(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 828 463 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.08.2024 Bulletin 2024/34

(21) Application number: **20206465.5**

(22) Date of filing: **09.11.2020**

(51) International Patent Classification (IPC):
F21V 29/60 *(2015.01)* ***F21V 29/508*** *(2015.01)*
F21K 9/23 *(2016.01)* ***F21V 29/83*** *(2015.01)*
F21S 41/148 *(2018.01)* ***F21S 45/43*** *(2018.01)*
F21Y 103/10 *(2016.01)* *F21Y 107/30* *(2016.01)*
F21Y 115/10 *(2016.01)*

(52) Cooperative Patent Classification (CPC):
F21K 9/23; F21S 41/148; F21S 41/192; F21S 45/43; F21V 29/508; F21V 29/60; F21V 29/83; F21Y 2103/10; F21Y 2107/30; F21Y 2115/10

(54) **LAMP AND CORRESPONDING METHOD**

LAMPE UND ENTSPRECHENDES VERFAHREN

LAMPE ET PROCÉDÉ CORRESPONDANT

(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

(30) Priority: **26.11.2019 IT 201900022209**

(43) Date of publication of application:
02.06.2021 Bulletin 2021/22

(73) Proprietors:
- **OSRAM GmbH**
  80807 München (DE)
- **OSRAM S.P.A. - SOCIETA' RIUNITE OSRAM EDISON CLERICI**
  20126 Milano (IT)

Designated Contracting States:
IT

(72) Inventors:
- **GREGIANIN, Francesco**
  I-30014 Cavarzere (Venezia) (IT)
- **SELCI, Alessio**
  I-31100 Treviso (IT)
- **BIZZOTTO, Alessandro**
  I-31033 Castelfranco Veneto (Treviso) (IT)

(74) Representative: **Bosotti, Luciano**
Buzzi, Notaro & Antonielli d'Oulx S.p.A.
Corso Vittorio Emanuele II, 6
10123 Torino (IT)

(56) References cited:
CN-A- 106 594 627 **CN-A- 109 140 373**
CN-U- 207 334 634 **US-A1- 2014 328 079**

EP 3 828 463 B1

Description

Technical Field

[0001] The description refers to lamps.

[0002] One or more embodiments may be applied to lamps employing solid-state light generators, e.g. LED light generators.

[0003] One or more embodiments may advantageously be employed in the automotive sector, e.g. as automotive retrofit lamps.

Technological Background

[0004] Lamps employing solid-state, e.g. LED, light generators, are increasingly replacing conventional filament and fluorescent lamps.

[0005] This is particularly true in the automotive sector.

[0006] Automotive LED lamps are adapted to provide flux and light distribution characteristics which are compatible with the usage requirements of automotive lamps, wherein the characteristics of intensity and distribution of the luminous flux are particularly important.

[0007] The desire of reproducing, as faithfully as possible, the performance of a conventional lamp, such as a halogen lamp, as regards both size and performance (lumen flux, for instance) must face the obstacle of the high temperature which may be reached by a solid-state, e.g. LED, source, and leads to the study of solutions which may improve heat dissipation.

[0008] This aspect is particularly meaningful in the automotive sector, e.g. in the implementation of H-type LED lamps which may be used in the place of conventional, e.g. halogen, lamps. This applies both to retrofit and (as the case may be) to first installation applications.

[0009] The state of the art comprises various documents disclosing LED lamps having forced ventilation mechanisms, such as e.g. US Patents 9,677,753 (Briedenassel); 10,415,787 (Lessard); 9,470,391 (Itagaki - to which US 2014/328079 A1 corresponds); 8,118,462 (Inoue); 8,066,414 (Pabst); 7,144,140 (Sun); as well as the US Patent Application Publications such as US2015/0146447 (Kuepper); 2011/0025211 (Bae); 2010/0165632 (Liang); and 2010/0027270 (Huang).

[0010] It will be appreciated, moreover, that apart from the Lessard and Kuepper documents, the lamps disclosed are not lamps for specific automotive use.

[0011] Documents such as European Patent Application 19204020.2 (EP 3 647 649 A1 - "A mounting structure for lighting devices, corresponding lighting device and method", filed on the 18th October 2019 claiming an Italian priority of 31st October 2018 - Designated Inventors Munarin, Castellan and Bizzotto) as well as Italian Patent Application 102019000010188 ("Lamp", filed on 26th June 2019 - Designated Inventor Gregianin), exemplify lamps of the presently considered type.

[0012] Document CN 109 140 373 A discloses an automotive lamp comprising a heat-conductive mounting plate, a heat-conductive pipe sleeve, a control circuit board, two lamp panels and a heat dissipating fan. The two lamp panels are mounted on two side surfaces of the heat-conductive mounting plate with LEDs are arranged on the lamp panels. The end parts of the lamp panels pass through corresponding ventilating ports and extend into the heat-conductive pipe sleeve. The heat dissipating fan is used for blowing air into the heat-conductive pipe sleeve and then blowing the air to the lamp panels through the corresponding ventilating ports.

[0013] Document CN 106 594 627 A, taken as a model for the preamble claim 1, discloses an automotive light comprising a metal heat pipe with a light source installation section and a heat conduction section, LED light sources arranged on the light source installation section, and a heat radiator comprising a metal radiator and a thermal conductive plastic isolator, wherein the metal radiator and the heat conduction section form thermal connection; and the thermal conductive plastic isolator covers the heat conduction section so as to separate the heat conduction section from outside air.

[0014] Document CN 207 334 634 U provides a similar disclosure of a car headlight comprising a radiator and a radiator fan. The radiator fan is installed to the opposite side of copper base plate.

Object and Summary

[0015] One or more embodiments aim at providing improved solutions, adapted to be employed with proper performances in various possible usage scenarios.

[0016] According to one or more embodiments, said object may be achieved thanks to a lamp having the features specifically set forth in claim 1 that follows.

[0017] One or more embodiments may refer to a corresponding method as per claim 9.

[0018] The claims are an integral part of the technical teaching provided herein with reference to the embodiments.

[0019] One or more embodiments facilitate achieving a high compatibility (virtually as high as 100%) with conventional halogen lamps, while meeting specifications such as ECE regulations.

[0020] This may be achieved as regards both size and performance, the possibility being given of reaching flux values of about 1200 lm.

[0021] According to one or more embodiments, achieving such results may be facilitated by the presence of an air-moving device (a blower or fan, for example) arranged centrally with respect to the lamp.

Brief Description of the Figures

[0022] One or more embodiments will now be described, by way of non-limiting example only, with reference to the annexed Figures, wherein:

Figure 1 is a side elevation view of a lamp according

to embodiments,

Figure 2 is an exploded perspective view of a lamp according to embodiments,

Figure 3, taken from specifications for the automotive sector, and therefore known in itself, exemplifies overall size characteristics which are to be applied to lamps according to embodiments.

Detailed Description of Exemplary Embodiments

[0023] In the following description, one or more specific details are given to provide a thorough understanding of embodiments. The embodiments may be implemented without one or several specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials or operations are not shown or described in detail in order to avoid obscuring certain aspects of embodiments.

[0024] Reference throughout this specification to "an embodiment" or "one embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the possible appearances of phrases such as "in an embodiment" or "in one embodiment" in one or more places throughout the present specification are not necessarily all referring to one specific embodiment. Furthermore, particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

[0025] The references/headings provided herein are given for convenience only, and therefore do not interpret the extent of protection or scope of the embodiments.

[0026] In the figures, reference number 10 denotes as a whole a lamp adapted to be used, for example, for the first installation or the retrofit of a light (e.g. a projector) of a vehicle such as a passenger car. Figure 1 shows a part of a reflector P of one of the lights (e.g. a headlamp) of such vehicle, which is not visible in its entirety in the figures.

[0027] The lamp 10 may be, for example (and as already stated in the foregoing), a solid-state automotive lamp which may be used e.g. as a retrofit lamp, replacing an equivalent conventional lamp of the H-type, such as a halogen lamp.

[0028] In one or more embodiments as exemplified herein, the lamp 10 may include a lamp body of elongated shape, whereon there are mounted, on opposed sides of the body itself, solid-state light sources.

[0029] In one or more embodiments, said sources comprise two linear arrays of (e.g. three) LEDs 141, 142, which extend in the direction of a longitudinal axis X10 of lamp 10.

[0030] A mounting element 20, having e.g. the shape of a flanged cup, is adapted to mount lamp 10 onto a support body P, e.g. a reflector of an automotive lamp.

[0031] As stated in the foregoing, the profile of such a reflector body is partially shown in dotted lines only in Figure 1; it is assumed, by way of example only, that lamp 10 is mounted with a side S1 and a side S2 facing downwardly and upwardly, respectively.

[0032] Possible advantages of such a mounting position, connected to the possible generation of a (forced) ascending flow of ventilation air AF_{IN}, AF_{OUT} from an air inlet 100 towards an air outlet 101, will be discussed in the following.

[0033] The mounting solution illustrated herein is however only one of the possible mounting solutions of lamp 10 on such a support body, such as a reflector of an automotive lamp, e.g. having coupling mechanisms substantially similar to a bayonet coupling ("quarter-turn" mechanisms).

[0034] For example, the US Patent Application published as US2010/0213809 A1 (Roehl) describes an automotive H7 lamp, formed onto a conventional lamp cap with a reference ring including a ring provided with lugs on three sides, which in turn define a reference plane.

[0035] As further discussed in the following, the presently illustrated ring member 20 is a general example of an element configured for mounting the lamp on a vehicle, said element comprising, at the rear portion of the lamp body, at least one reference formation (such as an annular flange 200a) which is adapted to define a reference plane (denoted as RP in Figure 1) transverse to the longitudinal axis X10.

[0036] In one or more embodiments as exemplified herein, lamp 10 may comprise, in the direction of longitudinal axis X10:

- a rear base portion 10a, with a proximal end (on the left in Figure 1) at which there is arranged a mounting element 20, which is adapted to be mounted (e.g. inserted) into support body P,
- a front portion 10b, wherefrom light radiation is emitted in use.

[0037] In one or more embodiments as exemplified herein (see e.g. the exploded perspective view in Figure 2), the lamp body 10 may comprise a laminar element 12 (having features similar to a Printed Circuit Board, PCB) having two mutually opposed surfaces whereon there are arranged the LED light generators 141, 142.

[0038] In one or more embodiments, as exemplified herein (always refer to the exploded perspective view in Figure 2), the laminar element 12 may be interposed between two complementary parts, e.g. complementary shells, 161, 162, of a printed (metal or plastic) material.

[0039] The parts 161, 162 with the laminar element 12 arranged therebetween may be kept together:

- at the rear base portion 10a of mounting element 20, which is applied and mounted around both parts 161, 162, and
- at the front portion 10b, via a screw 18 passing through bores provided in the parts 161, 162 themselves and in the laminar element 12, as well as in laminar spacers 171, 172 optionally interposed be-

tween the parts 161, 162 and the opposed faces of laminar element 12.

[0040] The arrangement of the LED light generators 141, 142 on the surfaces of laminar element 12 is therefore such that generators 141, 142 project light away from the laminar element 12 in a generally radial direction with respect to axis X10.

[0041] Parts 161, 162 (as well as laminar spaces 171, 172, if present) are therefore provided, at the LED light generators 141, 142, with light-permeable portions, such as e.g. transparent openings or portions. Such transparent openings or portions are located at the bottom of two cavities 221, 222 which, in the assembled lamp body, form two (mirror) symmetrical recesses with respect to an ideal diametral plane of the lamp body. Such diametral plan substantially coincides with the lying plane of laminar element 12.

[0042] In one or more embodiments, the lamp body (i.e. the elements 12, 161 and 162 and the mounting element 20) are engageable with each other, with the possibility of mounting lamp 10 on the support body P (see Figure 1) with said diametral plane, i.e. with laminar element 12, oriented in a vertical direction, in the plane of the drawing of Figure 1. Axis X10 is oriented in an at least approximately horizontal direction.

[0043] In one or more embodiments, the LED light generators 141, 142 may be arranged substantially at the front (distal) portion 10b of lamp 10. The LED light generators 141, 142 may be supplied, in a manner known in itself, by a circuitry 21 housed in the rear portion 10a of lamp 10, via electrical lines or tracks 141a, 142a provided on laminar element 12.

[0044] Circuitry 21 is in turn connected (e.g. via two electrical contact pins 210, adapted to extend through respective openings in the bottom wall of mounting element 20) to e.g. laminar contacts 20a, which are adapted to provide a hot and a ground contact for light generators 141, 142.

[0045] As already stated in the introduction to the present specification, the desire to reproduce as faithfully as possible, with a lamp 10 as exemplified herein, the performances of a conventional (e.g. halogen) lamp implies facing the problem of the high temperature which may be reached during the operation of a solid-state source, such as the LED generators 141, 142, with the consequent problems of heat dissipation. This also applies to the drive circuitry, i.e. circuitry 21, in the presently exemplified lamp 10.

[0046] To this end, one or more embodiments may envisage to impart, to the rear portion 10a of lamp 10 which hosts circuitry 21, an apertured (so to say cage-like) structure, having elongated, loophole-like apertures which are adapted to define an inlet 100 and an outlet 101 of ventilation air through the rear base portion 10a of the lamp body.

[0047] In one or more embodiments, said openings may be arranged in two arrays of arch-shaped slots, which are located on opposed side with respect to the ideal diametral plane discussed in the foregoing, which passes through laminar element 12, by providing e.g. one array in part 161 and the other array in part 162.

[0048] In one or more embodiments, said two arrays or arch-shaped apertures may be mirror symmetrical with respect to said diametral plane.

[0049] In one or more embodiments, the lamp body (e.g. parts 161, 162 in the lamp 10 as exemplified herein) may have, at least at the rear portion 10a, a cross section (with reference to longitudinal axis X10) which is at least approximately circular, optionally wider than the cross section of front portion 10b.

[0050] In one or more embodiments, the apertures (loopholes) defining the inlet 100 and the outlet 101 of ventilation air may have a arch-like shape, i.e. a C shape, which extends along rounded (e.g. circular) paths lying in transverse planes with respect to axis X10, optionally along paths which are orthogonal and/or centered with respect to axis X10.

[0051] When the lamp is mounted on the support body P in the previously described conditions - with axis X10 being approximately horizontal and with the diametral plane passing through the laminar support member 12 approximately in the vertical direction - the apertures may thus define ventilation air flow paths CA through the rear portion 10a of lamp 10. Such ventilation air, by passing through the lamp body along a generally transverse (diametral) path from inlet 100 to outlet 101, is adapted to impinge on circuitry 21 as well, with the effect of removing heat therefrom.

[0052] One or more embodiments may envisage that the heat developed by solid-state light generators 141, 142 during operation may be at least partly transferred towards the rear base portion 10a of lamp 10, by taking advantage of the thermal conductivity of laminar element 12 (PCB), of spacers 171, 172 (if present) and of parts 161, 162. Such elements, and particularly parts 161, 162 are adapted to be made, in a way known in itself, of a metal or plastic (e.g. printed) material having good heat transfer properties.

[0053] In this way, the heat developed by the solid-state light generators 141, 142 during operation may be at least partially dissipated thanks to an air ventilation flow, schematically shown by arrows AF_{IN}, AF_{OUT} in Figure 1, which passes through the rear portion 10a of lamp 10 entering (AF_{IN}) through air inlet 100, on a first side S1, and exiting (AF_{OUT}) from air outlet 101, on a second side S2 (diametrically opposed to first side S1), in a generally transverse direction with respect to the transverse direction defined by axis X10.

[0054] As exemplified herein, the ventilation air flow AF_{IN}, AF_{OUT} takes place therefore in a generally vertical direction, from the bottom to the top, with reference to the viewpoints of Figures 1 and 2.

[0055] It has been noticed that such air flow (an essentially convective flow) may advantageously be a forced flow, thanks to an air-moving element 102 (a blower such

as a fan, for example) mounted on the rear portion 10a of lamp 10.

[0056] In one or more embodiments, the air-moving element 102 may be arranged at a central position, i.e. at least approximately at axis X10. For example, the air-moving element 102 may be mounted on one of the faces of the laminar support member 12.

[0057] In one or more embodiments, the air-moving element may be for example a component such as MagLev Motor Fan, Model UFF3-700, available from Sunonwealth Electric Machine Industry Co., Ltd. of Kaohsiung City, Taiwan (sunon.com), or such as TK FAN DA1504L05S available from Shenzen Tenkai Group Limited of Shenzen, China (tkfan.com).

[0058] In one or more embodiments, the air-moving element 102 may be electrically supplied by the same circuitry the heat whereof is dissipated by element 102, the latter being optionally mounted on said circuitry.

[0059] In one or more embodiments as exemplified herein, air inlet 100 and air outlet 101 are located at a common longitudinal position (i.e. "at the same height", or at the same distance from reference plane RF) in the longitudinal direction of lamp 10 identified by axis X10, and the air-moving element 102 is positioned longitudinally in register with air inlet 100 and air oulet 101, i.e. at the same height of air inlet 100 and air outlet 101, always with reference to said longitudinal direction.

[0060] According to the invention, the air-moving element 102 is positioned in the rear base portion 10a of the lamp body between a proximal end of the rear base portion 10a, i.e. the end located remote from the light sources 141, 142 (where, as visible in the figures, the mounting element 20 is located configured to mount the lamp 10 on a vehicle P) and a distal end of the same rear base portion 10a, i.e. the end facing towards the light sources 141, 142.

[0061] Such a central arrangement of element 102 causes the air flow AF_{IN}, AF_{OUT} between air inlet 100 and air outlet 101 to encounter fewer obstacles, so that it may move with higher freedom and efficiency compared to a side arrangement of element 102 (e.g. at the bottom in Figure 1).

[0062] This may optionally enable (e.g. in applications which are not particularly critical) to avoid a vertical mounting condition, as exemplified in Figure 1, e.g. by providing a (forced) air flow AF_{IN}, AF_{OUT} in an at least approximately horizontal direction.

[0063] Figure 3 in the annexed drawings is taken from the ECE Regulations which impose the specifications for lamps to be used in the automotive sector, and specifically from a text known as Addendum 36: Regulation No. 37, pages 35-38, which lists the dimensional parameters relevant for H7 lamps, which must be met in a LED lamp adapted to be used as a retrofit for an H7 incandescent lamp. Said ECE text for H7 lamps corresponds to the US Specifications SAE 9004 or 9007.

[0064] One or more embodiments enable the implementation of LED lamps which, once energized, are adapted to emit at least 1200 lumen, while having the dimensions specified in the ECE Regulations, as shown in the annexed Figure.

[0065] The white space in the Figure represents the spatial envelope wherein the (LED) retrofit lamp must be insertable together with its components.

[0066] In this context, it has been remarked that two meaningful dimensional data may consist:

in the distance (currently denoted as Light Center Length, LCL) of 25 mm from the reference plane RP to the center CLS of the light source, as measured in an axial direction with respect to the lamp, i.e. on the reference axis; and

in the (maximum) length of the lamp, amounting to 44 mm, as measured from the reference plane RP.

[0067] One or more embodiments are adapted to properly dissipate the heat deriving from the generation, by LED sources such as sources 141, 142, of 1200 lumen, while being compatible with the dimensions specified by the ECE Regulations. In this respect, Figure 1 highlights that:

> distance d1 (as measured in the longitudinal direction identified by axis X10), which separates the reference plan RP identified by flange 200a of mounting element 20 from the center CLS of the light source 141, is adapted to approximately amount to 25 mm (taking into account the manufacturing and dimensional tolerances),
>
> length d2 (again, as measured in the longitudinal direction identified by axis X10) of the lamp portion, which extends from reference plane RP to the extremity of the front portion 10b, is adapted to be kept below the value of 44 mm.

[0068] For example, the simulation values referred to a luminous flus of 1222 lm with a supply current of 700 mA, with LED sources mounted onto a PCB support (MC) show temperature values Ts of the solid-state sources amounting to 130°C, and temperature values of the associated electronic components approximately amounting to 105/115°C.

[0069] As exemplified herein, a solid-state lamp (an automotive solid-state lamp, e.g. 10) for a vehicle comprises:

> a lamp body (e.g. 12, 161, 162, 20) extending in a longitudinal direction (see for example axis X10), the lamp body having a rear base portion (e.g. 10a) and a front portion (e.g. 10b) and including a (central) support body (e.g. 12),
>
> solid-state light sources (e.g. 141, 142) arranged on said support body in the front portion of the lamp body,
>
> drive circuitry (e.g. 21) of the light sources, arranged at the rear base portion of the lamp body,
>
> wherein:
>
> > the rear base portion of the lamp body comprises

ventilation apertures (e.g. 100, 101) configured to provide a flow path for ventilation air for said drive circuitry through the rear base portion of the lamp body between mutually opposed first (e.g. S1) and second (e.g. S2) sides of the rear base portion of the lamp body, said ventilation air flow path extending transverse to said longitudinal direction from an air inlet to an air outlet, an air-moving element (e.g. 102) is provided, arranged on the support body (12), in the rear base portion of the lamp body, said air-moving element being located in the ventilation air flow path from the air inlet to the air outlet, the air-moving element being activatable to produce an air flow (e.g. AF_{IN}, AF_{OUT}) from said first side towards said second side of the rear portion of the lamp body.

[0070] In a lamp as exemplified herein, the air inlet and the air outlet may be located at a common longitudinal position in said longitudinal direction, and the air-moving element is positioned longitudinally in register with the air inlet and the air outlet in said longitudinal direction.

[0071] According to the invention, the air-moving element is located in the rear base portion of the lamp body between a proximal end of the rear base portion, in a position remote from the solid-state light sources (where, as visible in the figures, the mounting element 20 is located) and a distal end of the rear base portion, adjacent the solid-state light sources.

[0072] In a lamp as exemplified herein, said ventilation apertures may comprise arch-shaped slots in the lamp body.

[0073] In a lamp as exemplified herein, the lamp body may comprise a thermally conductive material (e.g. in the portions or parts 161, 162, 12), which facilitates heat transfer from said solid-state light sources at the front portion of the lamp body towards said air-moving element (102) in the rear base portion of the lamp body.

[0074] In a lamp as exemplified herein,

the lamp comprises a mounting element (e.g. 20) configured to mount the lamp on a vehicle (e.g. on a reflector P), the mounting element comprising, at the rear portion of the lamp body, at least one reference formation (e.g. flange 200a) defining a reference plane (e.g. RP) transverse to said longitudinal direction,

the solid-state light sources are arranged on said support member with a center (e.g. CLS) of said solid-state light sources at a distance (e.g. d1) of approximately 25 mm from said reference plane.

[0075] In a lamp as exemplified herein:

the lamp comprises a mounting element (e.g. 20) configured to mount the lamp on a vehicle (e.g. on a reflector P), the mounting element comprising, at the rear portion of the lamp body, at least one reference formation (e.g. flange 200a) defining a reference plane (e.g. RP) transverse to said longitudinal direction,

the length (e.g. d2) of the lamp between the reference plane and the extremity of the front portion may be less than 44 mm.

[0076] A lamp as exemplified herein may fit a spatial envelope according to Figure 2 of Addendum 36 of ECE Regulation 37 for H7 lamps (SAE 9004 or 9007, in the United States).

[0077] In a lamp as exemplified herein, said solid-state light sources may comprise LED light sources.

[0078] In a lamp as exemplified herein, said solid-state light sources, when energized, may emit a luminous flux of at least 1200 lm.

[0079] A method of using a lamp as exemplified herein may comprise:

mounting (e.g. via element 20) the lamp on a vehicle (e.g. in a reflector P) with said first side and said second side of the rear base portion of the lamp body facing downwardly and upwardly, respectively,

activating the air-moving element to produce a (forced) air flow (e.g. AF_{IN}, AF_{OUT}) from said first side towards said second side of the rear portion of the lamp body.

[0080] Without prejudice to the basic principles, the implementation details and the embodiments may vary, even appreciably, from what has been described herein by way of non-limiting example only, without departing from the extent of protection.

[0081] The extent of protection is defined by the annexed claims.

LIST OF REFERENCE SIGNS

[0082]

Lamp	10
Rear portion	10a
Front portion	10b
Longitudinal axis	X10
Support member	12
(LED) light sources	141, 142
Electrically conductive formations	141a, 141b
Parts	161, 162
Spacers	171, 172
Screw	18
Mounting element	20
Flange of mounting element	200a
Laminar contacts	20a
Conductive pins	210
Circuitry	21

(continued)

Recesses	221, 222
Air inlet	100
Air outlet 1	101
Air-moving element	102
Flow of ventilation air	AF_{IN}, AF_{OUT}
First side	S1
Second side	S2
Reflector	P
Reference plane	RP
Center of light sources	CLS
Distances	d1, d2

Claims

1. An automotive solid-state lamp (10) for a vehicle, comprising:

a lamp body (12, 161, 162, 20) extending in a longitudinal direction (X10), the lamp body having a rear base portion (10a) and a front portion (10b) and including a support member (12),
solid-state light sources (141, 142) arranged on said support member (12) at the front portion (10b) of the lamp body (12, 161, 162, 20),
drive circuitry (21) of the light sources (141, 142) arranged at the rear base portion (10a) of the lamp body (12, 161, 162, 20),
wherein:

the rear base portion (10a) of the lamp body (12, 161, 162, 20) comprises ventilation apertures (100, 101) configured to provide a flow path for ventilation air of said drive circuitry (21) through the rear base portion (10a) of the lamp body (12, 161, 162, 20) between mutually opposed first (S1) and second (S2) sides of the rear base portion (10a) of the lamp body (12, 161, 162, 20), said ventilation air flow path extending from an air inlet (100) to an air outlet (101) transverse to said longitudinal direction (X10),
an air-moving element (102) is provided arranged on said support member (12) in the rear base portion (10a) of the lamp body (12, 161, 162, 20), the air-moving element (102) being located in the air flow path between the air inlet (100) and the air outlet (101), the air-moving element (102) activatable to produce air flow (AF_{IN}, AF_{OUT}) from said first side (S1) towards said second side (S2) of the rear portion (10a) of the lamp body (12, 161, 162, 20),
wherein:

the lamp comprises a mounting element (20) configured to mount the lamp (10) on a vehicle (P), wherein the mounting element (20) is located at a proximal end of the rear base portion (10a) remote from the solid-state light sources (141, 142), and
the air-moving element (102) is located in the rear base portion (10a) of the lamp body (12, 161, 162, 20) between a proximal end of the rear base portion (10a) remote from the solid-state light sources (141, 142) and a distal end of the rear base portion (10a) adjacent the solid-state light sources (141, 142),
characterized in that:

the mounting element (20) comprises at the rear base portion (10a) of the lamp body (12, 161, 162, 20) at least one reference formation (200a) defining a reference plane (RP) transverse to said longitudinal direction (X10), and
the solid-state light sources (141, 142) are arranged on said support member (12) with a center (CLS) of said solid-state light sources (141, 142) at a distance (d1) of approximately 25mm from said reference plane (RP).

2. The lamp (10) of claim 1, wherein the air inlet (100) and the air outlet (101) are located at a common longitudinal position in said longitudinal direction (X10) and the air-moving element (102) is positioned longitudinally in register with the air inlet (100) and the air outlet (101) in said longitudinal direction (X10).

3. The lamp (10) of claim 1 or claim 2, wherein said ventilation apertures (100, 101) comprise arch-shaped slots in the lamp body (161, 162).

4. The lamp (10) of any of the previous claims, wherein the lamp body comprises thermally conductive material (161, 162, 12) facilitating heat transfer from said solid-state light sources (141, 142) at the front portion (10b) of the lamp body (12, 161, 162, 20) towards said air-moving element (102) provided in the rear base portion (10a) of the lamp body.

5. The lamp (10) of any of the previous claims, wherein the length (d2) of the lamp (10) between the reference plane (RP) and the extremity of the front portion (10b) is less than 44mm.

6. The lamp (10) of any of the previous claims, wherein

the lamp fits a spatial envelope according to Figure 2 of Addendum 36 of ECE Regulation 37 for H7 lamps (SAE 9004 or 9007).

7. The lamp (10) of any of the previous claims, wherein said solid-state light sources comprise LED light sources (141, 142).

8. The lamp (10) of any of the previous claims, wherein said solid-state light sources (141, 142), when energized, emit a luminous flux of at least 1200 lm.

9. A method of using the lamp (10) of any of the previous claims, the method comprising:

mounting (20) the lamp (10) on a vehicle (P) with said first side (S1) and said second side (S2) of the rear base portion (10a) of the lamp body (12, 161, 162, 20) facing downwardly and upwardly, respectively,
activating the air-moving element (102) to produce air flow (AF_{IN}, AF_{OUT}) from said first side (S1) towards said second side (S2) of the rear portion (10a) of the lamp body (12, 161, 162, 20).

Patentansprüche

1. Fahrzeugfestkörperlampe (10) für ein Fahrzeug, umfassend:

einen Lampenkörper (12, 161, 162, 20), der sich in einer Längsrichtung (X10) erstreckt, wobei der Lampenkörper einen hinteren Basisabschnitt (10a) und einen vorderen Abschnitt (10b) aufweist und ein Stützelement (12) beinhaltet,
Festkörperlichtquellen (141, 142), die an dem Stützelement (12) an dem vorderen Abschnitt (10b) des Lampenkörpers (12, 161, 162, 20) angeordnet sind,
Ansteuerschaltung (21) der Lichtquellen (141, 142), die an dem hinteren Basisabschnitt (10a) des Lampenkörpers (12, 161, 162, 20) angeordnet ist,
wobei:

der hintere Basisabschnitt (10a) des Lampenkörpers (12, 161, 162, 20) Belüftungsöffnungen (100, 101) umfasst, die konfiguriert sind, um einen Strömungsweg für Belüftungsluft der Ansteuerschaltung (21) durch den hinteren Basisabschnitt (10a) des Lampenkörpers (12, 161, 162, 20) zwischen einander gegenüberliegenden ersten (S1) und zweiten (S2) Seiten des hinteren Basisabschnitts (10a) des Lampenkörpers (12, 161, 162, 20) bereitzustellen, wobei sich der Belüftungsluftströmungsweg von einem Lufteinlass (100) zu einem Luftauslass (101) quer zu der Längsrichtung (X10) erstreckt,
ein Luftbewegungselement (102) an dem Stützelement (12) in dem hinteren Basisabschnitt (10a) des Lampenkörpers (12, 161, 162, 20) angeordnet bereitgestellt ist, wobei sich das Luftbewegungselement (102) in dem Luftströmungsweg zwischen dem Lufteinlass (100) und dem Luftauslass (101) befindet,
das Luftbewegungselement (102) aktivierbar ist, um einen Luftstrom (AF_{IN}, AF_{OUT}) von der ersten Seite (S1) zu der zweiten Seite (S2) des hinteren Abschnitts (10a) des Lampenkörpers (12, 161, 162, 20) zu erzeugen,
wobei:

die Lampe ein Montageelement (20) umfasst, das konfiguriert ist, um die Lampe (10) an einem Fahrzeug (P) zu montieren, wobei sich das Montageelement (20) an einem proximalen Ende des hinteren Basisabschnitts (10a) entfernt von den Festkörperlichtquellen (141, 142) befindet, und
das Luftbewegungselement (102) sich in dem hinteren Basisabschnitt (10a) des Lampenkörpers (12, 161, 162, 20) zwischen einem proximalen Ende des hinteren Basisabschnitts (10a) entfernt von den Festkörperlichtquellen (141, 142) und einem distalen Ende des hinteren Basisabschnitts (10a) benachbart zu den Festkörperlichtquellen (141, 142) befindet,
dadurch gekennzeichnet, dass:

das Montageelement (20) an dem hinteren Basisabschnitt (10a) des Lampenkörpers (12, 161, 162, 20) mindestens eine Referenzformation (200a) umfasst, die eine Referenzebene (RP) quer zu der Längsrichtung (X10) definiert, und die Festkörperlichtquellen (141, 142) an dem Stützelement (12) mit einer Mitte (CLS) der Festkörperlichtquellen (141, 142) in einem Abstand (d1) von ungefähr 25 mm von der Referenzebene (RP) angeordnet sind.

2. Lampe (10) nach Anspruch 1, wobei sich der Lufteinlass (100) und der Luftauslass (101) an einer gemeinsamen Längsposition in der Längsrichtung (X10) befinden und das Luftbewegungselement

(102) in Längsrichtung in Ausrichtung mit dem Lufteinlass (100) und dem Luftauslass (101) in der Längsrichtung (X10) positioniert ist.

3. Lampe (10) nach Anspruch 1 oder Anspruch 2, wobei die Lüftungsöffnungen (100, 101) bogenförmige Schlitze in dem Lampenkörper (161, 162) umfassen.

4. Lampe (10) nach einem der vorhergehenden Ansprüche, wobei der Lampenkörper wärmeleitendes Material (161, 162, 12) umfasst, das eine Wärmeübertragung von den Festkörperlichtquellen (141, 142) an dem vorderen Abschnitt (10b) des Lampenkörpers (12, 161, 162, 20) zu dem Luftbewegungselement (102) erleichtert, das in dem hinteren Basisabschnitt (10a) des Lampenkörpers bereitgestellt ist.

5. Lampe (10) nach einem der vorhergehenden Ansprüche, wobei
die Länge (d2) der Lampe (10) zwischen der Referenzebene (RP) und dem Ende des vorderen Abschnitts (10b) weniger als 44 mm beträgt.

6. Lampe (10) nach einem der vorhergehenden Ansprüche, wobei die Lampe in eine räumliche Hülle gemäß Figur 2 von Anhang 36 der ECE-Vorschrift 37 für H7-Lampen (SAE 9004 oder 9007) passt.

7. Lampe (10) nach einem der vorhergehenden Ansprüche, wobei die Festkörperlichtquellen LED-Lichtquellen (141, 142) umfassen.

8. Lampe (10) nach einem der vorhergehenden Ansprüche, wobei die Festkörperlichtquellen (141, 142), wenn sie mit Energie versorgt werden, einen Lichtstrom von mindestens 1200 lm emittieren.

9. Verfahren zum Verwenden der Lampe (10) nach einem der vorhergehenden Ansprüche, wobei das Verfahren umfasst:

Montieren (20) der Lampe (10) an einem Fahrzeug (P), wobei die erste Seite (S1) und die zweite Seite (S2) des hinteren Basisabschnitts (10a) des Lampenkörpers (12, 161, 162, 20) jeweils nach unten und nach oben weisen,
Aktivieren des Luftbewegungselements (102), um einen Luftstrom (AF_{IN}, AF_{OUT}) von der ersten Seite (S1) zu der zweiten Seite (S2) des hinteren Abschnitts (10a) des Lampenkörpers (12, 161, 162, 20) zu erzeugen.

Revendications

1. Une lampe d'automobile à semi-conducteurs (10) pour un véhicule, comprenant :

un corps de lampe (12, 161, 162, 20) s'étendant dans une direction longitudinale (X10), le corps de lampe ayant une partie arrière de base (10a) et une partie avant (10b) et comprenant un organe support (12),
des sources de lumière à semi-conducteurs (141, 142) agencées sur ledit organe support (12) au niveau de la partie avant (10b) du corps de lampe (12, 161, 162, 20),
une circuiterie de pilotage (21) des sources de lumière (141, 142), agencée au niveau de la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20),
dans laquelle :

la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20) comprend des ouvertures de ventilation (100, 101) configurées pour former un trajet d'écoulement pour de l'air de ventilation de ladite circuiterie de pilotage (21) au travers de la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20) entre un premier (S1) et un second (S2) côté mutuellement opposés de la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20), ledit trajet d'écoulement d'air de ventilation s'étendant d'une entrée d'air (100) à une sortie d'air (101) transversalement par rapport à ladite direction longitudinale (X10),
un élément d'entrainement d'air (102) est disposé agencé sur ledit organe support (12) dans la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20), l'élément d'entrainement d'air (102) étant situé dans le trajet d'écoulement d'air entre l'entrée d'air (100) et la sortie d'air (101), l'élément d'entrainement d'air (102) étant activable pour produire un flux d'air (AF_{IN}, A_{FOUT}), depuis ledit premier côté (S1) vers ledit second côté (S2) de la partie arrière (10a) du corps de lampe (12, 161, 162, 20),
dans laquelle :

la lampe comprend un élément de montage (20) configuré pour monter la lampe (10) sur un véhicule (P), l'élément de montage (20) étant situé au niveau d'une extrémité proximale de la partie arrière de base (10a) à distance des sources de lumière à semi-conducteurs (141, 142), et
l'élément d'entrainement d'air (102) est situé dans la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20) entre une extrémité proximale de la partie arrière de base (10a) à distance des sources de lumière à semi-conduc-

teurs (141, 142) et une extrémité distale de la partie arrière de base (10a) adjacente aux sources de lumière à semi-conducteurs (141, 142),
caractérisée en ce que :

l'élément de montage (20) comprend au niveau de la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20) au moins une formation de référence (200a) définissant un plan de référence (RP) transversal à ladite direction longitudinale (X10), et
les sources de lumière à semi-conducteurs (141, 142) sont agencées sur ledit organe support (12) avec un centre (CLS) desdites sources de lumière à semi-conducteurs (141, 142) situé à une distance (d1) d'approximativement 25 mm dudit plan de référence (RP).

2. La lampe (10) de la revendication 1, dans laquelle l'entrée d'air (100) et la sortie d'air (101) sont situées en une position longitudinale commune dans ladite direction longitudinale (X10), et l'élément d'entrainement d'air (102) est positionné longitudinalement aligné sur l'entrée d'air (100) et la sortie d'air (101) dans ladite direction longitudinale (X10).

3. La lampe (10) de la revendication 1 ou de la revendication 2, dans laquelle lesdites ouvertures de ventilation (100, 101) comprennent dans le corps de lampe (161, 162) des fentes voûtées.

4. La lampe (10) de l'une des revendications précédentes, dans laquelle le corps de lampe comprend un matériau thermiquement conducteur (161, 162, 12) facilitant le transfert thermique depuis lesdites sources de lumière à semi-conducteurs (141, 142) au niveau de la partie avant (10b) du corps de lampe (12, 161, 162, 20) en direction dudit élément d'entrainement d'air (102) disposé dans la partie arrière de base (10a) du corps de lampe.

5. La lampe (10) de l'une des revendications précédentes, dans laquelle :
la longueur (d2) de la lampe entre le plan de référence (RP) et l'extrémité de la partie avant (10b) est inférieure à 44 mm.

6. La lampe (10) de l'une des revendications précédentes, dans laquelle la lampe tient dans une enveloppe spatiale conforme à la Figure 2 de l'Addendum 36 du Règlement ECE 37 pour les lampes H7 (SAE 9004 ou 9007).

7. La lampe (10) de l'une des revendications précédentes, dans laquelle lesdites sources de lumière à semi-conducteurs comprennent des sources de lumière LED (141, 142).

8. La lampe (10) de l'une des revendications précédentes, dans laquelle, lorsqu'elles sont alimentées, lesdites sources de lumière à semi-conducteurs (141, 142) émettent un flux lumineux d'au moins 1200 lm.

9. Un procédé d'utilisation de la lampe (10) de l'une des revendications précédentes, le procédé comprenant :

le montage (20) de la lampe (10) sur un véhicule (P) avec ledit premier côté (S1) et ledit second côté (S2) de la partie arrière de base (10a) du corps de lampe (12, 161, 162, 20) tournés respectivement vers le bas et vers le haut,
l'activation de l'élément d'entrainement d'air (102) pour produire un flux d'air (AF_{IN}, AF_{OUT}) depuis ledit premier côté (S1) vers ledit second côté (S2) de la partie arrière (10a) du corps de lampe (12, 161, 162, 20).

FIG. 1

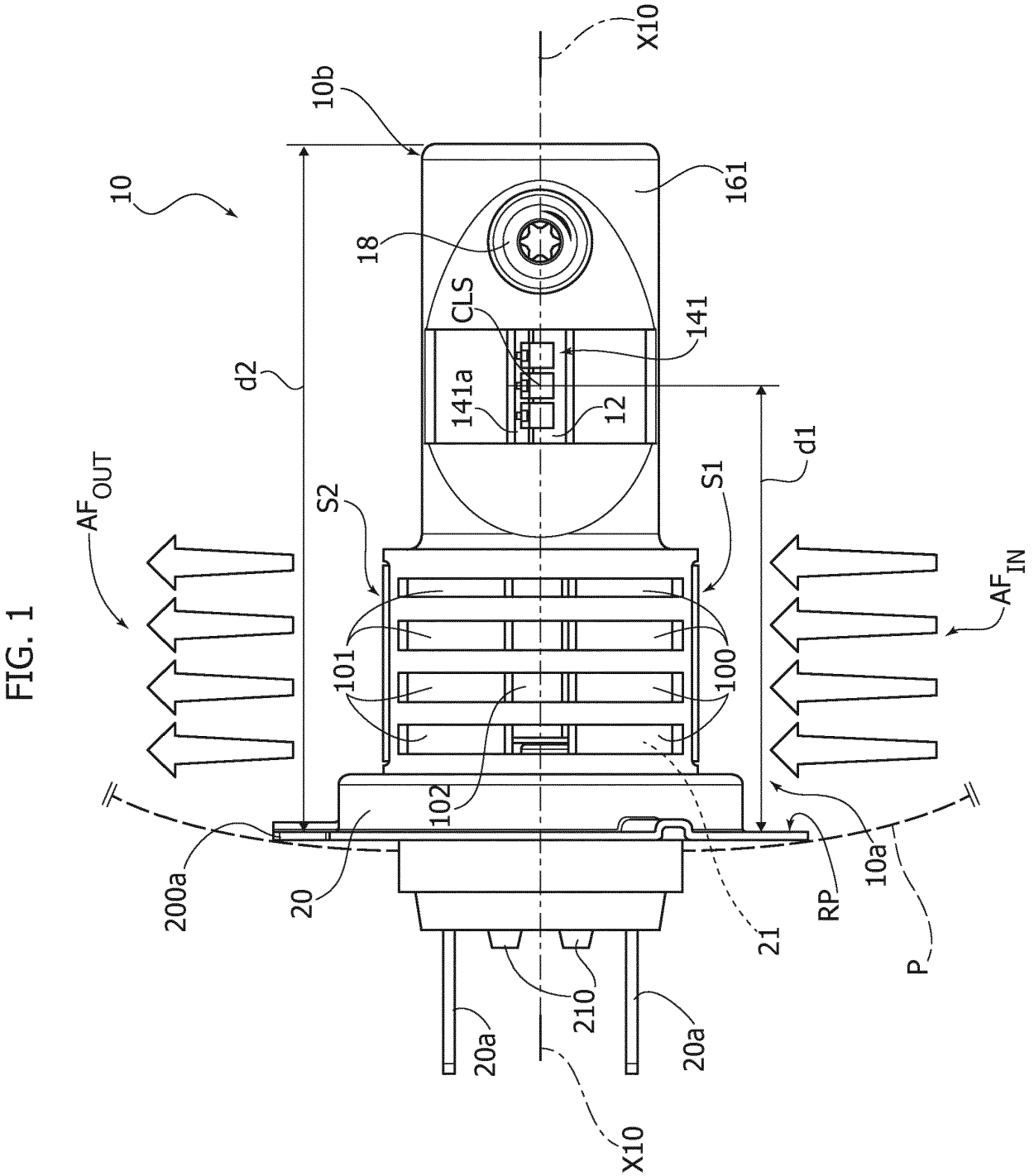

X10
10b
10
161
18
CLS
141
141a
12
d2
d1
S2
S1
AF_OUT
AF_IN
101
100
102
200a
20
21
RP
10a
P
210
20a
20a
X10

FIG. 2

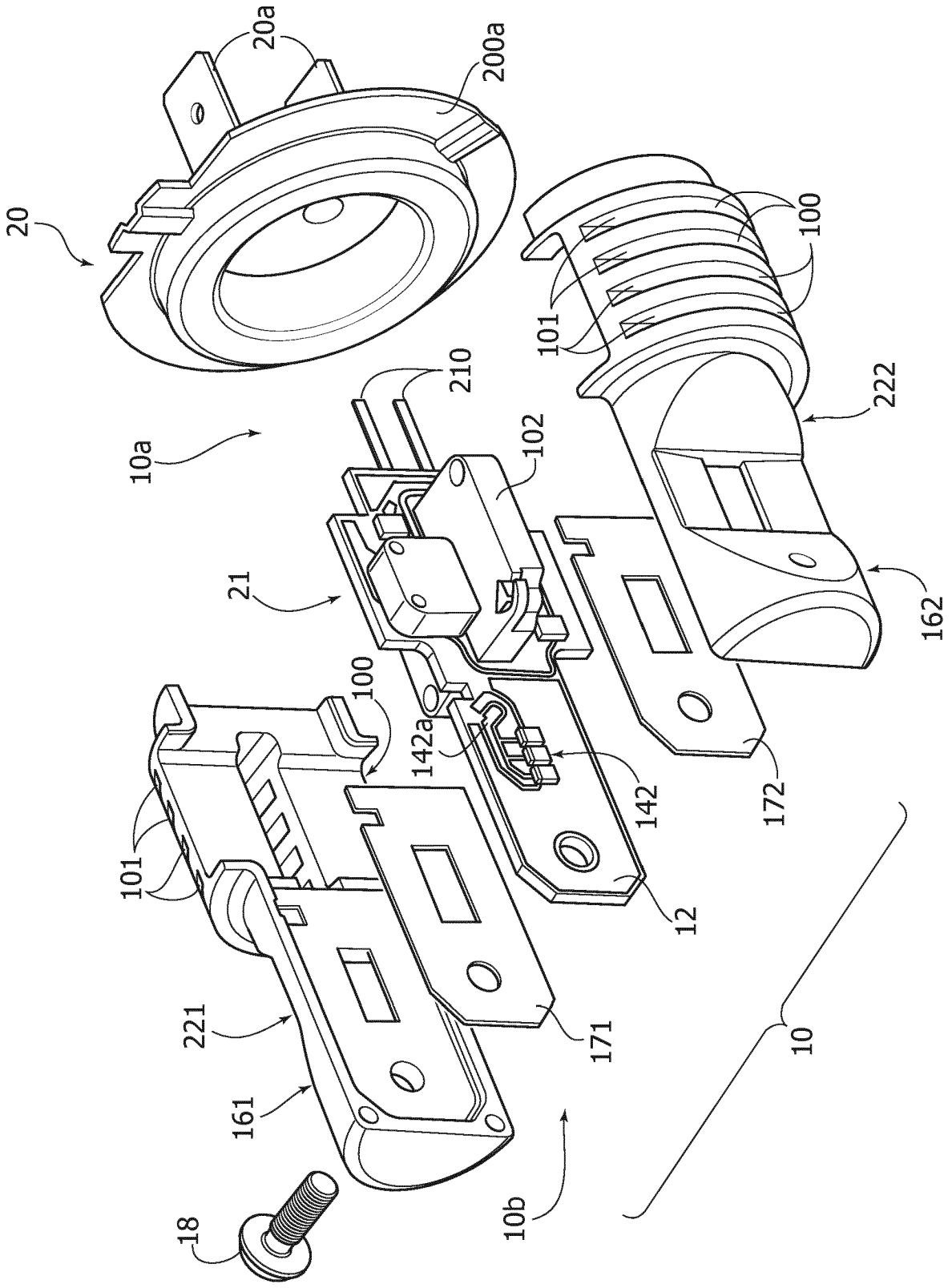
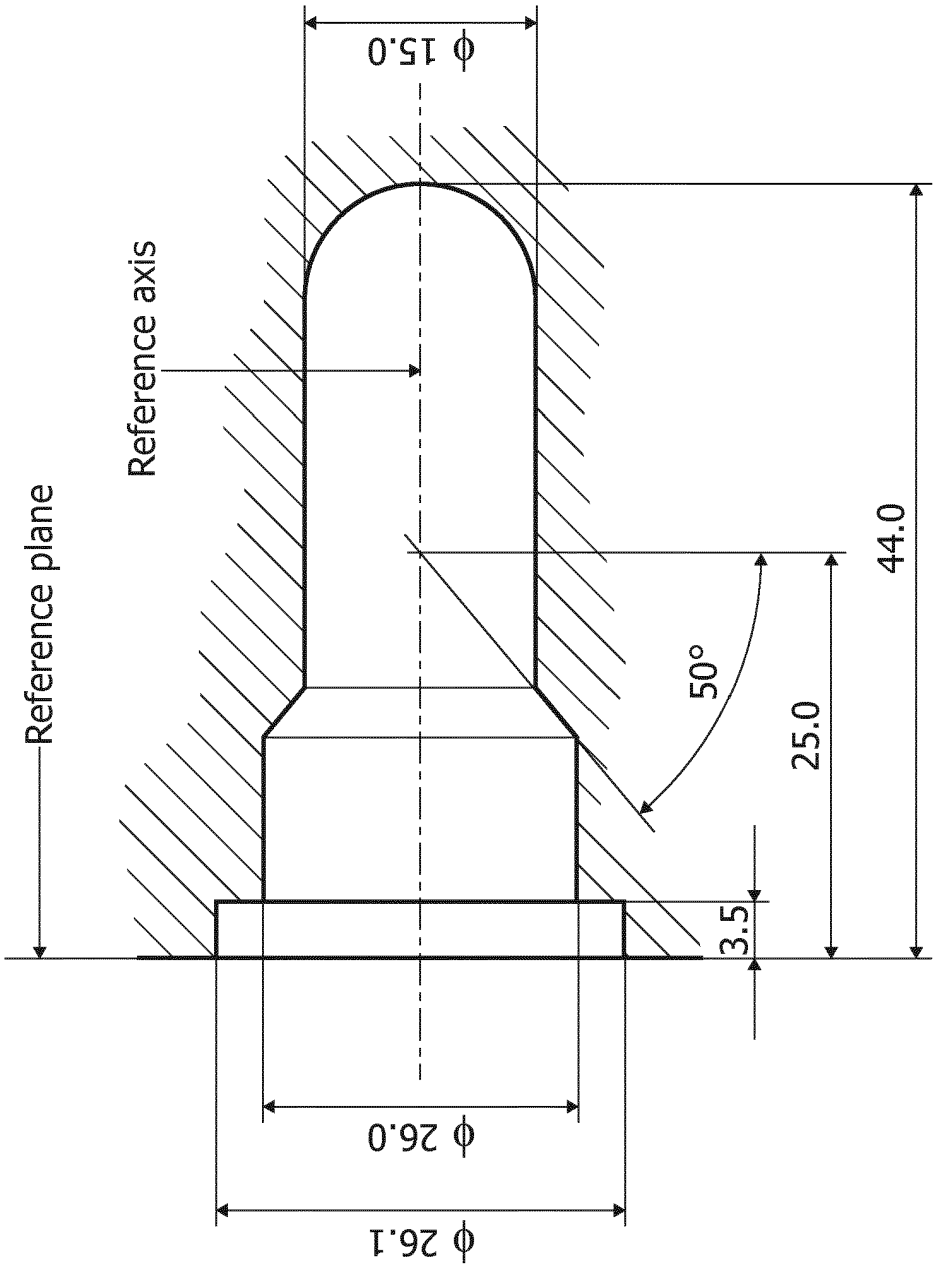

20
20a
200a
10a
210
102
21
100
142a
142
12
101
221
161
18
171
10b
10
172
162
222
101
100

FIG. 3



PRIOR ART

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 9677753 B, Briedenassel **[0009]**
- US 10415787 B, Lessard **[0009]**
- US 9470391 B, Itagaki **[0009]**
- US 2014328079 A1 **[0009]**
- US 8118462 B, Inoue **[0009]**
- US 8066414 B, Pabst **[0009]**
- US 7144140 B, Sun **[0009]**
- US 20150146447 A, Kuepper **[0009]**
- US 20110025211 A, Bae **[0009]**
- US 20100165632 A, Liang **[0009]**
- US 20100027270 A, Huang **[0009]**
- EP 19204020 **[0011]**
- EP 3647649 A1 **[0011]**
- IT 102019000010188 **[0011]**
- CN 109140373 A **[0012]**
- CN 106594627 A **[0013]**
- CN 207334634 U **[0014]**
- US 20100213809 A1, Roehl **[0034]**

Non-patent literature cited in the description

- *Addendum,* vol. 36 (37), 35-38 **[0063]**