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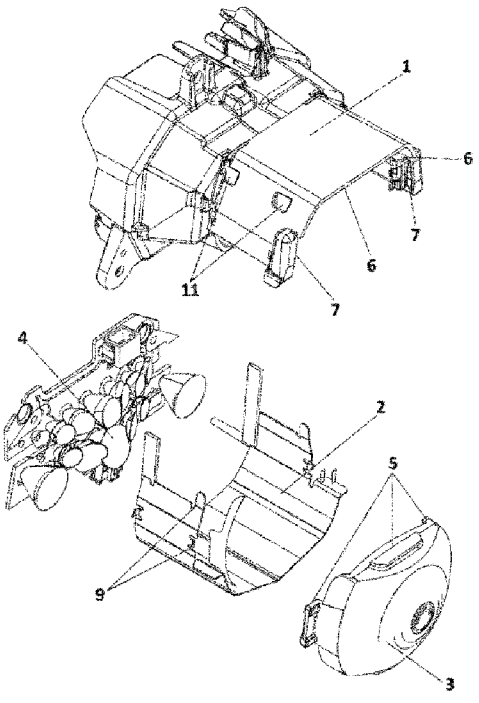
(54) Title: AUTOMOTIVE LUMINOUS MODULE AND METHOD FOR MANUFACTURING AN AUTOMOTIVE LUMINOUS MODULE

[Fig. 2]



(57) Abstract: The invention provides an automotive luminous module (10) comprising a housing with a first portion (1) and a second portion (2) and an optical element (3), wherein the first portion (1), the second portion (2) and the optical element (3) cooperate to define a closed space. The optical element (3) has first reference surfaces (5) and the first portion (1) has second reference surfaces (6) configured to receive the first reference surfaces (5), providing an alignment of the optical element (3) with respect to the first portion (1). The second portion (2) comprises a material with a thermal conductivity higher than 25 W/mK at 25°C. The first portion (1) has guide means (7) to secure the position of the optical element (3) with respect to the first portion, and the second portion (2) has attaching means (9) to secure the position of the first portion with respect to the second portion.

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Description

Titre: Automotive luminous module and method for manufacturing an automotive luminous module

[0001] The present invention belongs to the field of lamps for automotive vehicles, and more specifically, to the design of modules with a projection lens that are mounted in a headlamp.

[0002] Current luminous modules usually comprise projection lens, which is in charge of projecting the light emitted by the internal light sources to light the road in front of the vehicle.

[0003] However, with the increase in the plastic parts inside the headlamp components, there is a problem when the sun rays impinge on the projection lens and the radiation is focused on a single point inside the luminous module. When this single point was made of a metallic material, the heat was quickly and easily diffused, so that no harm was made to this part. However, if this point is made of plastic, and this is a common situation in current luminous module, heat is not dissipated so easily, and degradation and deformation may occur in this point, with severe consequences in the operation of the headlamp.

[0004] Some manufacturers put an additional metallic piece or coating over the plastic part where this focusing is foreseen to take place, and other ones try to absorb the radiant energy so that the radiation does not cause too much harm.

[0005] An alternative solution is therefore sought.

[0006] The invention provides a solution for these problems by means of an automotive luminous module and a method for manufacturing such an automotive luminous module. Preferred embodiments of the invention are also defined below.

[0007] Unless otherwise defined, all terms (including technical and scientific terms) used herein are to be interpreted as is customary in the art. It will be further understood that terms in common usage should also be interpreted as is customary in the relevant art and not in an idealised or overly formal sense unless expressly so defined herein.

[0008] In this text, the term “comprises” and its derivations (such as “comprising”, etc.) should not be understood in an excluding sense, that is, these terms should not be interpreted as excluding the possibility that what is described and defined may include further elements, steps, etc.

[0009] In a first inventive aspect, the invention provides an automotive luminous module comprising

- a housing comprising a first portion and a second portion;
- an optical element, wherein the first portion, the second portion and the optical element cooperate to define a closed space;
- a light source arranged to emit some light towards the optical element in an emitting direction;

the automotive luminous module being characterized in that

- the optical element has first reference surfaces and the first portion has second reference surfaces configured to receive the first reference surfaces, in such a way that the abutment of the first reference surfaces on the second reference surfaces provides an alignment of the optical element with respect to the first portion;
- the second portion comprises a material with a thermal conductivity higher than 25 W/mK at 25ºC;
- the first portion has guide means to secure the position of the optical element with respect to the first portion; and
- the second portion has attaching means to secure the position of the first portion with respect to the second portion.

[0010] The introduction of a second thermal diffusive portion different from the first portion of the housing, but cooperating to create a closed space to prevent light leakage, avoids the need of coating a plastic surface with a metallic layer. This is advantageous, since there are some issues associated to metallic coatings (not accessibility of some areas, need of specific tools, may introduce dimensional changes in parts...). In this invention, the same part is used to prevent light leakage, avoid sunburn issues and fasten the lens to the housing. Furthermore, this solution

reduces weight, since there is no need of additional plastic parts to close the housing.

[0011] The first portion is usually comprised in a main portion of the housing, while the second portion is smaller and is arranged in an additional step during the manufacturing process.

[0012] An optical element is an element that has some optical properties to receive a light beam and emit it in a certain direction and/or shape, as a person skilled in automotive lighting would construe without any additional burden. Reflectors, collimators, light guides, projection lenses, etc., or the combination thereof are some examples of these optical elements.

[0013] In some particular embodiments, the first portion is made of plastic such as, for example, poly-butylene terephthalate (PBT GF30, PBT GF50), poly-amides (PA66 GF50) or poly-ethylene terephthalate (PET GF35).

[0014] Plastic is a cheap and light material, suitable for manufacturing the main portion of the housing.

[0015] In some particular embodiments, the second portion is made of metal, such as aluminium or steel.

[0016] Metals are highly thermal conductive materials, which suits in the application of this luminous module.

[0017] In some particular embodiments, the guide means further comprise a stop element and a clipping element.

[0018] Stop and clipping elements help to achieve a correct position of the optical element with respect to the housing, which is advantageous in the calibration of the projected light pattern.

[0019] In some particular embodiments, the guide means extend along a guide direction which is perpendicular to the emitting direction.

[0020] Hence, the optical element may be introduced in this perpendicular direction, which is advantageous, since isostatism is achieved in X and Y axis. Isostatism in Z axis is achieved by means of the second portion.

[0021] In some particular embodiments, the thickness of the second portion is higher than 1 mm.

[0022] This thickness is enough to be part of the mechanical requirements of the housing, since this second portion is a structural part of the housing.

[0023] In some particular embodiments, the optical element comprises at least three first reference surfaces and the first portion comprises at least three second reference surfaces configured to receive the first reference surfaces, wherein two of the reference surfaces are orthogonal to other of the reference surfaces.

[0024] This helps to achieve a correct positioning of the optical element with respect to the housing, in different directions.

[0025] In some particular embodiments, the second portion comprises a bended plate which comprises two main bending zones.

[0026] These bending zones receive the elastic deformation needed to clip the second portion to the first portion of the housing.

[0027] In some particular embodiments, the optical element is a lens.

[0028] The lens is particularly suitable to project the light emitted by the light sources.

[0029] In some particular embodiments, the light source comprises a solid-state light source and a primary optical element, such as a collimator.

[0030] The term "solid state" refers to light emitted by solid-state electroluminescence, which uses semiconductors to convert electricity into light. Compared to incandescent lighting, solid state lighting creates visible light with reduced heat generation and less energy dissipation. The typically small mass of a solid-state electronic lighting module provides for greater resistance to shock and vibration compared to brittle glass tubes/bulbs and long, thin filament wires. They also eliminate filament evaporation, potentially increasing the life span of the illumination module. Some examples of these types of lighting comprise semiconductor light-emitting diodes (LEDs), organic light-emitting diodes (OLED), or polymer light-emitting diodes (PLED) as sources of illumination rather than electrical filaments, plasma or gas.

[0031] The primary optical element is intended to project the light cone which is suitable for being projected by the main optical element.

[0032] In some particular embodiments, the primary optical element is a collimator. A collimator provides an optimal optical behaviour for this application. The collimator is able to transform the divergent beams of light coming from a unique light source into a parallel distribution of light beams.

[0033] In a second inventive aspect, the invention provides a method of manufacturing an automotive luminous module according to the first inventive aspect, the method comprising the steps of

- locating a first portion of a housing upside down so that the guide means are accessible;
- introducing the optical element in the guide means with the aid of gravity; and
- press the second portion against the lens so as to achieve an elastic deformation in the second portion until the second portion reaches the attaching means that secure the position of the second portion with respect to the first portion.

[0034] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate an embodiment of the invention, which should not be interpreted as restricting the scope of the invention, but just as an example of how the invention can be carried out. The drawings comprise the following figures:

[0035] [Fig. 1] shows a perspective view of a lighting module according to the invention.

[0036] [Fig. 2] shows an exploded view of this lighting module.

[0037] [Fig. 3] shows a first step in the manufacturing of this lighting module.

[0038] [Fig. 4] shows a detail of the connection in one of the manufacturing steps of the lighting module.

[0039] [Fig. 5] shows a next step in the assembly of this lighting module.

[0040] [Fig. 6] shows a lighting module according to the invention which has been installed in an headlamp of an automotive vehicle.

[0041] The example embodiments are described in sufficient detail to enable those of ordinary skill in the art to embody and implement the systems and processes herein described. It is important to understand that embodiments can be provided in many alternate forms and should not be construed as limited to the examples set forth herein.

[0042] Accordingly, while embodiment can be modified in various ways and take on various alternative forms, specific embodiments thereof are shown in the drawings and described in detail below as examples. There is no intent to limit to the particular forms disclosed. On the contrary, all modifications, equivalents, and alternatives falling within the scope of the appended claims should be included. Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate.

[0043] Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate.

[0044] Figure 1 shows a perspective view of a lighting module according to the invention, which comprises

- a housing comprising a first portion 1 and a second portion 2, and
- a lens 3.

[0045] The first 1 and second 2 portions of the housing and the lens 3 cooperate to define a closed space, where light leakage is prevented.

[0046] The second portion is made of aluminium, which provides a high thermal conductivity to manage the heat produced by the focusing of the sun rays coming from the exterior of the lighting module and crossing the lens.

[0047] Although not seen in this figure, the lighting module 10 further comprises light sources arranged to emit light towards the lens.

[0048] Figure 2 shows an exploded view of this lighting module.

[0049] In this exploded view, the light sources 4 are seen. These light sources 4 comprise a plurality of LEDs and collimators. The collimators project the light emitted by the LEDs to create the light cones which will be received by the projecting lens 3.

[0050] This figure also shows the different surfaces, guides and attaching means used to fit each element with each other, achieving a solid and stable result.

[0051] First of all, the lens 3 has first reference surfaces 5 and the first portion 1 of the housing has second reference surfaces 6 configured to receive the first reference surfaces 5, in such a way that the abutment of the first reference surfaces on the second reference surfaces provides an alignment of the lens with respect to the first portion.

[0052] The first portion 1 has also guide means 7 to secure the position of the lens 3 with respect to the first portion 1. These guide means 7 ends in one of the second reference surfaces 6, so that the lugs 8 of the lens 3 are introduced in the guiding means 7 until the first surface 5 abuts against the second surface 6, so that the lens 3 is perfectly fitted into position.

[0053] The second portion 2 has also some attaching means 9 to secure the position of the first portion 1 with respect to the second portion 2. These attaching means 9 are clips and snap-fit connections that finds correspondence in other housings and holes 11 of the first portion 1.

[0054] Figure 3 shows a first step in the manufacturing of this lighting module 10.

[0055] The first portion 1 is arranged upside down, so that the guide means 7 and the reference surfaces 6 are accessible. The lens 3 is then introduced with the aid of gravity, so the lugs 8 are introduced in the guide means 7 of the first portion until the reference surface 5 abuts on the reference surface 6.

[0056] Figure 4 shows a detail of the connection, wherein there is a further clip protrusion 12 which retain the lens 3 into position once the reference surface 6 has been reached.

[0057] Figure 5 shows a next step in the assembly of this lighting module. Once the lens 3 has been fitted into position, the second portion 2 is elastically deformed

on the bending lines 13 to reach its position in the lighting module. For this purpose, the clipping means 9 are forced into the holes 11 of the second portion 2, so that the second portion perfectly closes the space and is retained in the lighting module.

[0058] Figure 6 shows a lighting module 10 according to the invention which has been installed in a headlamp 101 of an automotive vehicle 100.

[0059] Due to the aforementioned improvements of invention, plastic elements may be used inside the automotive lighting module without the risk that solar rays may be focused and cause deformations or degradations in said plastic parts.

Revendications

[Revendication 1] Automotive luminous module (10) comprising

- a housing comprising a first portion (1) and a second portion (2);
- an optical element (3), wherein the first portion (1), the second portion (2) and the optical element (3) cooperate to define a closed space; and
- a light source (4) arranged to emit some light towards the optical element (3) in an emitting direction;

the automotive luminous module being characterized in that

- the optical element (3) has first reference surfaces (5) and the first portion (1) has second reference surfaces (6) configured to receive the first reference surfaces (5), in such a way that the abutment of the first reference surfaces (5) on the second reference surfaces (6) provides an alignment of the optical element (3) with respect to the first portion (1);
- the second portion (2) comprises a material with a thermal conductivity higher than 25 W/mK at 25ºC;
- the first portion (1) has guide means (7) to secure the position of the optical element (3) with respect to the first portion; and in that
- the second portion (2) has attaching means (9) to secure the position of the first portion with respect to the second portion.

[Revendication 2] Automotive luminous module (10) according to claim 1, wherein the first portion (1) is made of plastic, such as, for example, poly-butylene terephthalate, poly-amides or poly-ethylene terephthalate.

[Revendication 3] Automotive luminous module (10) according to any of the preceding claims, wherein the second portion (2) is made of metal, such as aluminium or steel.

[Revendication 4] Automotive luminous module (10) according to any of the preceding claims, wherein the guide means (7) further comprise a stop element (6) and a clipping element (12).

[Revendication 5] Automotive luminous module (10) according to claim 4, wherein the guide means (7) extend along a guide direction which is perpendicular to the emitting direction.

[Revendication 6] Automotive luminous module (10) according to any of the preceding claims, wherein the thickness of the second portion is higher than 1 mm.

[Revendication 7] Automotive luminous module (10) according to any of the preceding claims, wherein the optical element comprises at least three first reference surfaces and the first portion comprises at least three second reference surfaces configured to receive the first reference surfaces, wherein two of the reference surfaces are orthogonal to other of the reference surfaces.

[Revendication 8] Automotive luminous module (10) according to any of the preceding claims, wherein the second portion comprises a bended plate which comprises two main bending zones (13).

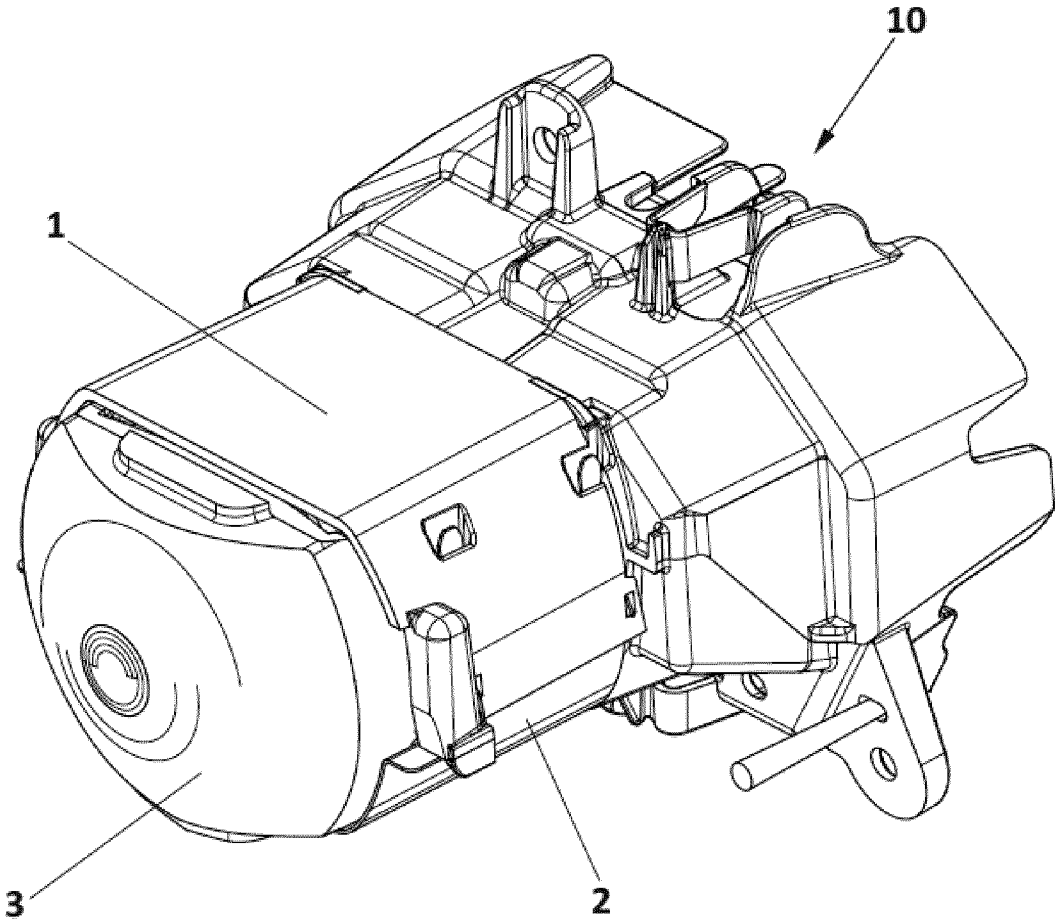
[Revendication 9] Automotive luminous module (10) according to any of the preceding claims, wherein the optical element is a lens (3).

[Revendication 10] Automotive luminous module (10) according to any of the preceding claims, wherein the light source (4) comprises a solid-state light source and a primary optical element, such as a collimator.

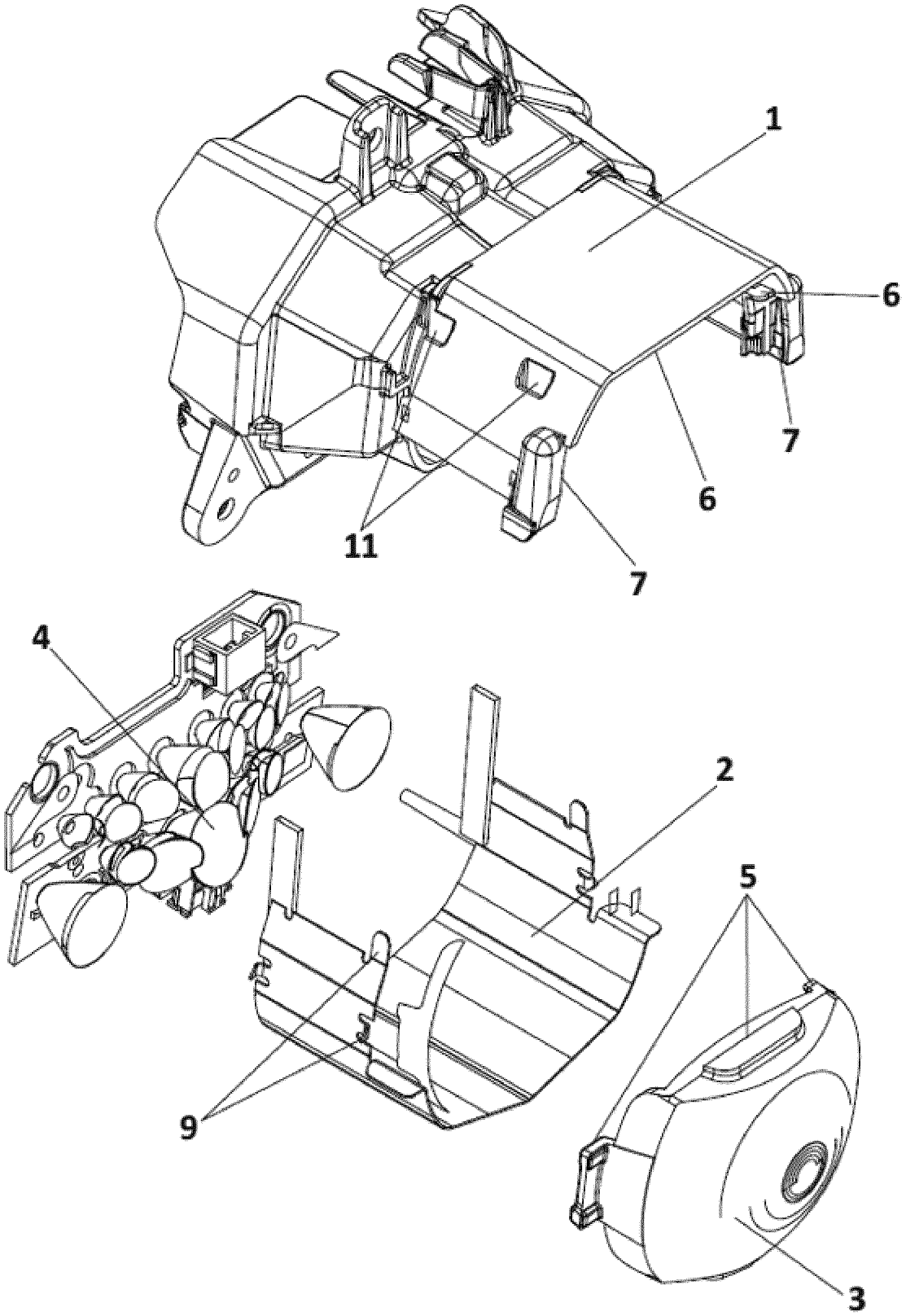
[Revendication 11] Method of manufacturing an automotive luminous module (10) according to any of the preceding claims, the method comprising the steps of

- locating a first portion (1) of a housing upside down so that the guide means (7) are accessible;
- introducing the optical element (3) in the guide means with the aid of gravity; and
- pressing the second portion (2) against the optical element (3) so as to achieve an elastic deformation in the second portion (2) until the second portion (2) reaches the attaching means (9) that secure the position of the second portion (2) with respect to the first portion (1).

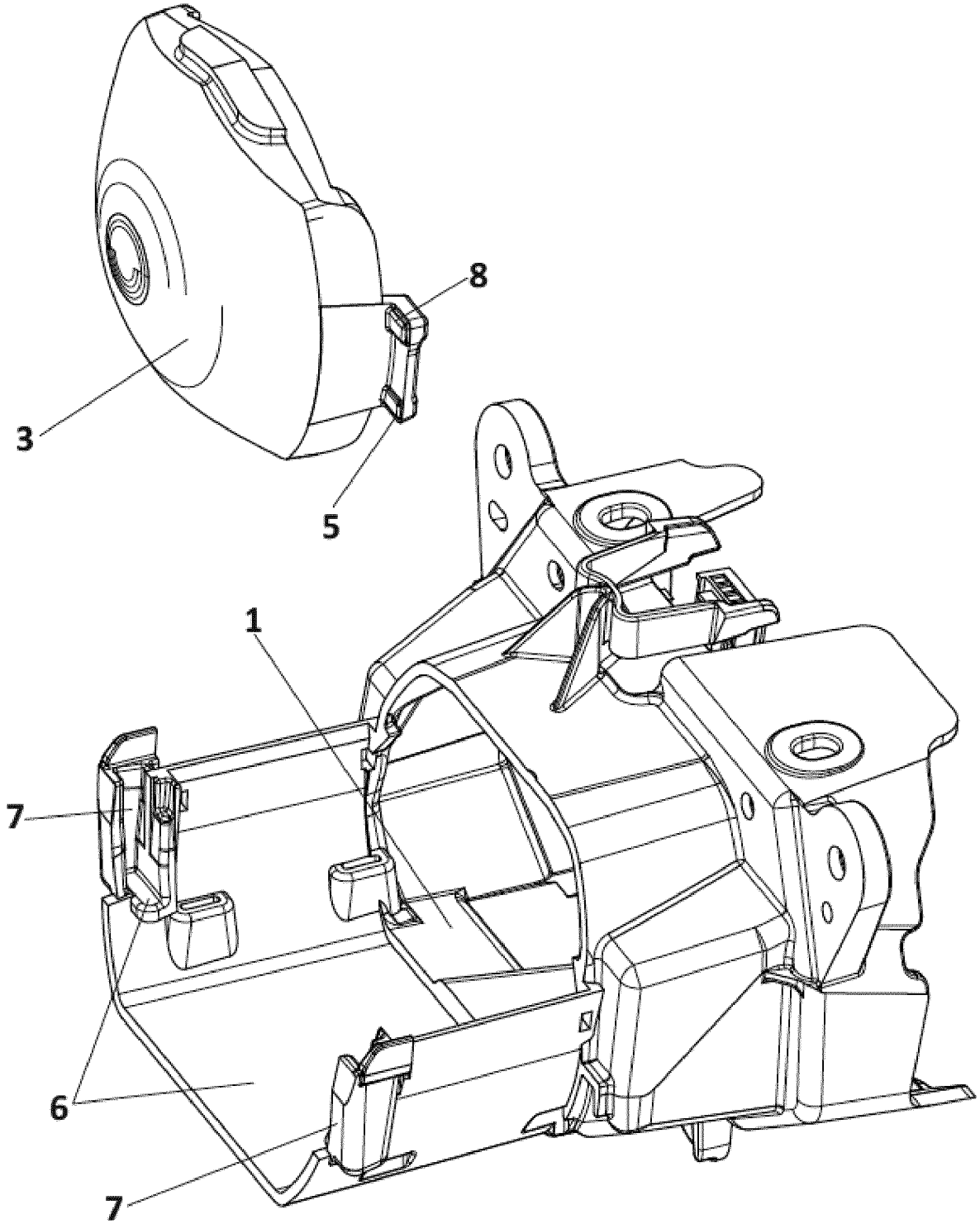
[Fig. 1]



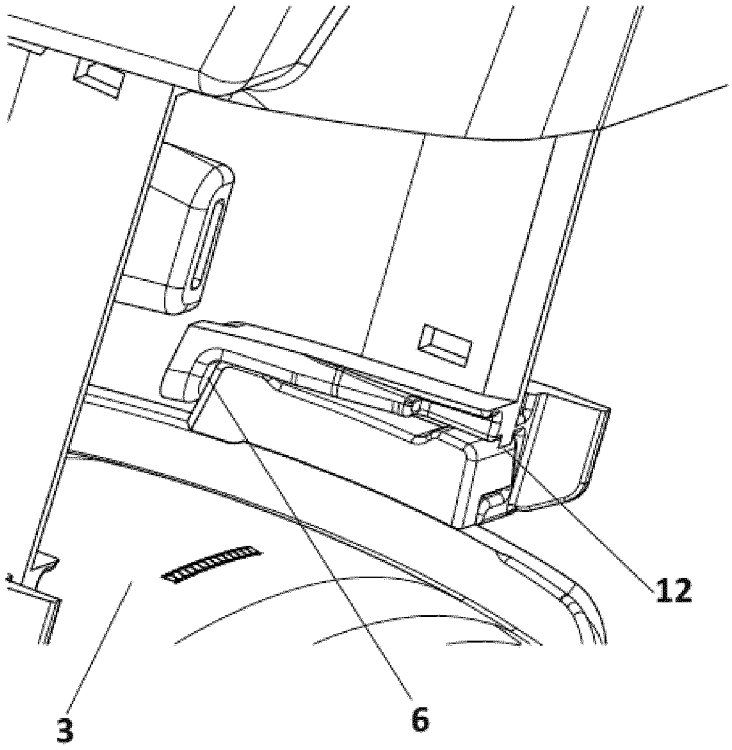
[Fig. 2]



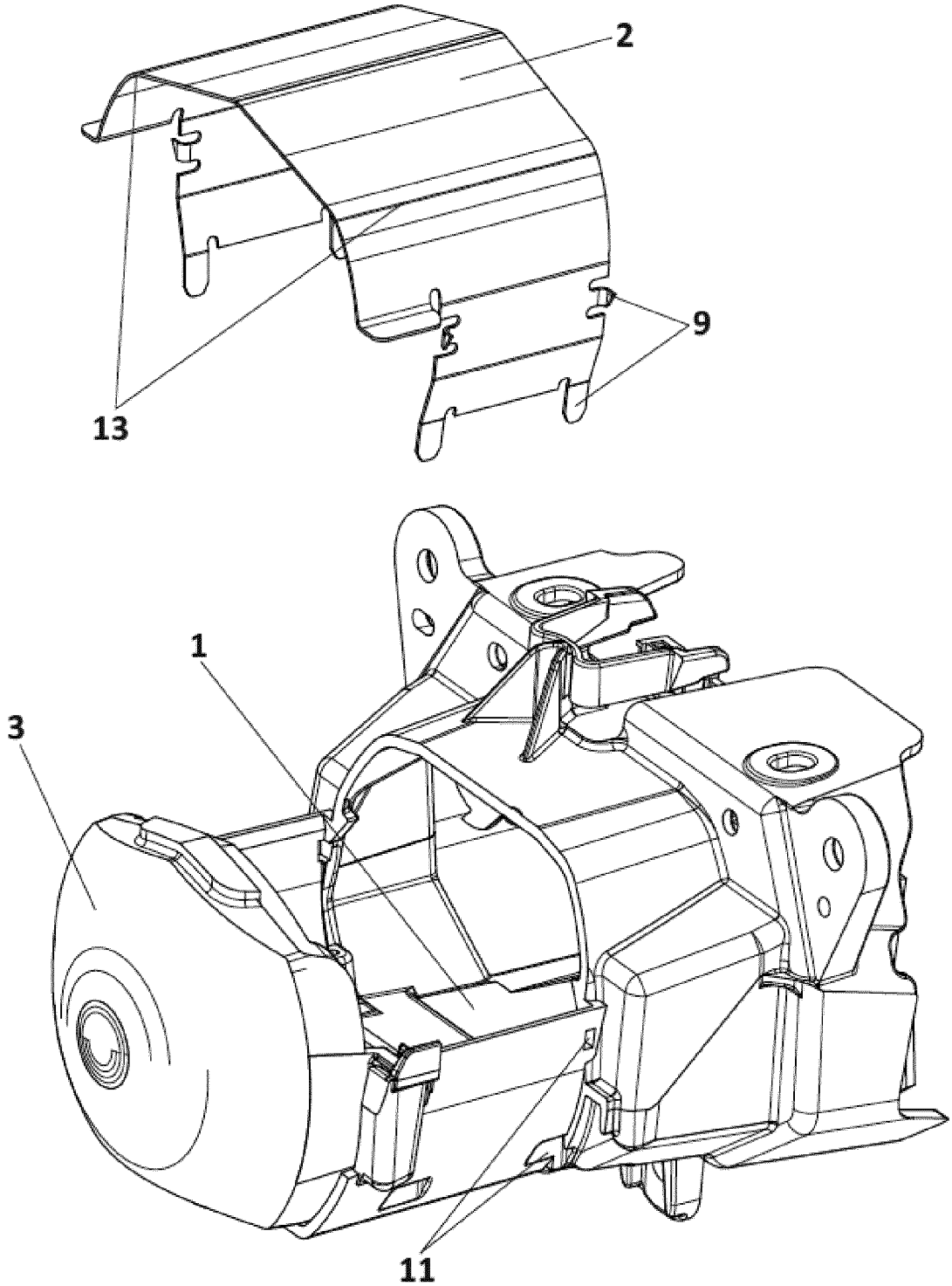
[Fig. 3]



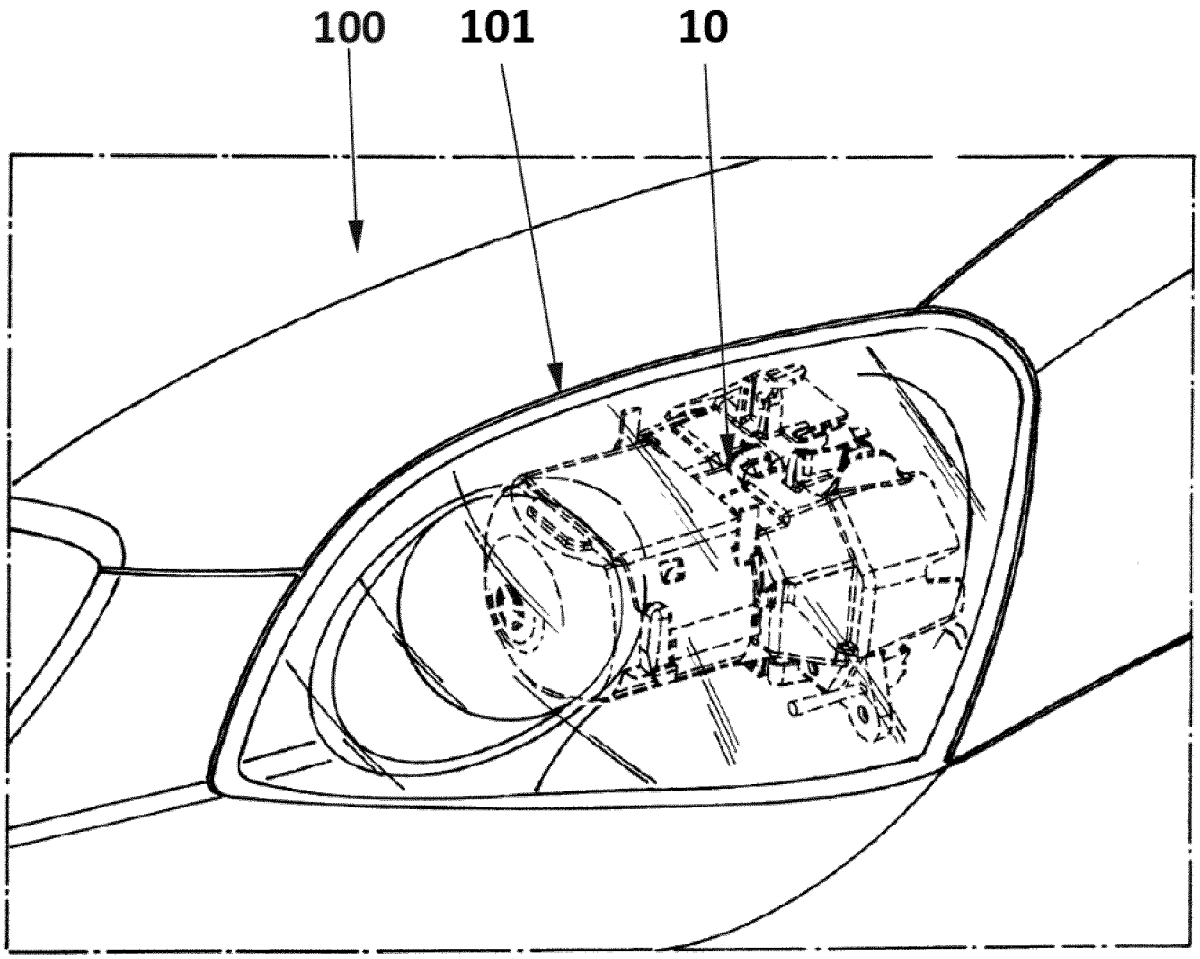
[Fig. 4]



[Fig. 5]



[Fig. 6]



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2021/086284

A. CLASSIFICATION OF SUBJECT MATTER
INV. F21S41/143 F21S41/255 F21S41/29 F21S45/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F21S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 April 2022	12/04/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Guénon, Sylvain

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

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International application No
PCT/EP2021/086284

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