

(19)



(11)

EP 4 279 801 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.11.2023 Bulletin 2023/47

(51) International Patent Classification (IPC):
F21S 41/19^(2018.01) F21S 43/19^(2018.01)

(21) Application number: **22174312.3**

(52) Cooperative Patent Classification (CPC):
F21S 41/198; F21S 43/195

(22) Date of filing: **19.05.2022**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **RUBIA MENA, Juan Antonio**
23600 Martos (ES)
• **MORAL, Francisco**
23600 Martos (ES)
• **FERNANDEZ CHAICHIO, Ricardo**
23600 Martos (ES)

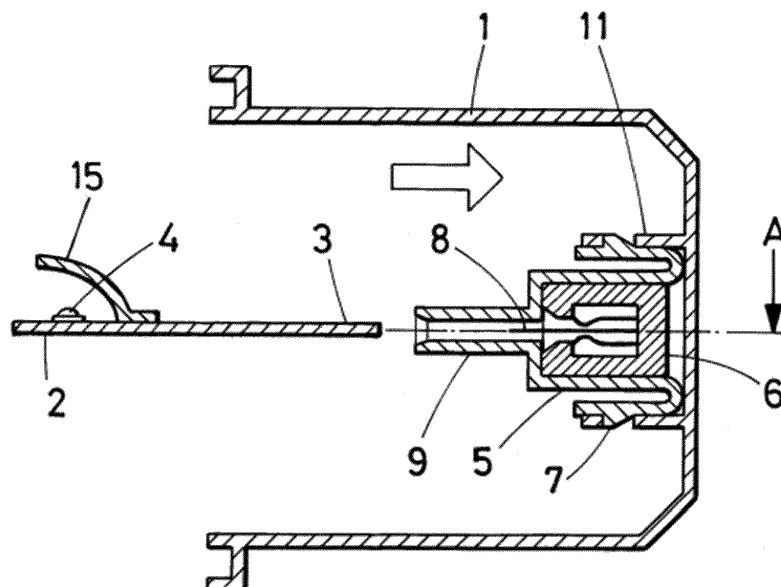
(71) Applicant: **Valeo Vision**
93012 Bobigny Cedex (FR)

(74) Representative: **Valeo Visibility**
Service Propriété Industrielle
c/o Valeo Vision
34, rue Saint André
93012 Bobigny (FR)

(54) AUTOMOTIVE LIGHTING DEVICE WITH A CARD EDGE CONNECTOR

(57) The invention provides an automotive lighting structure comprising a housing (1), an electronic substrate (2) with an edge protrusion (3) and a light source (4) arranged in the electronic circuit of the electronic substrate (2). It further comprises a carrier part (5) and a card edge female connector (6) housed in a connector zone of the carrier part (5). The carrier part (5) comprises

attaching means (7) configured to attach the carrier part (5) to the housing (1), and also comprises a guide element (9) which protrudes from the opening (8) of the connector zone in the same direction as the insertion direction, the guide element (9) being configured to guide the edge protrusion (3) of the electronic substrate towards the connector zone.

**Fig. 1****EP 4 279 801 A1**

Description

TECHNICAL FIELD

[0001] This invention is related to the field of automotive lighting devices, and more particularly, to the electric connections between elements comprised therein.

STATE OF THE ART

[0002] Automotive lighting devices require an increasing amount of electric connections, which are intended to provide control and power supply to the light sources contained therein.

[0003] These electric connections are usually managed in harness of wires coming from the control unit. This harness usually ends in a connector which in turn couples with the local connector in the device.

[0004] There is a specific type of connectors known as "card-edge" connectors. These connectors comprise a female element configured for receiving a protrusion element of a printed circuit board. This protrusion element comprises the electrical connections of the board, while the female element contains the corresponding connections which will be transformed into the wire harnesses to be arranged along the vehicle.

[0005] Since the connection of the printed circuit board into the card-edge connector is usually done manually, a correct connection must be ensured. To achieve this aim, the lighting device housings provide a guide to guide the protrusion towards their final position in the correct orientation, together with retaining means to keep the connector in place, thus avoiding accidental detachments.

[0006] This configuration presents some drawbacks. Firstly, the guide is provided for a specific design of a lighting device. A slight design change may render this guide useless, since the guide may only be used under very specific conditions. So the guide has to be redesigned specifically for each lighting device.

[0007] Further, as the guide is integrally moulded with the housing, its orientation is constrained by the demoulding axis of the housing. It is therefore difficult, to adapt the orientation of the guide. Since the orientation of the printed circuit board depends on the orientation of the guide, it is thus difficult to adapt the orientation of the printed circuit board in the housing. Yet, some lighting devices require a specific orientation of the printed circuit board. And, it is also desirable to be able to customized the orientation of the connection according to customer requests.

[0008] It is therefore desired to find an alternative solution to the attachment of a card-edge protrusion into a card-edge connector which may overcome the aforementioned problems.

SUMMARY OF THE INVENTION

[0009] The invention provides a solution for this problem by an automotive lighting device. This automotive lighting device comprises:

a housing;
an electronic substrate comprising an electronic circuit and an edge protrusion comprising electric connection tracks;
a light source arranged in the electronic circuit of the electronic substrate the automotive lighting structure being characterized in that it further comprises a carrier part and a card edge female connector, the card edge female connector having an insertion direction, wherein:

the carrier part comprises attaching means configured to attach the carrier part to the housing; the carrier part comprises a connector zone where the card edge female connector is housed, the connector zone comprising an opening configured to receive the edge protrusion; and

the carrier part comprises a guide element which protrudes from the opening of the connector zone in the same direction as the insertion direction, the guide element being configured to guide the edge protrusion of the electronic substrate towards the connector zone.

[0010] A separate carrier part which houses the female connector provides several advantages. First one is protection of the edge protrusion: the edge protrusion is protected by the guide element of the carrier part, so that it is safe while being introduced in the carrier part. Second one is the protection of the female connector: since the correct insertion direction is provided by these guides, the edge protrusion reaches the female connector in the right direction, so that the integrity of this female connector is preserved. Further, the carrier part is a different element from the housing and houses the female connector. The guiding element is not fixed to the housing, the orientation direction may be chosen when designing this part and its coupling to the housing. This provides more freedom to the arrangement of the elements inside the lighting device.

[0011] In some particular embodiments, the housing comprises securing means configured to cooperate with the attaching means in order to attach the carrier part to the housing.

[0012] As said before, the carrier part is a separate part from the housing, and is attached thereof by its attaching means.

[0013] These attaching means may be directly connected to the housing, since it is enough that the attaching means finds a counterpart in a fixed part, such as the housing, to be successfully provided.

[0014] However, in other cases, the housing comprises securing means which actively cooperate with the attaching means of the carrier part.

[0015] In some particular embodiments, the securing means protrude from the housing in a protrusion direction and the protrusion direction is different from the insertion direction. In particular embodiments, the protrusion direction forms an angle between 10° and 30° with respect to the insertion direction.

[0016] Then, the electronic substrate can be oriented along the insertion direction, and thus have an orientation which is different from the protrusion direction. The orientation of the electronic substrate and of the light source can thus be chosen independently from the orientation of the securing means.

[0017] This design is enabled by the carrier part. Indeed, as the securing means is integrally moulded with the housing, the protrusion direction is determined by the moulding process. The protrusion direction of the securing means has to follow the demoulding axis of the housing so that the securing means can be easily demoulded. Without the carrier part, the insertion direction would necessarily be the protrusion direction, and it would be determined by the demoulding axis. According to the invention, the carrier part can be adapted so that once it is attached to the housing, the insertion direction is different from the protrusion direction. In particular, the way the carrier part is attached to the securing means can determine the insertion direction.

[0018] There are different ways to implement this concept.

[0019] In some particular embodiments, the securing means and the attaching means are configured to cooperate as a snap fit connection.

[0020] A snap fit connection comprises two elements which accept the joint but prevent the separation, due to an elastic slope element which deforms to allow insertion and a stop element which avoids separation.

[0021] In some particular embodiments,

the securing means comprises a first securing protrusion and a second securing protrusion;
the attaching means comprises a first attaching leg and a second attaching leg;
the first securing protrusion comprises a first hole intended to receive the snap fit connection of the first attaching means;
the second securing protrusion comprises a second hole intended to receive the snap fit connection of the second attaching means, and
the perpendicular projection of the centre of the first hole over the second securing protrusion does not cross the centre of the second hole.

[0022] This arrangement of holes for the snap fit connection is one of the options to achieve an insertion direction which is different from the protrusion direction. Only by adjusting the position of the holes in securing

protrusion, the positioning of the carrier part relative to the securing means is different, and it is thus possible to achieve a different insertion direction than the protrusion direction.

[0023] Moreover, with this adjustment of positioning of the holes, the orientation of the insertion direction relative to the protrusion direction can be selected and changed from one lighting device to another. Indeed, for two different lighting devices, the modification of the moulding process of the housing is very slight. Only the position of the hole on the securing protrusion is modified, but the demoulding axis can remain the same, and can be determined by the demoulding axis of the housing. It is thus possible to easily adapt each lighting device to obtain the wanted insertion direction.

[0024] In some particular embodiments, the portion of the housing comprised between the first securing protrusion and the second securing protrusion comprises an abutment intended to receive a zone of the carrier part. For example, this abutment also forms a protrusion from the housing, in the direction of the carrier part.

[0025] In particular, the housing is moulded in a single part, meaning that the abutment is integrally moulded with the rest of the housing. The stability of the carrier part is thus improved. Since the carrier part is tilted with respect to the protrusion direction, this abutment provides a support for the advanced portion of the carrier part, thus providing a way of securely inserting the carrier part into the attaching means.

[0026] In some particular embodiments, the guide element comprises bevelled ends.

[0027] These bevelled ends are oriented for protecting the edge protrusion when being inserted in the guide element.

[0028] In some particular embodiments, the edge protrusion of the electronic substrate comprises a first mechanic connector and the carrier part comprises a second mechanic connector configured to cooperate with the first mechanic connection for the retention of the edge protrusion, wherein the first mechanic connector and the second mechanic connector comprises one of notches and protrusions.

[0029] This notch-protrusion system is used to retain the edge protrusion in the correct position inside the female connector, thus ensuring the electric connection between these two elements.

[0030] In some particular embodiments, the electronic substrate is a printed circuit board.

[0031] This invention is particularly adapted to the use of printed circuit boards, which have edge connections for card edge female connectors.

[0032] In some particular embodiments, the light source is a solid-state light source, such as a light emitting diode.

[0033] 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 device 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 lifespan of the illumination device. 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.

[0034] The lighting device may be a headlamp or a rearlamp, although this invention could also be implemented in a lighting module comprised in one of them.

[0035] 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.

[0036] 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.

BRIEF LIST OF DRAWINGS AND REFERENCE NUMBERS

[0037] 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:

Figure 1 shows some elements of a first embodiment of an automotive lighting device according to the invention.

Figure 2 shows a different embodiment of some parts of a lighting device according to the invention.

Figure 3 shows some parts of a third embodiment of a lighting device according to the invention.

Figure 4 provides a top view of the connection between the edge protrusion of the printed circuit board and the carrier part in an embodiment of a lighting device according to the invention.

Figure 5 shows a general perspective view of an automotive lighting device according to the invention, installed in an automotive vehicle.

[0038] In these figures, the following reference numbers have been used:

1	Housing
2	PCB
3	Edge protrusion
4	LED
5	Carrier part
6	Card edge female connector
7	Attaching means
8	Opening
9	Guide element
10	Automotive lighting device
11	Securing means
12	Additional support element
13	First mechanic connector
14	Second mechanic connector
15	Reflector
16	First hole of the securing protrusion
17	Second hole of the securing protrusion
18	Conductive tracks
100	Automotive vehicle

DETAILED DESCRIPTION OF THE INVENTION

[0039] 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.

[0040] 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.

[0041] Figure 1 shows some elements of a first embodiment of an automotive lighting device according to the invention.

[0042] In this figure, a housing 1 is presented to house all the elements which are described below. This housing 1 comprises some securing protrusions 11.

[0043] A carrier part 5 is coupled to these securing protrusions 11 by means of attaching legs 7. These attaching legs 7 are especially configured to provide a snap fit connection with the securing protrusions 11, thus creating an easy and secure way of placing the carrier part 5 in a specific location of the housing 1.

[0044] This carrier part 5 comprises a connector zone, which is a hollow zone where a card edge female connector 6 is housed. This card edge female connector 6

provides the electric connection from the vehicle main power supply. This card edge female connector 6 comprises a plurality of electric connection tracks which are intended to be electrically connected with the connection tracks of an edge protrusion.

[0045] This edge protrusion which matches with the card edge female connector 6 is part of a printed circuit board 2. This printed circuit board 2 comprises an electronic circuit with a LED 4, and a reflector 15 which is especially adapted to project the light emitted by the LED 4. However, in different embodiments, the printed circuit board 2 may comprise any type of lighting arrangement. The printed circuit board 2 is intended to be electrically fed via the card edge female connector 6. To do so, the edge protrusion 3 of the printed circuit board 2, which comprises the electric connection tracks, as seen in Figure 4, is inserted in the card edge female connector 6, so that the electric connection tracks of the edge protrusion 3 and the electric connection tracks of the card edge female connector 6 make contact. With this connection, power supply is carried to the electric circuit of the printed circuit board 2 so that the LED 4 receives electric power to emit light.

[0046] This insertion is performed in an insertion direction (which in this case is horizontal, from the left of the image to the right). For a better protection of this connection, the carrier part 5 comprises a guide 9 which protrudes from an opening 8 which opens the connector zone to the exterior. This guide 9 is oriented in this insertion direction, to ensure that the printed circuit board 2 reaches the card edge female connector 6 in the correct orientation. The ends of the guide 9 are bevelled for a more secure insertion, helping the printed circuit board 2 to enter the guide 9 safely.

[0047] Hence, the insertion direction of the printed circuit board 2 with respect to the housing 1 is defined by the orientation of the card edge female connector 6 with respect to the housing 1. This orientation is provided by the orientation that the carrier part 5 confers to this card edge female connector 6, since this connector 6 is housed in the connector zone of the carrier part 5. If the carrier part 5 is moved, the female connector 6 is moved. If the carrier part 5 rotates, the female connector 6 rotates.

[0048] Hence, a rotation in the carrier part 5 would affect to the orientation of the insertion direction.

[0049] This rotation may be desired by the designer because the lighting device can be rotated but the light emission direction should be maintained in the same direction (since the direction of the light emission is provided by the regulations, while the orientation of a lighting device may be defined by the car manufacturer).

[0050] Without the carrier part 5 of the invention, this orientation modification would require a complete re-design of the lighting device.

[0051] However, due to the presence of the carrier part 5, a modification in the orientation of the printed circuit board 2 with respect to the housing 1 can be made without

a substantial re-design.

[0052] Figure 2 shows some parts of a second embodiment of a lighting device according to the invention. This second embodiment is similar to the first embodiment shown in Figure 1, but in this case, the housing has been slightly modified to achieve the aforementioned orientation change. This orientation change is performed by the modification of the securing protrusions 11. The different angle of the protrusions 11 provides a different angulation reference for the rest of the system, which remains unchanged. The carrier part 5 is inserted in the securing protrusions 11 in the same way as in figure 11, and the rest of the elements (printed circuit board, LED,...) are the same as in the previous figure.

[0053] This is an easy and quick way of modifying the relative orientation of the light emission direction with respect to the housing. However, in some cases, this option may be difficult to demould.

[0054] Figure 3 shows some parts of a third embodiment of a lighting device according to the invention. In this embodiment, the change in the orientation of the card edge female connector 6 is achieved by a slight modification in the position of the holes of the securing protrusions 11. Further, an additional support element 12 forming an abutment is integrated in the moulding process of the housing.

[0055] This additional support element 12 is used in conjunction with this different location of the holes in each of the securing protrusions 11. As may be seen in this figure, the securing means 11 comprises a first securing protrusion 11a and a second securing protrusion 11b. The attaching means 7 comprises in turn a first attaching leg 7a and a second attaching leg 7b. The first securing protrusion 11a comprises a first hole 16 intended to receive the snap fit connection of the first attaching leg 7a. The second securing protrusion comprises a second hole 17 intended to receive the snap fit connection of the second attaching leg 7b. However, the perpendicular projection of the centre of the first hole 16 over the second securing protrusion 11b does not cross the centre of the second hole 17. This bias has the effect of tilting the carrier part 5 without modifying the protrusion direction, making this embodiment as easy to demould as the embodiment of Figure 1, but with the result of an angle α of the printed circuit board with respect to these securing protrusions 11.

[0056] Figure 4 provides a top view of the connection between the edge protrusion 3 of the printed circuit board 2 and the carrier part 5.

[0057] As seen in this figure, the edge protrusion 3 of the printed circuit board 2 comprises two notches 13 and the carrier part 5 comprises two protrusions 14, configured to cooperate with the notches 13 for the retention of the edge protrusion 3. The edge protrusion 3 comprising the conductive tracks 18 abuts against the back portion of the female card edge connector 6.

[0058] Figure 5 shows a general perspective view of an automotive lighting device 10 according to the inven-

tion, installed in an automotive vehicle 100.

Claims

1. An automotive lighting device (10) comprising

a housing (1);
an electronic substrate (2) comprising an electronic circuit and an edge protrusion (3) comprising electric connection tracks;
a light source (4) arranged in the electronic circuit of the electronic substrate (2); the automotive lighting structure being **characterized in that** it further comprises a carrier part (5) and a card edge female connector (6), the card edge female connector (6) having an insertion direction, wherein:

the carrier part (5) comprises attaching means (7) configured to attach the carrier part (5) to the housing (1);
the carrier part (5) comprises a connector zone where the card edge female connector (6) is housed, the connector zone comprising an opening (8) configured to receive the edge protrusion (3); and
the carrier part (5) comprises a guide element (9) which protrudes from the opening (8) of the connector zone in the same direction as the insertion direction, the guide element (9) being configured to guide the edge protrusion (3) of the electronic substrate towards the connector zone.

2. Automotive lighting device (10) according to claim 1, wherein the housing comprises securing means (11) configured to cooperate with the attaching means (7) in order to attach the carrier part to the housing.

3. Automotive lighting device (10) according to claim 2, wherein the securing means (11) protrude from the housing in a protrusion direction and wherein the protrusion direction is different from the insertion direction.

4. Automotive lighting device (10) according to claim 3, wherein the protrusion direction forms an angle between 10° and 30° with respect to the insertion direction.

5. Automotive lighting device (10) according to any of claims 3 to 4, wherein the securing means (11) and the attaching means (7) are configured to cooperate as a snap fit connection.

6. Automotive lighting device (10) according to claim

5, wherein

the securing means (11) comprises a first securing protrusion and a second securing protrusion;
the attaching means (7) comprises a first attaching leg and a second attaching leg;
the first securing protrusion comprises a first hole intended to receive the snap fit connection of the first attaching means;
the second securing protrusion comprises a second hole intended to receive the snap fit connection of the second attaching means, and the perpendicular projection of the centre of the first hole over the second securing protrusion does not cross the centre of the second hole.

7. Automotive lighting device (10) according to claim 6, wherein the portion of the housing comprised between the first securing protrusion and the second securing protrusion comprises an abutment (12) intended to receive a zone of the carrier part (5).

8. Automotive lighting device (10) according to any of the preceding claims, wherein the guide element (9) comprises bevelled ends.

9. Automotive lighting device (10) according to any of the preceding claims, wherein the edge protrusion (3) of the electronic substrate (2) comprises a first mechanic connector (13) and the carrier part (5) comprises a second mechanic connector (14) configured to cooperate with the first mechanic connection (13) for the retention of the edge protrusion (3), wherein the first mechanic connector (13) and the second mechanic connector (14) comprises one of notches and protrusions.

10. Automotive lighting device (10) according to any of the preceding claims, wherein the electronic substrate (2) is a printed circuit board.

11. Automotive lighting device (10) according to any of the preceding claims, wherein the light source (4) is a solid-state light source, such as a light emitting diode.

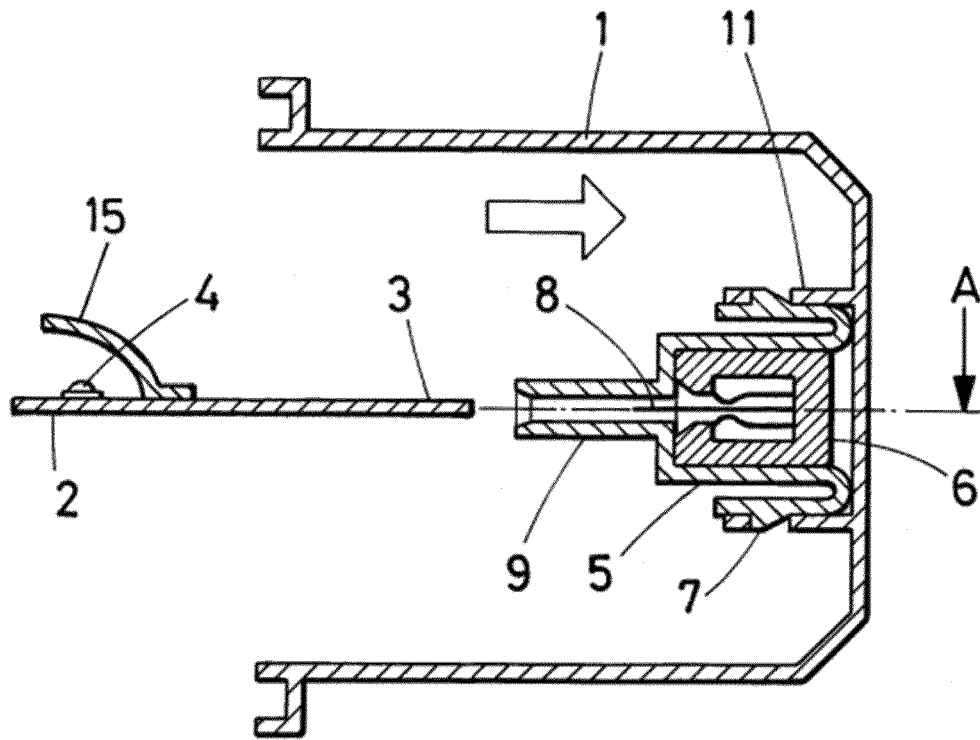


Fig. 1

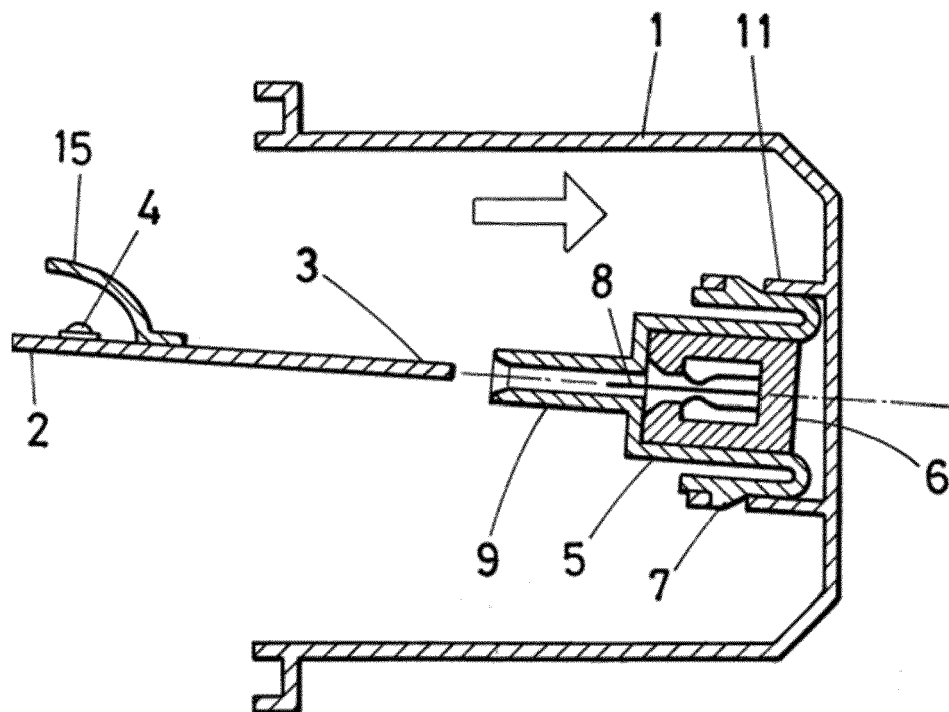


Fig. 2

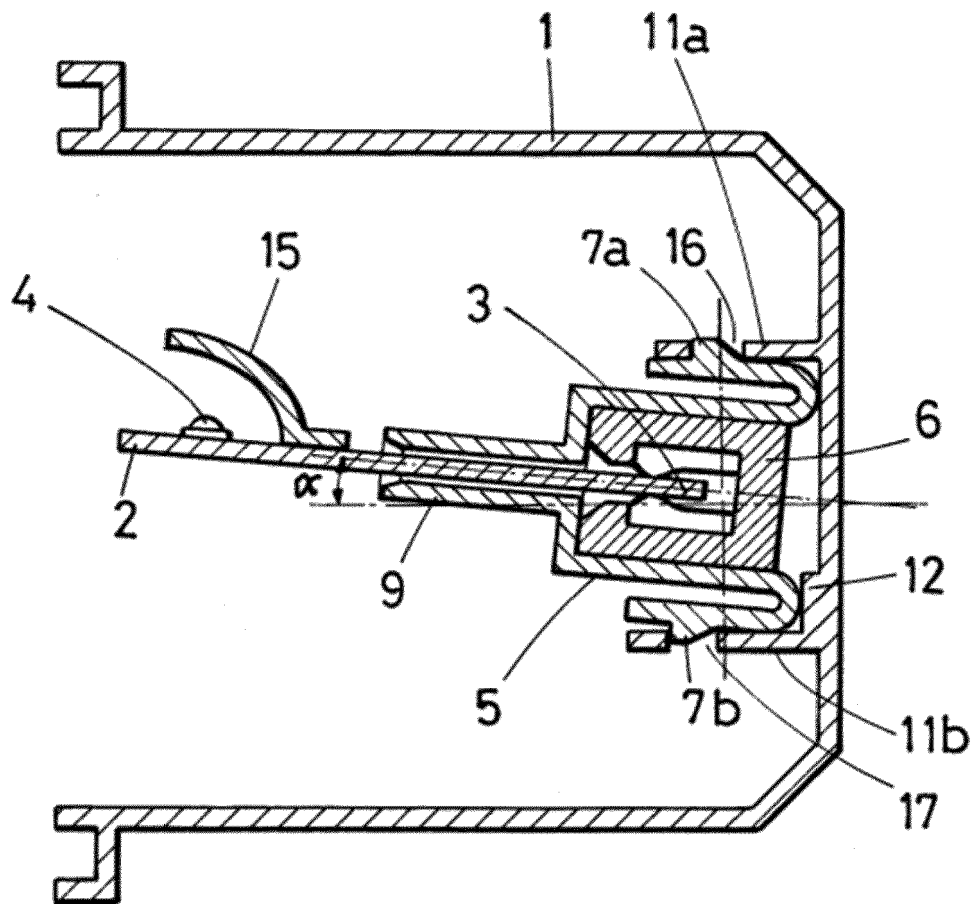


Fig. 3

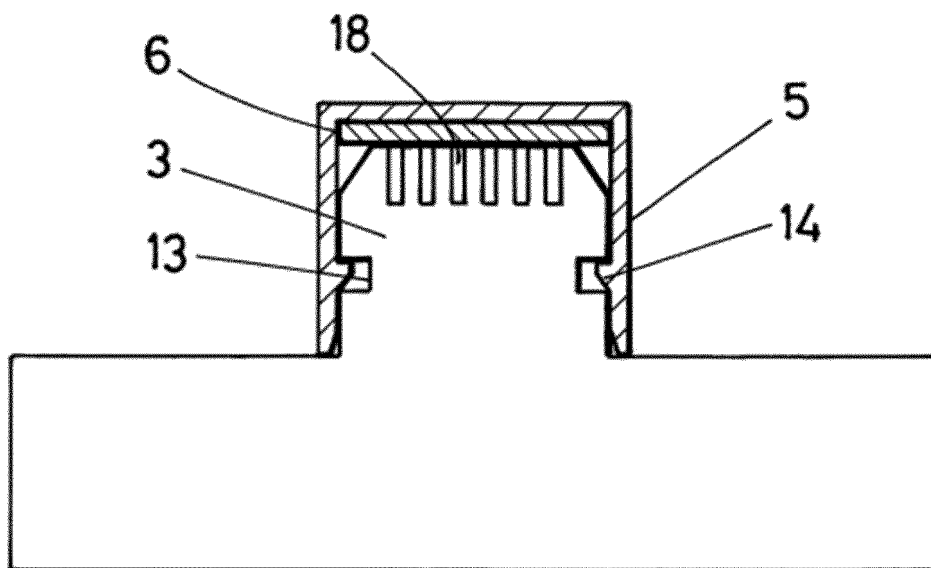


Fig. 4

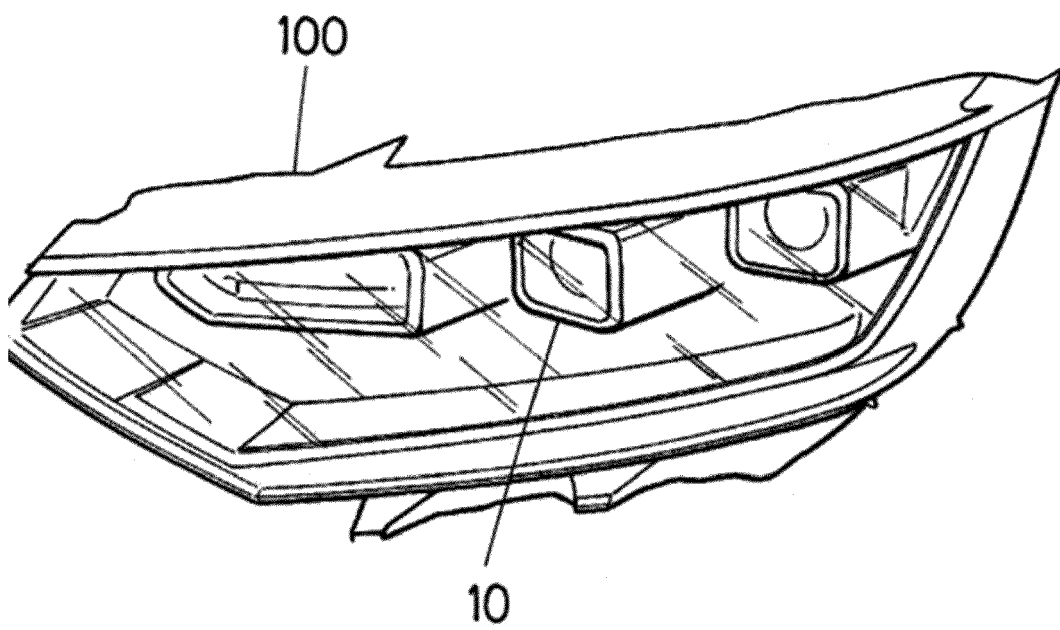


Fig. 5



EUROPEAN SEARCH REPORT

Application Number

EP 22 17 4312

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	KR 101 853 614 B1 (SL CORP [KR]) 3 May 2018 (2018-05-03)	1-5, 8-11	INV.
A	* paragraphs [0061], [0074]; figures 7, 12, 13 *	6, 7	F21S41/19 F21S43/19
X	US 2013/279189 A1 (SUZUKI HIROYUKI [JP] ET AL) 24 October 2013 (2013-10-24) * paragraphs [0044], [0045]; figures 1, 2 *	1-5, 8, 10, 11	
X	US 2016/076724 A1 (JIN HUI [FR] ET AL) 17 March 2016 (2016-03-17) * paragraphs [0040], [0044]; figures 2, 3, 5, 6 *	1, 2, 8, 11	
			TECHNICAL FIELDS SEARCHED (IPC)
			F21S
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		21 October 2022	Guénon, Sylvain
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 17 4312

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-10-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 101853614 B1	03-05-2018	KR 20180035003 A	05-04-2018
		US 2018163941 A1	14-06-2018

US 2013279189 A1	24-10-2013	BR 112013010480 A2	02-08-2016
		CN 103328260 A	25-09-2013
		DE 112012000472 T5	17-10-2013
		JP 5721446 B2	20-05-2015
		JP 2012144183 A	02-08-2012
		KR 20130061749 A	11-06-2013
		US 2013279189 A1	24-10-2013
		WO 2012096408 A1	19-07-2012

US 2016076724 A1	17-03-2016	CN 105423208 A	23-03-2016
		EP 2996142 A1	16-03-2016
		FR 3025866 A1	18-03-2016
		US 2016076724 A1	17-03-2016
