system of the pre-assembled element to the printed circuit 24 is an alternative method with respect to the fastening method of the pre-assembled element by means of SMT technique.

[0052] Said shape coupling preferably comprises a pair of pins 48 of the fastening portion 40 which are each engaged in a corresponding hole in the printed circuit 24.

[0053] According to a further embodiment, the fastening portion 40 of the directional lens 32 comprises at least one pin 48 which is engaged in a recess 52 obtained on the emission head 28. Obviously, the so-called kinematic inversion may be provided, i.e. recess 52 is obtained on the fastening portion 40 of the directional lens 32 and the pin is obtained on the emission head 28. Such a coupling between pin 48 and recess 52 not only obtains the fastening of the directional lens 32 on the emission head according to the predefined geometrical orientation, but also constitutes a lead and a guide for the coupling of the shape coupling between the directional lens 32 and the LED light source 16.

[0054] As may be appreciated by what is described, the present invention allows the drawbacks introduced in the known art to be overcome.

[0055] In particular, the automotive lighting and/or signaling device according to the present invention allows the directional lens to be pre-assembled on the LED: thereby, a quick and accurate positioning of the lens on the LED is obtained.

[0056] In particular, the light assembly process may therefore be automated with the advantage of pre-installing the lens on the related LED and then installing the pre-assembled element directly on the printed circuit.

[0057] Thereby, the costs and times of assembling lenses on respective LEDs are reduced.

[0058] Advantageously, it is thus avoided to fasten the lenses directly on the printed circuit, as occurs in an SMT process.

[0059] The solution of the present invention instead provides a shape coupling which ensures sealing over time and which does not suffer from either vibrations or thermal shock over time.

[0060] Those skilled in the art, with the objective of meeting contingent and specific needs, can make several changes and variants to the lighting and/or signaling devices and to the related assembly methods described above, all contained within the scope of the invention, which is defined by the following claims.

Claims

1. A lighting and/or signaling device (4), in particular for the automotive field, comprising:

- a container body (8) which delimits a containment seat (12) closed by a lenticular body (20),
- at least one LED light source (16) arranged to be supported on a printed circuit (24) in said containment seat (12), said LED light source (16) being configured to emit, through an emission head (28), a light beam comprising a plurality of light rays,
- at least one directional lens (32) associated to at least partially cover said LED light source (16) so as to directionally affect said light rays according to a predefined direction or spatial distribution, **characterized in that**
- said directional lens (32) is directly fastened on the LED light source (16) by shape coupling to said emission head (28) so as to cause the centering and the orientation of the directional lens (32) with respect to the LED light source (16).

2. A lighting and/or signaling device (4) according to claim 1, wherein the shape coupling is defined by an engagement element obtained in the directional lens (32) and walls of a casing of said emission head (28), said engagement element stably and rigidly engaging said walls of the casing.

3. A lighting and/or signaling device (4) according to claim 1 or 2, wherein the directional lens (32) comprises an optical portion (36) shaped to deflect the light rays incident thereon according to a predetermined direction or pattern, and a fastening portion (40) for obtaining the shape coupling with the emission head (28).

4. A lighting and/or signaling device (4) according to claim 3, wherein at least the fastening portion (40) of the directional lens (32) is made of an elastically

cold deformable material so as to obtain a shape coupling with the emission head (28) of the LED light source (16).

5. A lighting and/or signaling device (4) according to claim 3 or 4, wherein at least the fastening portion (40) of the directional lens (32) is made of a deformable polymer material to allow the fastening by shape coupling.

6. A lighting and/or signaling device (4) according to claim 3, 4 or 5, wherein at least the fastening portion (40) of the directional lens (32) is made of silicone.

7. A lighting and/or signaling device (4) according to claim 3, 4, 5 or 6, wherein the directional lens (32) comprises the optical portion (36) and the fastening portion (40), which are co-molded to each other in different materials, the material of the optical portion (36) being more rigid than the material of the fastening portion (40).

8. A lighting and/or signaling device (4) according to any one of claims 2 to 7, wherein said shape coupling is a snap coupling.

9. A lighting and/or signaling device (4) according to any one of claims 2 to 8, wherein said shape coupling comprises at least one undercut (44) between the emission head (28) and the fastening portion (40), with respect to a coupling or insertion direction of the directional lens (32) on the emission head (28).

10. A lighting and/or signaling device (4) according to claim 9, said insertion or coupling direction is perpendicular to a support plane (P) on the printed circuit (24).

11. A lighting and/or signaling device (4) according to claim 9, wherein said insertion or coupling direction is parallel to a support plane (P) on the printed circuit (24).

12. A lighting and/or signaling device (4) according to any one of claims 2 to 11, wherein said shape coupling comprises at least one pin (48) of the fastening portion (40) which is engaged in a hole in the printed circuit (24).

13. A lighting and/or signaling device (4) according to any one of claims 2 to 12, wherein the fastening portion (40) of the directional lens (32) comprises at least one pin (48) which is engaged in a recess (52) obtained on the emission head (28).

14. An assembly method of a lighting and/or signaling device (4), in particular for the automotive field, comprising the steps of:

- preparing a container body (8) which delimits a containment seat (12) closed by a lenticular body (20),
 - preparing at least one LED light source (16) arranged to be supported on a printed circuit (24) in said containment seat (12), said LED light source (16) being configured to emit, through an emission head (28), a light beam comprising a plurality of light rays,
 - preparing at least one directional lens (32) associated to at least partially cover said LED light source (16) so as to directionally affect said light rays, **characterized in that** it comprises the step of:
 - fastening said directional lens (32) directly on the LED light source (16) by shape coupling to said emission head (28), wherein said shape coupling causes the centering and the orientation of the directional lens (32) with respect to the LED light source (16).
15. An assembly method of a lighting and/or signaling device (4) according to claim 14, comprising the step of preparing a lighting and/or signaling device (4) according to any one of claims 1 to 13.

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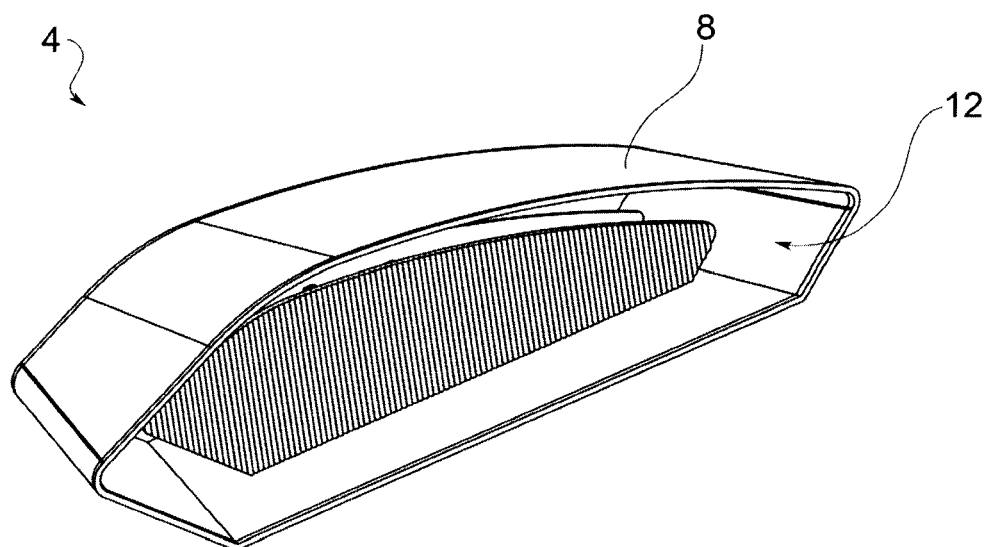


FIG.1

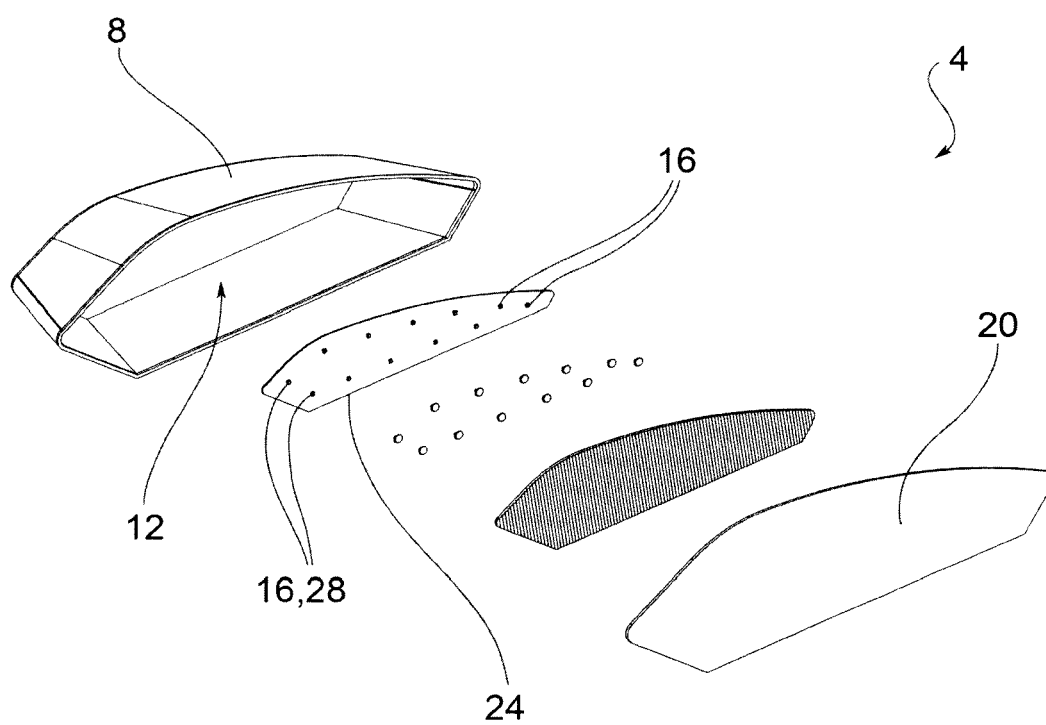


FIG.2

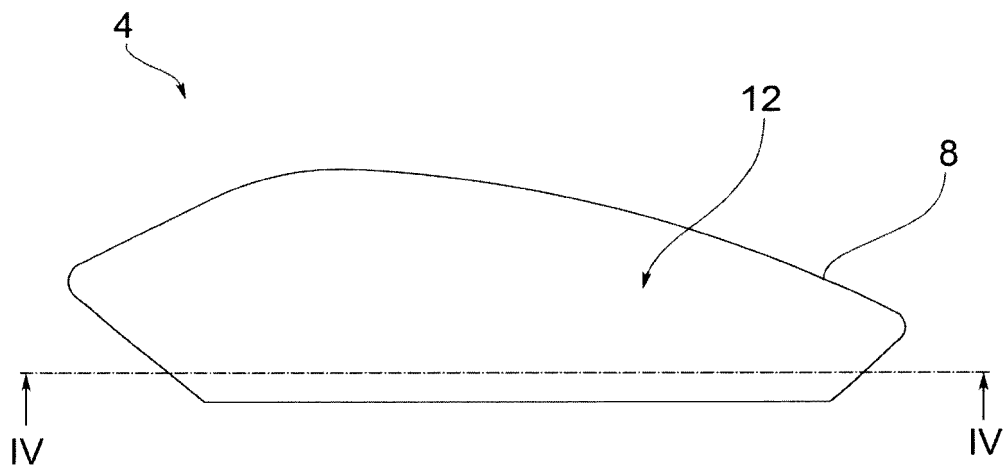


FIG.3

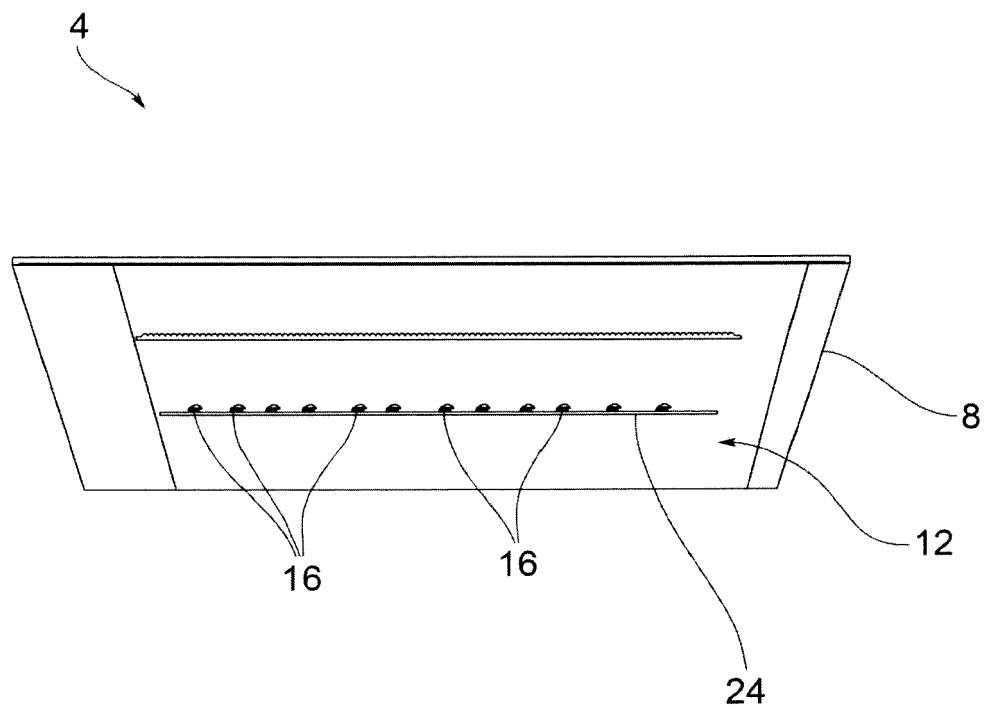


FIG.4

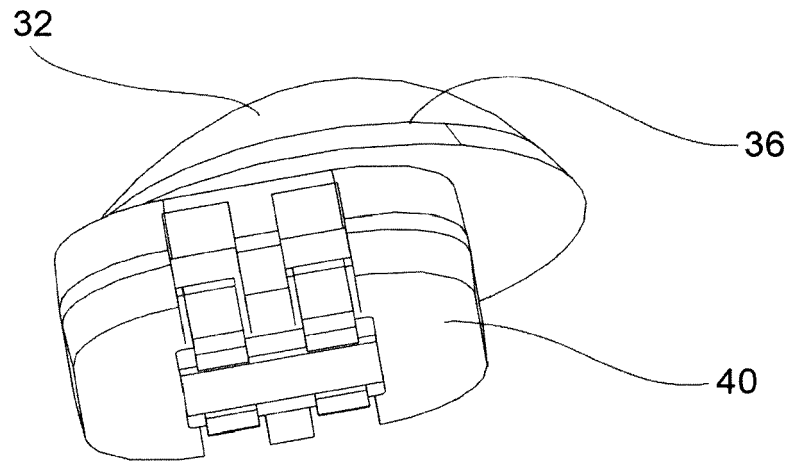


FIG. 5

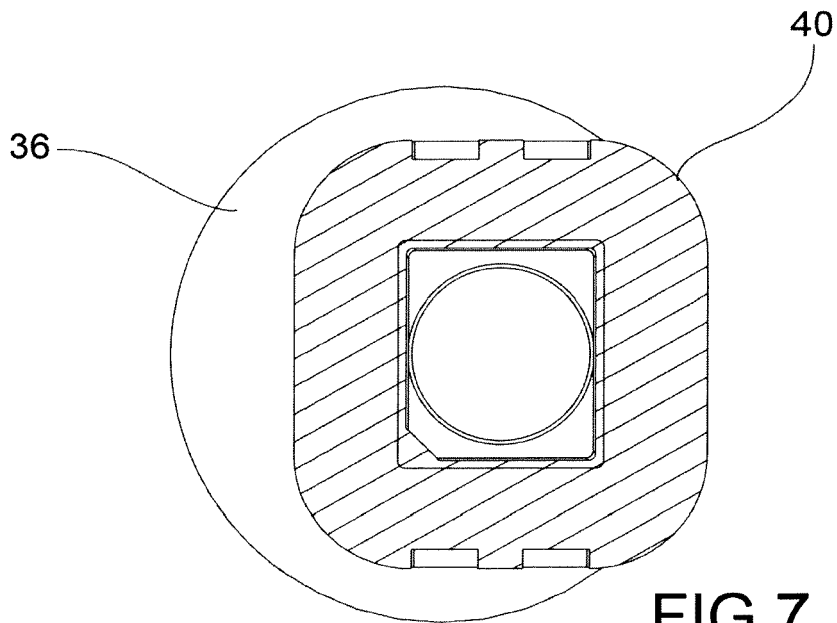


FIG. 7

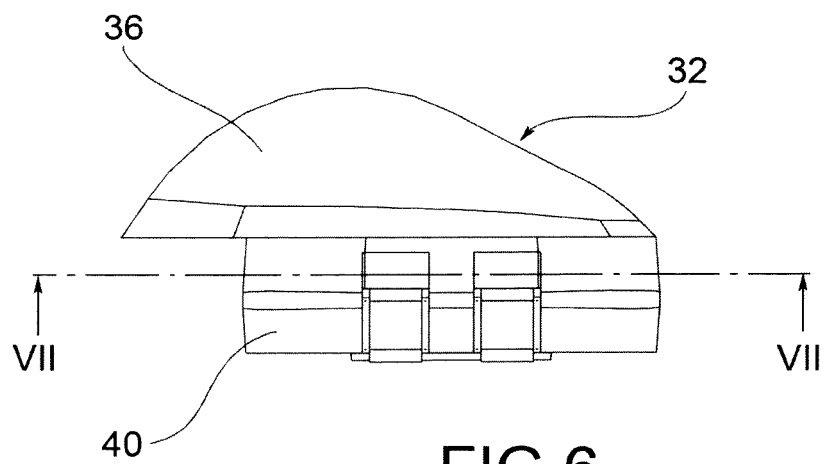


FIG. 6

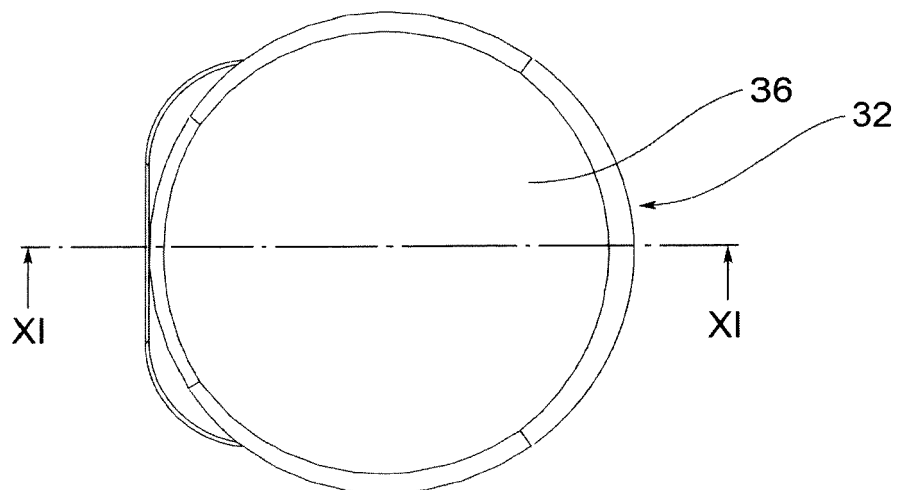
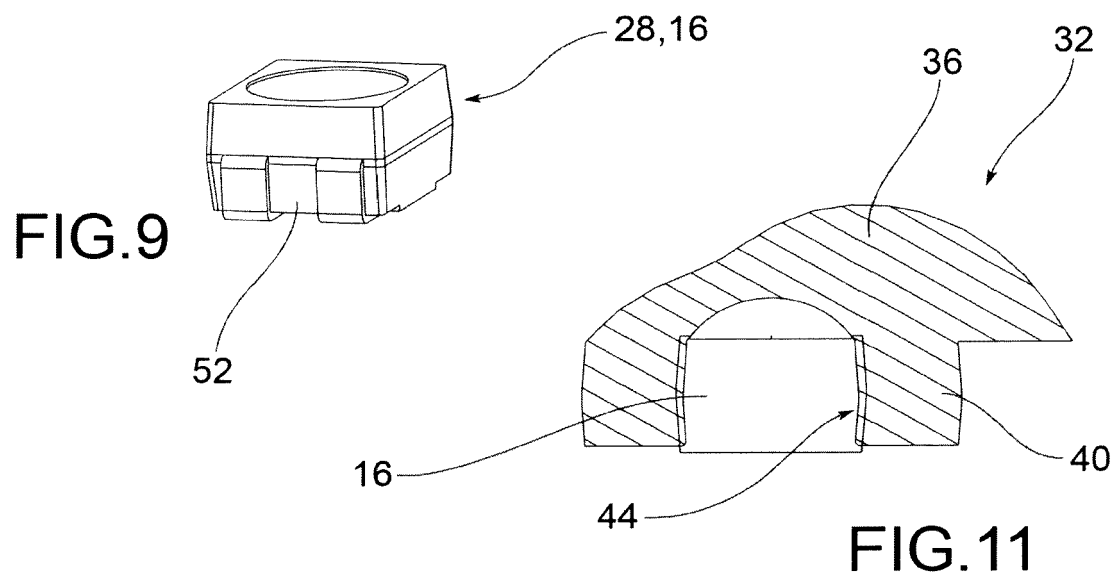
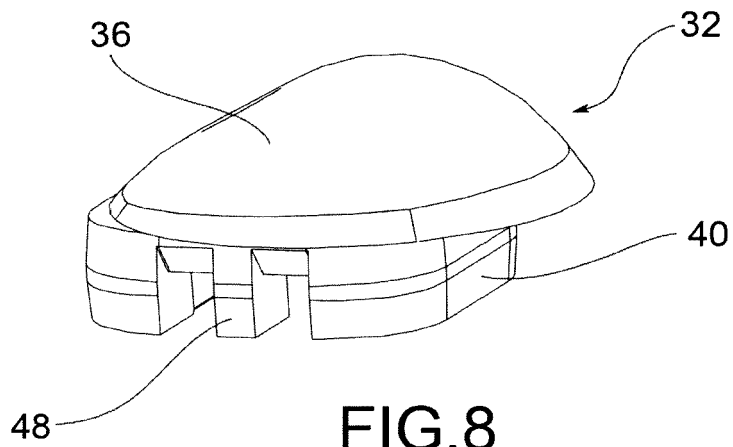


FIG. 10

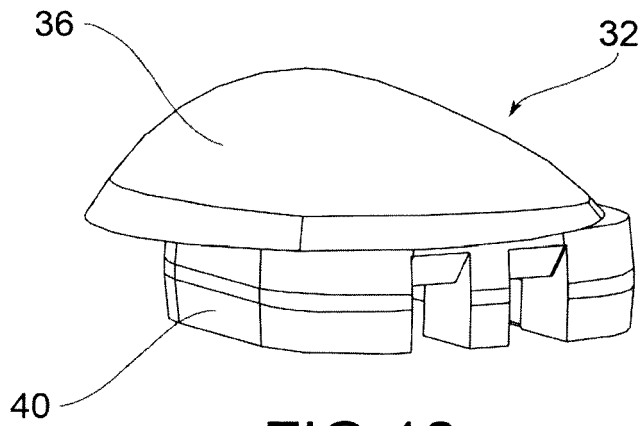


FIG. 12

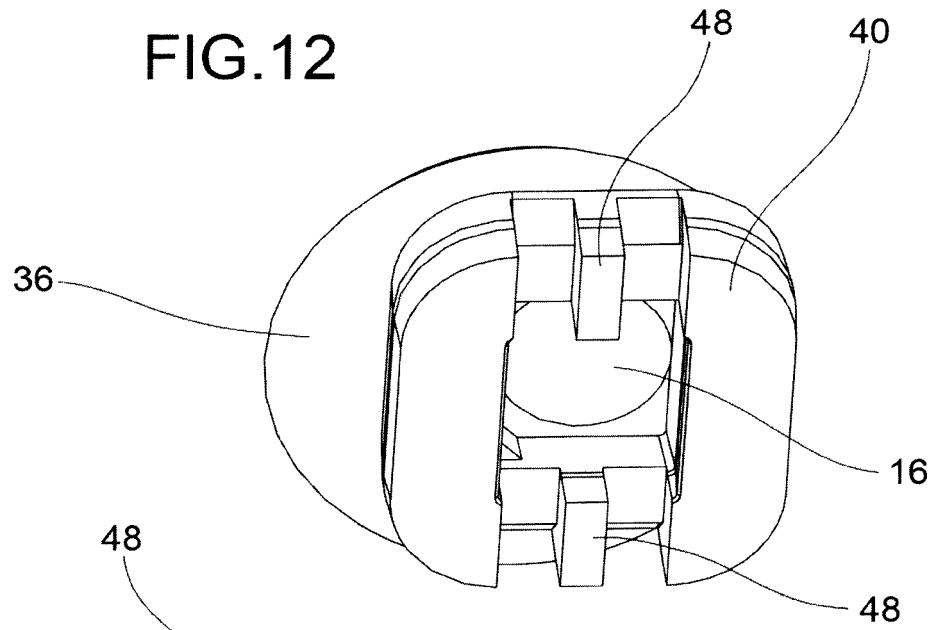


FIG. 13

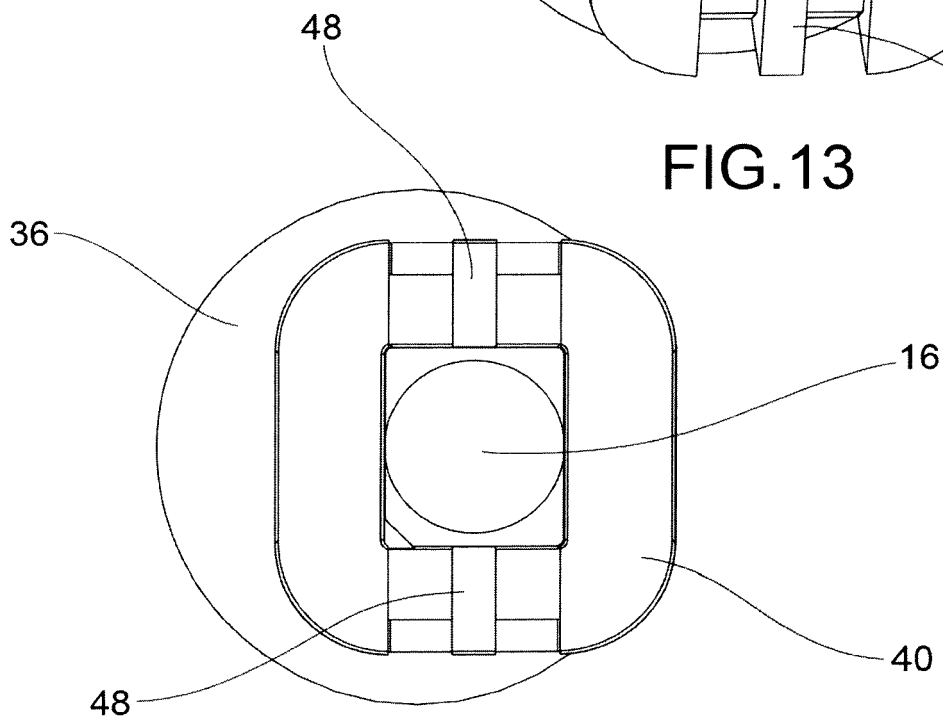


FIG. 14

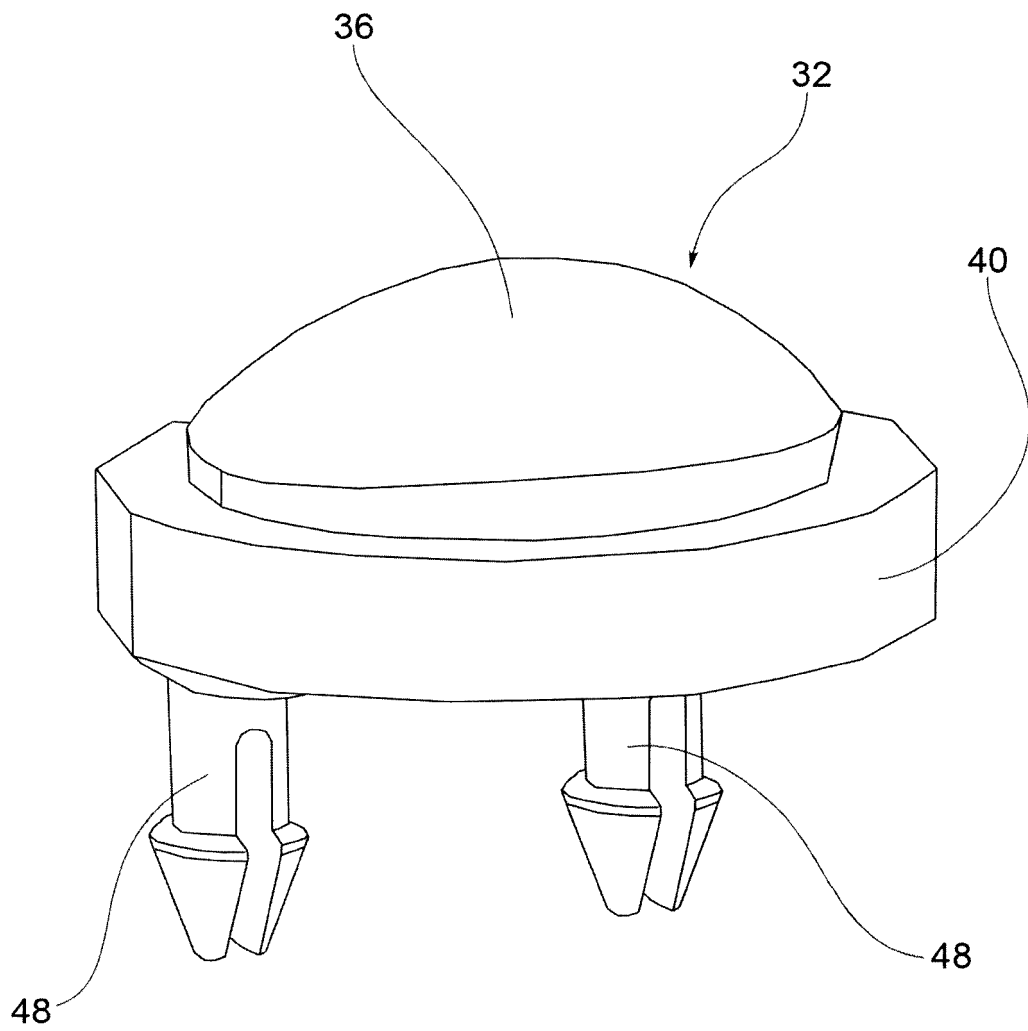


FIG.15



EUROPEAN SEARCH REPORT

Application Number
EP 19 42 5086

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 March 2020	Examiner Allen, Katie
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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