



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.02.2022 Bulletin 2022/06

(51) International Patent Classification (IPC):
F21S 41/148 ^(2018.01) **F21S 41/19** ^(2018.01)
F21S 45/47 ^(2018.01)

(21) Application number: **20189392.2**

(52) Cooperative Patent Classification (CPC):
F21S 41/148; F21S 41/192; F21S 45/47

(22) Date of filing: **04.08.2020**

(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) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **dompatent von Kreisler Selting Werner - Partnerschaft von Patent- und Rechtsanwälten mbB**
Deichmannhaus am Dom
Bahnhofsvorplatz 1
50667 Köln (DE)

(71) Applicant: **Lumileds LLC**
San Jose, CA 95131 (US)

(54) **RETROFIT LED LAMP FOR A VEHICLE LIGHT**

(57) An LED lamp (1) for a vehicle light, the LED lamp (1) comprising a retrofit body (112) defining a longitudinal direction and being integrally configured as a heat sink, a conductive structure (13) being arranged in a cavity of the retrofit body (12) and at least one LED module (11) being electrically connected to the conductive structure (13), the at least one LED module (11) comprising a substrate (111) and a diode semiconductor (112) applied onto the substrate (111); a retrofit body (12), a conductive structure (13), and a method for manufacturing an LED lamp (1) for a vehicle.

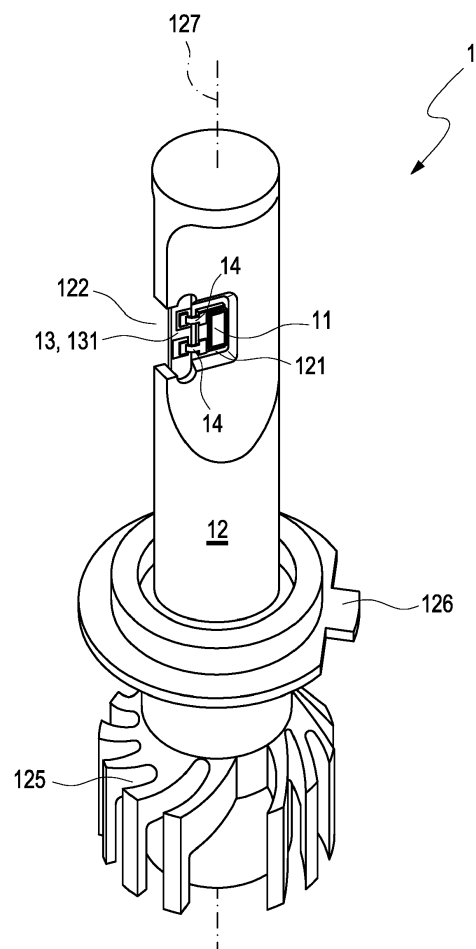


Fig. 1

Description

FIELD OF THE INVENTION

[0001] The invention relates to an LED lamp for a vehicle light, the LED lamp comprising a retrofit body defining a longitudinal direction and being integrally configured as a heat sink, a conductive structure being arranged in a cavity of the retrofit body and at least one LED module being electrically connected to the conductive structure, the at least one LED module comprising a substrate and a diode semiconductor applied onto the substrate. The invention further relates to a retrofit body for an LED lamp, a conductive structure for an LED lamp and a method for manufacturing an LED lamp for a vehicle light.

BACKGROUND OF THE INVENTION

[0002] Lamps for vehicle lights are available in many different configurations and are used to provide a vehicle light, e.g. a headlight of a vehicle, with a light source. Conventional lamps comprise a lamp base matching a lamp socket of the respective vehicle light, a bulb supported by the lamp base and filled with a gas, e.g. a halogen gas, and a filament arranged within the bulb and electrically connected to electrical contacts electrically connectable from outside.

[0003] Vehicle lights and corresponding lamps, respectively, provide lamp sockets and lamp bases matching each other and being standardized for economical and practical reasons. Exemplary lamp sockets for headlight halogen lamps are standardized for H4, H7 and H9 lamps to name only a few. Headlight halogen lamps matching one of these exemplary lamp sockets are configured for consuming an electrical power of 55 W, 60 W or 65 W.

[0004] Recently, LED lamps have been provided to be used instead of conventional lamps. LED lamps for replacing conventional lamps may also be referred to as LED retrofit bulbs although they usually do not comprise a bulb.

[0005] Such an LED lamp is configured for consuming a lower electrical power than a conventional lamp, e.g. in a range between 10 W and 20 W. The LED lamp usually comprises one or more, particularly two, LED modules. Each LED module of the LED lamp may have a layered structure comprising a plate-like substrate, one or more diode semiconductors applied to the substrate for emitting light and a luminescent layer applied to each diode semiconductor for converting e.g. blue light emitted by the diode semiconductor into white light emitted by the LED module.

[0006] The LED lamp further comprises a conventional lamp base for matching a respective lamp socket of a vehicle light and a retrofit body. The retrofit body is configured for supporting the one or more LED modules and arranging them, relative to the lamp base, essentially at

a position of a filament of a conventional lamp.

[0007] Despite the lower electrical power being consumed a diode semiconductor generates a large quantity of heat during normal operation which has to be removed from the diode semiconductor, i.e. the diode semiconductor has to be cooled appropriately. As an LED lamp of the initially-mentioned kind is required to optically imitate a conventional lamp as close as possible the at least one diode semiconductor has to be concentrated in a very small spatial volume. However, removing the generated heat from the at least one diode semiconductor is the more difficult the smaller the spatial volume is.

[0008] As a higher operation temperature of the at least one diode semiconductor increases a risk of a defect of the at least one diode semiconductor, the service life of the LED lamp tends to be the shorter the better the LED lamp imitates a conventional lamp.

SUMMARY OF THE INVENTION

[0009] It is an object of the present invention to provide an LED lamp for a vehicle light which optically imitates a conventional lamp as close as possible having as long a service life as possible at the same time. Further objects of the invention are providing a retrofit body for an LED lamp and a conductive structure for an LED lamp and suggesting a method for manufacturing an LED lamp for a vehicle light.

[0010] The invention is defined by the independent claims. The dependent claims specify advantageous embodiments, respectively.

[0011] A first aspect of the invention is an LED lamp for a vehicle light, the LED lamp comprising a retrofit body defining a longitudinal direction and being integrally configured as a heat sink, a conductive structure being arranged in a cavity of the retrofit body and at least one LED module being electrically connected to the conductive structure, the at least one LED module comprising a substrate and a diode semiconductor applied onto the substrate. The conductive structure may comprise a printed circuit board (PCB) or a lead frame. The LED lamp is configured to replace a conventional lamp for a vehicle light, i.e. to be mounted in a conventional socket of the vehicle light thereby arranging the diode semiconductor essentially at a location of a filament of a conventional lamp being mounted in the vehicle light.

[0012] According to the invention, the substrate is attached to the retrofit body with at most a joining material being arranged between the substrate and the retrofit body. The joining material may comprise a thermally conductive adhesive or a solder paste. The diode semiconductor and the heat sink, i.e. the retrofit body, are only separated by the substrate and at most the joining material. A spatial distance between the diode semiconductor and the supporting retrofit body is as small as possible. Due to the small spatial distance the diode semiconductor may be arranged within a small focus volume being predetermined by a size of a filament of a conventional

lamp. As a result, the LED lamp imitates a conventional lamp very well.

[0013] At the same time, the diode semiconductor and the retrofit body wholly acting as an effective heat sink are mechanically separated from each other as little as possible, i.e. thermally connected as intimate as possible. Due to the close thermal connection a heat transfer from the diode semiconductor to the retrofit body is improved. Due to the improved heat transfer an operating temperature of the diode semiconductor is lowered resulting in a longer service life of the diode semiconductor and, hence, the LED lamp. The retrofit body preferably comprises a support portion being laterally adjacent to a lateral opening of the retrofit body, the support portion supporting the at least one LED module. The support portion may be configured as a rectangular plate having a thickness in a range from 0.5 mm to 1.5 mm and preferably of 1 mm. Advantageously, a finger-like portion of the conductive structure is arranged laterally adjacent to the support portion. The electrical contacts of the finger-like portion are close to the LED module allowing for a short electric connection of the LED module and the conductive structure.

[0014] In a preferred embodiment, the conductive structure is configured to be inserted into and fixed within a central bore of the retrofit body, the finger-like portion fitting in a duct of the retrofit body and comprising two electrical contacts for contacting the at least one LED module with the electrical contacts, in an inserted state of the conductive structure, being accessible through the lateral opening. Connecting the electrical contacts of the conductive structure to the contact elements of the LED module is facilitated by the lateral opening.

[0015] Advantageously, the central bore extends longitudinal from an end face of the retrofit body, and the duct extends longitudinal from a bottom portion of the central bore to the lateral opening. The central bore may accommodate a driver circuit for driving the LED module. The central bore preferably has a cylindrical shape or a rectangular cross-section. The duct may also have a cylindrical shape or a rectangular cross-section and allows the conductive structure for extending in the longitudinal direction to the lateral opening. The duct does not need to be completely enclosed but may have a lateral opening.

[0016] The duct may be arranged eccentrically with respect to the central bore. The eccentric arrangement allows the conductive structure for being arranged laterally within the retrofit body.

[0017] In many embodiments, an edge region of the retrofit body surrounding the lateral opening widens in a light emission direction of the at least one LED module. The edge region may have a bevel or one or more steps for enlarging a maximum light emission angle of the at least one LED module.

[0018] In other embodiments, the LED lamp may comprise two LED modules being attached to opposite sides of the support portion. The two LED modules emit light

in two opposite directions thereby better imitating a filament of a conventional lamp emitting light into a full spatial angle. The substrates of the LED modules usually have a thickness in a range from 0.5 to 1-5 mm and preferably of 1 mm. Accordingly, the opposing diode semiconductors are spaced apart by about 3 mm only which essentially corresponds to a diameter of a filament coil of a conventional lamp. The LED lamp may also comprise an even number of LED modules half of them being attached to each side of the support portion, respectively.

[0019] It is preferred that the conductive structure is arranged spaced apart from the substrate of the LED module. A heat transfer from the LED module to the conductive structure is reduced due to the spatial separation of the LED module and the conductive structure. The reduced heat transfer allows for a long service life of the conductive structure and, hence, the LED lamp.

[0020] In many embodiments, the LED lamp comprises a pair of conductive elements electrically connecting the at least one LED module to the electrical contacts of the conductive structure. Each conductive element may comprise a metal ribbon or a metal wire.

[0021] A second aspect of the invention is a retrofit body for an LED lamp to be mounted to a vehicle light, the retrofit body being integrally configured as a heat sink for at least one LED module and for supporting the at least one LED module, the retrofit body comprising a central bore extending longitudinal from an end face of the retrofit body, a lateral opening and a duct extending longitudinal from a bottom portion of the central bore to the lateral opening, wherein the central bore, the duct and the lateral opening are configured to accommodate a conductive structure, the conductive structure being configured to be inserted into and fixed within the central bore and comprising a finger-like portion fitting in the duct of the retrofit body, the finger-like portion comprising two electrical contacts for contacting the at least one LED module with the electrical contacts, in an inserted state of the conductive structure, being accessible through the lateral opening. The retrofit body may be provided as a semi-finished product which may be manufactured by molding and/or machining.

[0022] A third aspect of the invention is a conductive structure for an LED lamp to be mounted to a vehicle light, the conductive structure being configured to be inserted into and fixed within a retrofit body of an LED lamp, the retrofit body being integrally configured as a heat sink and comprising a central bore extending longitudinal from an end face of the retrofit body, a lateral opening, and a duct extending longitudinal from a bottom portion of the central bore to the lateral opening, wherein the conductive structure comprises a finger-like portion fitting in the duct of the retrofit body, the finger-like portion comprising two electrical contacts for at least one LED module, the electrical contacts being accessible through the lateral opening of the retrofit body in an inserted state of the conductive structure. The conductive structure may be provided as semi-finished product which may be manu-

factured in a usual way.

[0023] A fourth aspect of the invention is a method for manufacturing an LED lamp for a vehicle. The method comprises the steps of:

- providing, as a first semi-finished product, at least one LED module, the LED module comprising a substrate, a diode semiconductor applied onto the substrate and a luminescent layer applied onto the diode semiconductor;
- providing, as a second semi-finished product, a retrofit body being integrally configured as a heat sink for the at least one LED module, the retrofit comprising a central bore extending longitudinal from an end face of the retrofit body, a lateral opening, and a duct extending longitudinal from a bottom portion of the central bore to the lateral opening;
- attaching the substrate of the at least one LED module to the retrofit body adjacent to the lateral opening with at most a joining material being arranged between the substrate and the retrofit body;
- providing, as a third semi-finished product, a conductive structure configured to be inserted into and fixed within the central bore of the retrofit body, the conductive structure comprising a finger-like portion fitting in the duct of the retrofit body, the finger-like portion comprising two electrical contacts for contacting the at least one LED module with the electrical contacts being accessible through the lateral opening in an inserted state of the conductive structure;
- inserting the conductive structure into the central bore and the duct of the retrofit body; and
- electrically connecting the at least one LED module with the electrical contacts of the conductive structure via a pair of conductive elements.

[0024] The method allows for manufacturing the LED lamp very easily by assembling three semi-finished products wherein the first semi-finished product is thermally connected to the second semi-finished product and electrically connected to the third semi-finished product.

[0025] In many embodiments, electrically connecting the at least one LED module comprises an ultrasonic welding of the conductive elements both to the at least one LED module and to the electrical contacts of the conductive structure. The ultrasonic welding may be easily carried out as both the contact elements of the LED module and the electrical contacts of the conductive structure are accessible via the lateral opening of the retrofit body.

[0026] In a preferred embodiment, two LED modules are attached to the support portion of the retrofit body on opposite sides of the support portion.

[0027] It is an essential advantage of the LED lamp according to the invention that a conventional lamp is imitated very well due to a close sandwiching of diode semiconductors and a retrofit body of the LED lamp and a service life of the LED lamp is long due to an efficient cooling. Another advantage is the ease of manufacture

due to using three semi-finished products during a final assembly.

[0028] It shall be understood that a preferred embodiment of the invention can be any combination of features of the dependent claims with the respective independent claims. Further advantageous embodiments are defined below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

Fig. 1 schematically shows a perspective view of an LED lamp according to an embodiment of the invention;

Fig. 2 schematically shows a lateral view of the LED module of the LED lamp shown in fig. 1;

Fig. 3 schematically shows a cross-sectional view of the retrofit body of the LED lamp shown in fig. 1; and

Fig. 4 schematically shows a top view of the conductive structure of the LED lamp shown in fig. 1.

[0030] In the figures, like numbers refer to like objects throughout. Objects shown in the figures are not necessarily drawn to scale.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0031] Fig. 1 schematically shows a perspective view of an LED lamp 1 according to an embodiment of the invention. The LED lamp 1 may be mounted to a vehicle light, e.g. a head light of a vehicle. The LED lamp 1 comprises a retrofit body 12 defining a longitudinal direction 127. The retrofit body 12 may comprise a metal and is integrally configured as a heat sink which may have a plurality of fins 125 extending perpendicular to the longitudinal direction 127 from one end of the retrofit body 12. The LED lamp 1 may also comprise a flange 126 for mounting the LED lamp 1 to a corresponding socket of the vehicle light. The flange 126 may comprise a plastic or consist of a plastic and may have an annular shape wherein the retrofit body 12 extends through the flange 126. In other embodiments the flange 126 may be an integral portion of the retrofit body.

[0032] The LED lamp 1 further comprises two LED modules 11 one of which is hidden in the figure.

[0033] Fig. 2 schematically shows a lateral view of the LED module 11 mounted on the retrofit body 12 of the LED lamp 1 shown in fig. 1. The LED module 11 comprises a plate-like substrate 111, a diode semiconductor 112 applied to the substrate 111 for emitting light and a luminescent layer 113 applied to the diode semiconductor 112 for converting e.g. blue light emitted by the diode semiconductor 112 into white light emitted by the LED module 11. Furthermore, the LED module 11 comprises a pair of electrical contact elements 114 which are electrically connected to the diode semiconductor 112. The

substrate 111 is attached to the retrofit body 12, particularly a support portion 121 of the retrofit body 12, with a joining material 15 being arranged between the substrate 111 and the retrofit body 12.

[0034] The joining material 15 may be a thermally conductive adhesive or a solder paste. In different embodiments the joining material 15 may even be omitted. In these embodiments the substrate 111 may be immediately attached to the support portion 121. The immediate attachment may, for instance, be accomplished by ultrasonic welding or by riveting or screwing to name only a few possibilities.

[0035] Fig. 3 schematically shows a cross-sectional view of the retrofit body 12 of the LED lamp 1 shown in fig. 1. The retrofit body 12 comprises a metal or consists of a metal, e.g. aluminum, and has a cavity which comprises a central bore 123 extending longitudinal from an end face of the retrofit body 12 and a duct 124 extending longitudinal from a bottom portion of the central bore 123 to a lateral opening 122 of the retrofit body 12. The duct 124 is arranged eccentrically with respect to the central bore 123. The central bore 123 has a cylindrical shape, but may have a different shape in other embodiments. An edge region of the retrofit body 12 surrounding the lateral opening 122 has bevels and widens in light emission directions of the LED modules 11 as can be best seen in fig. 1. In other embodiments, the edge region may have one or more steps or a combination of bevels and steps.

[0036] The retrofit body 12 comprises a support portion 121 which is preferably configured plate-like with a thickness in a range of 0.5 mm to 1.5 mm and preferably of 1 mm. The support portion 121 is arranged laterally adjacent to the lateral opening 122. The support portion 121 supports both LED modules 11 which are attached to opposite sides of the support portion 121.

[0037] The retrofit body 12 may be provided as a semi-finished product in manufacturing the LED lamp 1. The retrofit body 12 is integrally configured as a heat sink for at least one LED module 11 and for supporting the at least one LED module 11. The retrofit body 12 comprises the central bore 123 and the duct 124. The duct 124 and the lateral opening 122 are configured to accommodate a conductive structure 13 of the LED lamp 1 which is described in detail below.

[0038] The LED lamp 1 further comprises a conductive structure 13 being arranged in the cavity of the retrofit body 12.

[0039] Fig. 4 schematically shows a top view of the conductive structure 13 of the LED lamp 1 shown in fig. 1. The conductive structure 13 may comprise a printed circuit board (PCB) or a lead frame and is configured to be inserted into and fixed within the central bore 123. The conductive structure 13 may support a driver circuit 133 of the LED lamp 1 for driving the LED modules 11. The conductive structure 13 comprises a finger-like portion 131 fitting in the duct 124 of the retrofit body 12. The finger-like portion 131, in the inserted state of the con-

ductive structure 13, is arranged laterally adjacent to the support portion 121 of the retrofit body 12.

[0040] The finger-like portion 131 comprises two pairs of electrical contacts 132 for contacting the at least one LED module 11 which are arranged on opposite sides of the finger-like portion 131 at a free end of the finger-like portion 131. The electrical contacts 132, in an inserted state of the conductive structure 13, are accessible through the lateral opening 122.

[0041] Each LED module 11 is electrically connected to the conductive structure 13. The LED lamp 1 comprises two pairs of conductive elements 14 electrically connecting the LED modules 11 to the electrical contacts 132 of the conductive structure 13. Each conductive element 14 is configured as a metal ribbon. In other embodiments, each conductive element may be configured as a metal wire.

[0042] The conductive structure 13 may be provided as a semi-finished product for manufacturing the LED lamp 1. The conductive structure 13 is configured to be inserted into and fixed within the retrofit body 12 of the LED lamp 1 and comprises a finger-like portion 131 fitting in the duct 124 of the retrofit body 12 with the finger-like portion 131 comprising two electrical contacts 132 for at least one LED module 11. The LED lamp 1 for a vehicle is manufactured by carrying out the following steps. The LED modules 11 are provided as first semi-finished products. The retrofit body 12 is provided as a second semi-finished product. The two LED modules 11, i.e. the substrates 111 of the two LED modules 11, are attached to the retrofit body 12 adjacent to the lateral opening 122 with the joining material 15 being arranged between the substrate 111 and the retrofit body 12.

[0043] The conductive structure 13 is provided as a third semi-finished product. The conductive structure 13 is inserted into the central bore 123 and the duct 124 of the retrofit body 12. The LED modules 11 are electrically connected with the electrical contacts 132 of the conductive structure 13 each via a pair of the conductive elements 14. Electrically connecting the LED modules 11 may comprise an ultrasonic welding of the conductive elements 14 both to the LED modules 11 and to the electrical contacts 132 of the conductive structure 13.

[0044] Variations of the disclosed embodiments can be understood and effected by those skilled in the art, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality of elements or steps. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

[0045] Any reference signs in the claims should not be construed as limiting the scope thereof.

REFERENCE SIGNS:

[0046]

1 LED lamp
 11 LED module
 111 substrate
 112 diode semiconductor
 113 luminescent layer
 114 contact element
 12 retrofit body
 121 support portion
 122 lateral opening
 123 bore
 124 duct
 125 fin
 126 flange
 127 longitudinal direction
 13 conductive structure
 131 finger-like portion
 132 electrical contact
 133 driver circuit
 14 contact element
 15 joining material

Claims

1. An LED lamp (1) for a vehicle light, the LED lamp (1) comprising a retrofit body (12) defining a longitudinal direction (127) and being integrally configured as a heat sink, a conductive structure (13) being arranged in a cavity of the retrofit body (12) and at least one LED module (11) being electrically connected to the conductive structure (13), the at least one LED module (11) comprising a substrate (111) and a diode semiconductor (112) applied onto the substrate (111), wherein the substrate (111) is attached to the retrofit body (12) with at most a joining material (15) being arranged between the substrate (111) and the retrofit body (12).
2. The LED lamp (1) as claimed in claim 1, wherein the retrofit body (12) comprises a support portion (121) being laterally adjacent to a lateral opening (122) of the retrofit body (12), the support portion (121) supporting the at least one LED module (11).
3. The LED lamp (1) as claimed in claim 2, wherein a finger-like portion (131) of the conductive structure (13) is arranged laterally adjacent to the support portion (121).
4. The LED lamp (1) as claimed in claim 2, wherein the conductive structure (13) is configured to be inserted into and fixed within a central bore (123) of the retrofit body (12), the finger-like portion (131) fitting in a duct (124) of the retrofit body (12) and comprising two

electrical contacts (132) for contacting the at least one LED module (11) with the electrical contacts (132), in an inserted state of the conductive structure (13), being accessible through the lateral opening (122).

- 5
5. The LED lamp (1) as claimed in claim 4, wherein the central bore (123) extends longitudinal from an end face of the retrofit body (12), and the duct (124) extends longitudinal from a bottom portion of the central bore (123) to the lateral opening (122).
- 10
6. The LED lamp (1) as claimed in claim 4, wherein the duct (124) is arranged eccentrically with respect to the central bore (123).
- 15
7. The LED lamp (1) as claimed in claim 2, wherein an edge region of the retrofit body (12) surrounding the lateral opening (122) widens in a light emission direction of the at least one LED module (11).
- 20
8. The LED lamp (1) as claimed in claim 2, comprising two LED modules (11) being attached to opposite sides of the support portion (121).
- 25
9. The LED lamp (1) as claimed in claim 1, wherein the conductive structure (13) is arranged spaced apart from the substrate (111) of the LED module (11).
- 30
10. The LED lamp (1) as claimed in claim 4, comprising a pair of conductive elements (14) electrically connecting the at least one LED module (11) to the electrical contacts (132) of the conductive structure (13).
- 35
11. A retrofit body (12) for an LED lamp (1) to be mounted to a vehicle light, the retrofit body (12) being integrally configured as a heat sink for at least one LED module (11) and for supporting the at least one LED module (11), the retrofit body (12) comprising a central bore (123) extending longitudinal from an end face of the retrofit body (12), a lateral opening (122) and a duct (124) extending longitudinal from a bottom portion of the central bore (123) to the lateral opening (122), wherein the central bore (123), the duct (124) and the lateral opening (122) are configured to accommodate a conductive structure (13), the conductive structure (13) being configured to be inserted into and fixed within the central bore (123) and comprising a finger-like portion (131) fitting in the duct (124) of the retrofit body (12), the finger-like portion (131) comprising two electrical contacts (132) for contacting the at least one LED module (11) with the electrical contacts (132), in an inserted state of the conductive structure (13), being accessible through the lateral opening (122).
- 40
- 45
- 50
- 55
12. A conductive structure (13) for an LED lamp (1) to be mounted to a vehicle light, the conductive struc-

ture (13) being configured to be inserted into and fixed within a retrofit body (12) of the LED lamp (1), the retrofit body (12) being integrally configured as a heat sink and comprising a central bore (123) extending longitudinal from an end face of the retrofit body (12), a lateral opening (122) and a duct (124) extending longitudinal from a bottom portion of the central bore (123) to the lateral opening (122), wherein the conductive structure (13) comprises a finger-like portion (131) fitting in the duct (124) of the retrofit body (12), the finger-like portion (131) comprising two electrical contacts (132) for at least one LED module (11), the electrical contacts (132), in an inserted state of the conductive structure (13), being accessible through the lateral opening (122) of the retrofit body (12).

13. A method for manufacturing an LED lamp (1) for a vehicle, the method comprising the steps of:

- providing, as a first semi-finished product, at least one LED module (11), the LED module (11) comprising a substrate (111) and a diode semiconductor (112) applied onto the substrate (111);
- providing, as a second semi-finished product, a retrofit body (12) being integrally configured as a heat sink for the at least one LED module (11), the retrofit body (12) comprising a central bore (123) extending longitudinal from an end face of the retrofit body (12), a lateral opening (122), and a duct (124) extending longitudinal from a bottom portion of the central bore (123) to the lateral opening (122);
- attaching the substrate (111) of the at least one LED module (11) to the retrofit body (12) adjacent to the lateral opening (122) with at most a joining material (15) being arranged between the substrate (111) and the retrofit body (12);
- providing, as a third semi-finished product, a conductive structure (13) configured to be inserted into and fixed within the central bore (123) of the retrofit body (12), the conductive structure (13) comprising a finger-like portion (131) fitting in the duct (124) of the retrofit body (12), the finger-like portion (131) comprising two electrical contacts (132) for contacting the at least one LED module (11) with the electrical contacts (132), in an inserted state of the conductive structure (13), being accessible through the lateral opening (122);
- inserting the conductive structure (13) into the central bore (123) and the duct (124) of the retrofit body (12);
- electrically connecting the at least one LED module (11) with the electrical contacts (132) of the conductive structure (13) via a pair of conductive elements (14).

14. The method as claimed in claim 13, wherein electrically connecting the at least one LED module (11) comprises an ultrasonic welding of the conductive elements (14) both to the at least one LED module (11) and to the electrical contacts (132) of the conductive structure (13).

15. The method as claimed in claim 13 or 14, wherein two LED modules (11) are attached to the support portion (121) of the retrofit body (12) on opposite sides of the support portion (121).

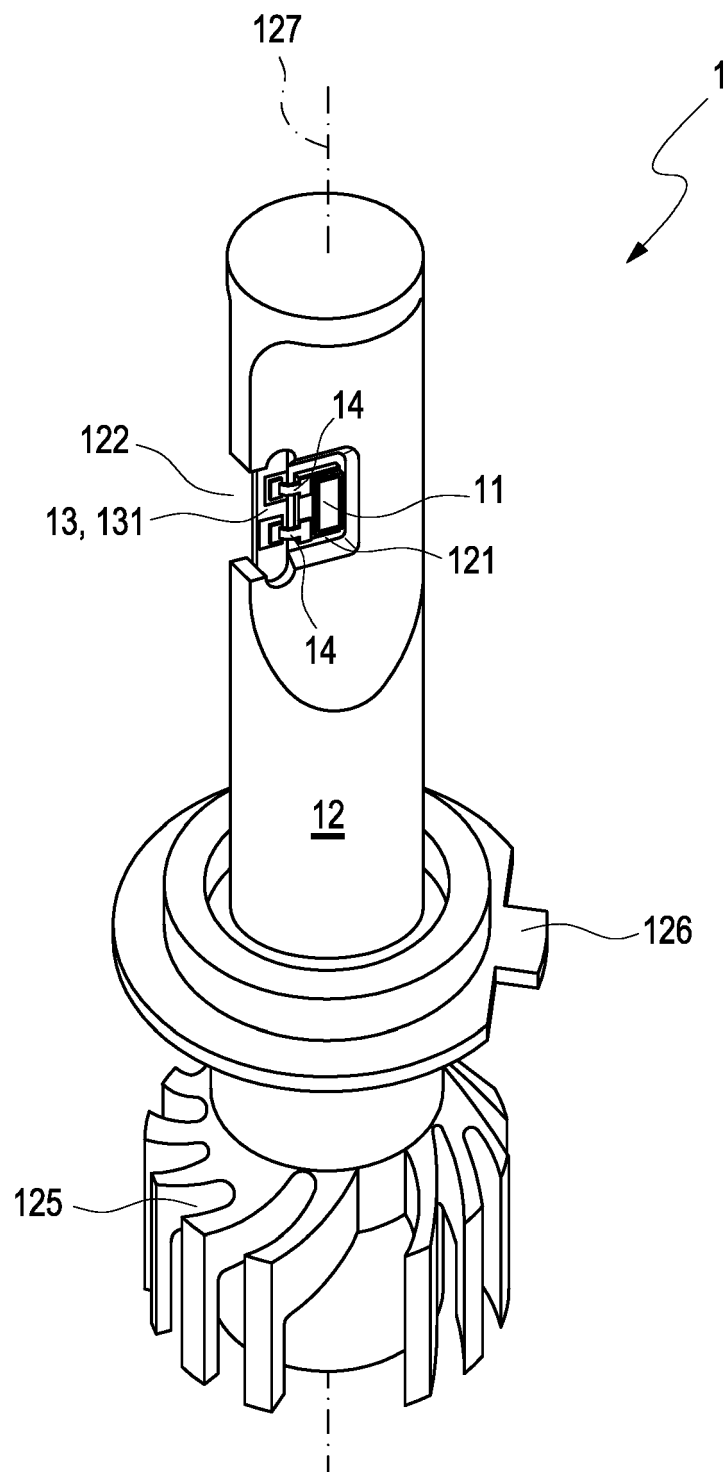


Fig. 1

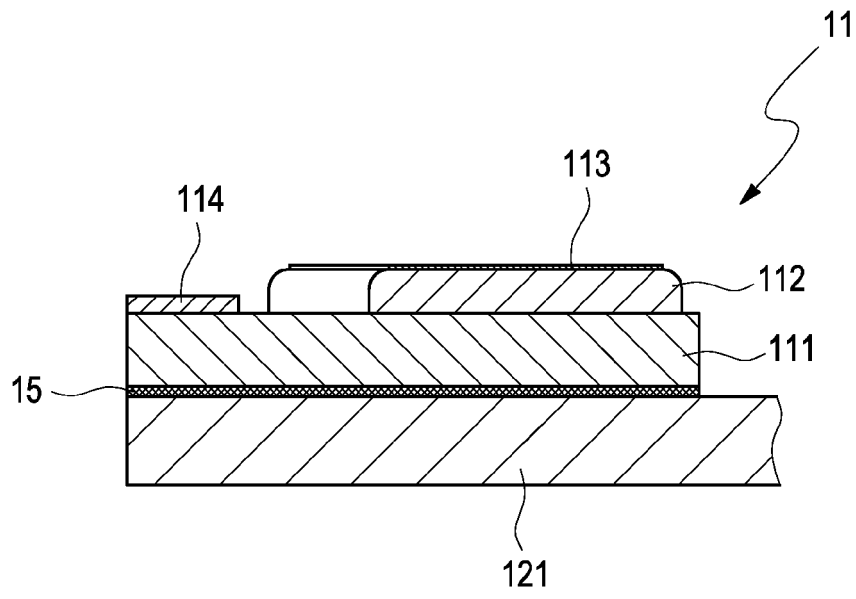


Fig. 2

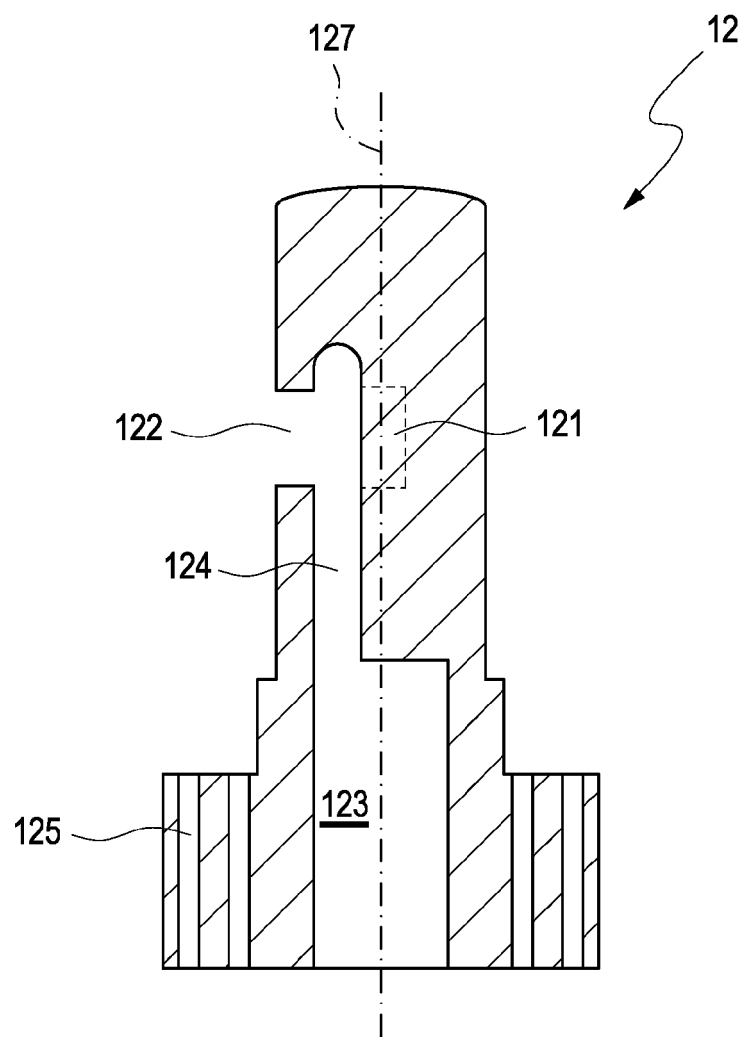


Fig. 3

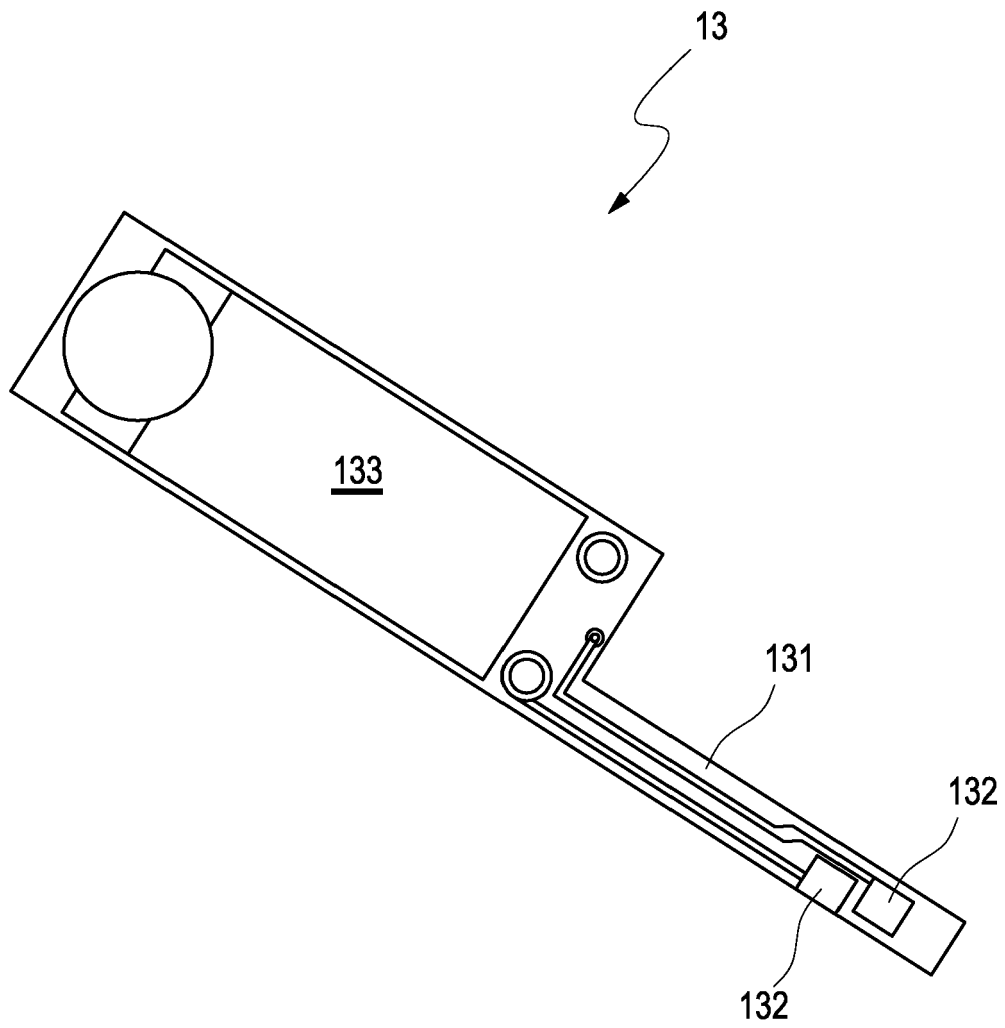


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 20 18 9392

5

10

15

20

25

30

35

40

45

50

55

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	JP 2014 120388 A (LIFE ELEX INC) 30 June 2014 (2014-06-30) * see attached machine translation; paragraphs [0010] - [0058]; figures 1-4 *	1-4, 8-13,15	INV. F21S41/148 F21S41/19 F21S45/47
X	CN 110 375 261 A (SHENZHEN AURORA TECH LIMITED) 25 October 2019 (2019-10-25) * see attached machine translation; figures 1-6 *	1,2,7-9	
X	EP 3 287 691 A1 (KUO CHUN-HSIEN [TW]) 28 February 2018 (2018-02-28) * paragraphs [0001] - [0024]; figures 1-5 *	1,2,7,8	
X	EP 3 537 033 A1 (TOSHIBA LIGHTING & TECHNOLOGY [JP]) 11 September 2019 (2019-09-11) * paragraphs [0001] - [0135]; figures 1-9 *	1-6, 11-14	
X	EP 3 441 666 A1 (TOSHIBA LIGHTING & TECHNOLOGY [JP]) 13 February 2019 (2019-02-13) * paragraphs [0001] - [0087]; figures 1-6 *	1-6, 11-13	TECHNICAL FIELDS SEARCHED (IPC) F21S F21K
X	DE 10 2015 201153 A1 (OSRAM GMBH [DE]) 28 July 2016 (2016-07-28) * paragraphs [0013], [0019] - [0035]; figures 1,2 *	1,11-13	
A	EP 1 496 551 A2 (NICHIA CORP [JP]) 12 January 2005 (2005-01-12) * paragraphs [0102] - [0118]; figures 7-11 *	1-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 November 2020	Examiner Goltes, Matjaz
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	



EUROPEAN SEARCH REPORT

Application Number
EP 20 18 9392

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2019/360681 A1 (ZHOU XIAOZHONG [CN] ET AL) 28 November 2019 (2019-11-28) * paragraphs [0053] - [0077]; figures 1-20 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 November 2020	Examiner Goltes, Matjaz
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 20 18 9392

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.

06-11-2020

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2014120388 A	30-06-2014	NONE	
CN 110375261 A	25-10-2019	NONE	
EP 3287691 A1	28-02-2018	EP 3287691 A1	28-02-2018
		JP 6309677 B2	11-04-2018
		JP 2018029059 A	22-02-2018
		TW 201805564 A	16-02-2018
		US 2018045391 A1	15-02-2018
EP 3537033 A1	11-09-2019	CN 209524440 U	22-10-2019
		EP 3537033 A1	11-09-2019
		JP 2019153521 A	12-09-2019
		US 2019277472 A1	12-09-2019
EP 3441666 A1	13-02-2019	CN 207962514 U	12-10-2018
		EP 3441666 A1	13-02-2019
		JP 2019036404 A	07-03-2019
		US 10203080 B1	12-02-2019
DE 102015201153 A1	28-07-2016	CN 105823011 A	03-08-2016
		DE 102015201153 A1	28-07-2016
		US 2016215948 A1	28-07-2016
EP 1496551 A2	12-01-2005	CN 1577907 A	09-02-2005
		EP 1496551 A2	12-01-2005
		US 2005007783 A1	13-01-2005
US 2019360681 A1	28-11-2019	CA 3005802 A1	18-10-2018
		US 2019360681 A1	28-11-2019