



(51) International Patent Classification:

F21V 29/70 (2015.01) *F21K 9/90* (2016.01)
F21K 9/00 (2016.01) *F21Y 115/10* (2016.01)

(21) International Application Number:

PCT/IB2016/052662

(22) International Filing Date:

10 May 2016 (10.05.2016)

(25) Filing Language:

Italian

(26) Publication Language:

English

(30) Priority Data:

102015000016000 20 May 2015 (20.05.2015) IT

(71) Applicant: **OSRAM GMBH** [DE/DE]; Marcel-Breuer-Strasse 6, 80807 München (DE).

(71) Applicant (*for IT only*): **OSRAM S.P.A. - SOCIETA' RI-UNITE OSRAM EDISON CLERICI** [IT/IT]; Viale dell'Innovazione, 3, 20126 Milano (IT).

(72) Inventor: **BIZZOTTO, Alessandro**; Via Montegrappa, 96/A, 31033 Castelfranco Veneto (Treviso) (IT).

(74) Agent: **BOSOTTI, Luciano**; Buzzi, Notaro & Antonielli d'Oulx S.r.l., Via Maria Vittoria, 18, 10123 Torino (IT).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: A LIGHTING DEVICE AND CORRESPONDING METHOD

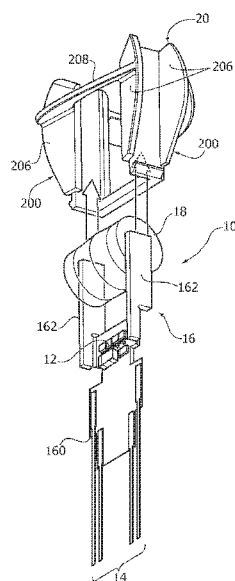


FIG. 3

(57) Abstract: A lighting device (10) includes: - a support member (16) with a fork-like shape with two prongs (162) carrying mutually facing electrically powered light radiation sources (L), e.g. LED sources, and - an annular heat sink member (20) fitted onto said prongs (162) and extending around said light radiation sources (L).

"A lighting device and corresponding method"

Technical Field

5 The present description relates to lighting devices.

One or more embodiments may refer to lighting devices employing solid-state light radiation sources, such as LED sources.

Technological Background

10 The introduction and the increasingly widespread use of solid-state light radiation sources, such as LED sources, has opened new possibilities of implementation of lighting devices.

This is true e.g. for the retrofitting replacement
15 of existing traditional light radiation sources, such as filament lamps, thereby offering improved mechanical, electrical, thermal and optical performances while preserving, as regards appearance and use, features which are substantially similar to
20 traditional electrically powered light radiation sources.

While pursuing these goals, it is desirable to provide a good mechanical and thermal coupling without having to resort to additional elements, such as
25 adhesives, fixation members etc.

Specifically, it is desirable to overcome those solutions which envisage e.g. mounting the light engine onto a heat sink by using fixation members, glues, biadhesive tapes etc.

30 Object and Summary

One or more embodiments aim at providing further improvements in this respect.

According to one or more embodiments, said object is achieved thanks to a device having the features
35 specifically set forth in the claims that follow.

One or more embodiments may also concern a corresponding method.

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

One or more embodiments may offer one or more of the following advantages:

- an intrinsic simplicity, with a small number of parts and consequent savings in complexity and cost,
- 10 - the possibility of achieving an efficient coupling of the heat sink, the support element (e.g. a PCB), therefore facilitating cooling.

Brief Description of the Figures

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

- Figure 1 is a perspective view of a lighting device which may comprise one or more embodiments;
- Figure 2 shows a component adapted to be
20 included into a device as shown in Figure 1,
- Figures 3 and 4 show a possible mounting sequence of one or more embodiments, and
- Figure 5 is a view corresponding to a cross section of the upper part of Figure 4, shown in
25 enlarged scale.

In this respect, it will be appreciated that, for ease of understanding, the views in the various Figures may not be drawn to the same scale.

Detailed Description

30 In the following description, numerous specific details are given to provide a thorough understanding of exemplary embodiments. One or more embodiments may be practiced without one or several specific details, or with other methods, components, materials, etc. In
35 other instances, well-known structures, materials, or

operations are not shown or described in detail to avoid obscuring various aspects of the embodiments.

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

The headings provided herein are for convenience
15 only, and therefore do not interpret the extent of protection or the scope of the embodiments.

In Figure 1, reference 10 denotes a lighting device which employs electrically powered light radiation sources. In one or more embodiments, these
20 may be solid-state light radiation sources, such as LED sources.

According to known criteria, sources L of this kind may be driven by drive circuits 12 connected to electrically conductive lines 14, which are adapted to
25 provide power supply to light radiation sources L. One or more embodiments may also additionally include functions for a "smart" driving of sources L (i.e. dimming, thermal control, etc.).

One or more embodiments may allow for assembling
30 device 10 without the need of fixation components.

For such purpose, device 10 may comprise a laminar support member 16 provided with mutually opposed surfaces 16a, 16b.

In one or more embodiments, as exemplified in the
35 Figures, laminar support member 16 may have a general

fork-like shape, with a body portion 160 from which two prongs 162 extend.

Specifically, starting from a substantially planar initial shape (shown in Figure 2) it is possible to
5 impart a generally channel-like shape to support member 16 (at least in the proximal portion of prongs 162), as shown in the following Figures.

In one or more embodiments, circuits 12 and/or lines 14 arranged on first surface 16a of support 16
10 may be located within the channel-like shape, which may be obtained when prongs 162 are bent or folded with respect to body portion 160.

In one or more embodiments, light radiation sources L may be arranged on prongs 162 (e.g. on the
15 face of such planar prongs corresponding to first surface 16a). As a result, when the prongs 162 are bent or folded with respect to body portion 160, light radiation sources L arranged on prongs 162 are mutually facing.

Although the presently exemplified embodiments refer to the presence of two light radiation sources L, which are located at the distal ends of prongs 162, one or more embodiments may envisage the provision, on each prong 162, of a higher number of light radiation
25 sources L, and/or the arrangement of light radiation sources L in a position other than distal.

In one or more embodiments, the space between prongs 162 carrying the light radiation sources L may be left empty, so that the light radiation emitted by
30 sources L propagates towards the surrounding environment.

In one or more embodiments, in the space between both prongs 162 carrying light radiation sources L there may be inserted, optionally before starting or
35 completing the bending or folding movement of prongs

162, a spacer member, e.g. in order to keep prongs 162 at a predetermined distance.

In one or more embodiments, in the space between both prongs 162 carrying light radiation sources L there may be inserted an optical element (such as e.g. one or more reflectors or a lens) acting on at least part of the light radiation emitted by sources L.

In one or more embodiments, the functions of a spacer member and of an optical member may be performed by a single component, such as e.g. lens 18 exemplified in Figure 5.

In one or more embodiments, component 18 may be provided with opposed end cavities 180, wherein light radiation sources L carried by the prongs will be inserted as a result of the bending movement imparted to such prongs 162.

In one or more embodiments, the supporting or holding action of component 18 between prongs 162 may be simply due to the fact that prongs 162 clamp, or so to say "pinch", component 18 therebetween. In one or more embodiments, the holding action by prongs 162 on component 18 may be strengthened by applying adhesive material between prongs 162 and optical member 18.

As exemplified in Figure 1, in one or more embodiments it is therefore possible to obtain a lighting device 10 comprising:

- a fork-shaped support member 16, having a pair of prongs 162 carrying electrically powered, mutually facing light radiation sources L, and optionally
- a spacer member such as an optical member, e.g. a lens 18, arranged in the space between prongs 162 carrying mutually facing light radiation sources L.

Further details concerning the implementation of a lighting device such as device 10 in Figure 1 may be found in an Italian Patent Application filed on the

same date by the same Applicants.

Figures 3 and following exemplify the possibility of providing lighting device 10 with a heat sink 20, adapted to be fitted onto prongs 162 with member 18 -
5 if present - sandwiched therebetween. This may take place, e.g. as exemplified in the sequence of Figures 3 and 4.

In one or more embodiments, heat sink 20 may have an annular shape, wherein device 10 may be inserted
10 (i.e. fitted) in such a way as to achieve the final condition as exemplified in Figures 4 and 5.

In this condition, heat sink 20 is adapted to form a sort of collar fitted onto prongs 162, so that it can optionally perform, in addition to the function of a
15 heat sink, a clamping of prongs 162 against the ends of component 18, if present; in this way, component 18 may be kept in the desired position, being interposed between light radiation sources L, without the need of further fixation means, e.g. the application of
20 adhesive layers (which however is not excluded in one or more embodiments).

In one or more embodiments, heat sink 20 may be fitted onto prongs 162 through an interference fit. In this way, in one or more embodiments heat sink 20 may
25 be mounted and held on device 10 without the provision of specific fixation or holding means.

In one or more embodiments, as exemplified in the Figures, heat sink 20 may comprise two mutually opposed bodies 200, located at the mutually opposed outer sides
30 of prongs 162.

In one or more embodiments, such prongs 162 may comprise, as in the presently exemplified embodiments, laminar bodies, so that heat dissipating bodies 200 may have planar surfaces 200a (see Figure 5) which may rest
35 against corresponding and equally planar surfaces of

prongs 162, so as to achieve a (large) heat transfer surface from light radiation sources L.

In one or more embodiments, between surfaces 200a and prongs 162 there may be sandwiched a Thermal Interface Material (TIM) 204.

In one or more embodiments, as exemplified in the Figures, heat dissipating bodies 200 of heat sink 20 may have the configuration of finned bodies, e.g. channel-shaped bodies having side walls 206. In one or more embodiments, side walls 206 may be mutually diverging.

In one or more embodiments, the general annular shape of heat sink 20 may include bridge-like members 208, extending between the heat dissipating bodies.

In one or more embodiments, bridge-like elements 208 may be configured as reflective surfaces, which act as reflectors. Further details concerning such option may be found in an Italian Patent Application filed on the same date by the same Applicants.

The view in Figure 5 highlights that, in one or more embodiments, heat sink 20 may be sized in such a way that drive circuits 12 mounted on the support may face inwardly of heat sink 20, i.e. may be located in a position at least partially co-extensive with heat sink 20.

In one or more embodiments, heat sink 20 may have, in addition to bridge-like formations 208, further portions (e.g. the surfaces of side walls 206 facing outwardly of device 10) having reflective surfaces, so as to further contribute to the diffusive action of the light radiation emitted by sources L.

Of course, without prejudice to the basic principles, the implementation details and the embodiments may vary, even appreciably, with respect to what has been described herein by way of non-limiting

example only, without departing from the extent of protection.

The extent of protection is defined by the annexed claims.

CLAIMS

1. A lighting device (10), including:
 - a support member (16) with a fork-like shape with two prongs (162) carrying mutually facing
 - 5 electrically powered light radiation sources (L), and
 - an annular heat sink member (20) fitted onto said prongs (162) and extending around said light radiation sources (L).
- 10 2. The lighting device of claim 1, wherein said annular heat sink member (20) is interference fitted onto said prongs (162).
3. The lighting device of claim 1 or claim 2, wherein said annular heat sink member (20) includes heat dissipating bodies (200) at the mutually opposed
- 15 outer sides of said prongs (162).
4. The lighting device of claim 3, wherein said prongs (162) include laminar bodies and said heat dissipating bodies (200) include planar heat transfer surfaces (200a) against the laminar bodies of the
- 20 prongs (162).
5. The lighting device of claim 3 or claim 4, wherein said heat dissipating bodies (200) are finned bodies, preferably channel-shaped bodies with side walls (206) forming heat dissipating fins.
- 25 6. The lighting device of claims 3 to 5, including bridge-like members (208) extending between said heat dissipating bodies (200).
7. The lighting device of any of the previous claims, including electrical drive circuits (12) for
- 30 said light radiation sources (L), wherein said electrical circuits (12) are arranged on said support member (16) at a location at least partially co-extensive with said heat sink member (20).
8. The lighting device of any of the previous
- 35 claims, including a spacer member, preferably an

optical member (18), between said mutually facing light radiation sources (L).

9. The lighting device of any of the previous claims, wherein said heat sink member (20) includes at least one light reflective surface (206, 208).

10. The lighting device of any of the previous claims, wherein said electrically powered light radiation sources include solid-state light radiation sources, preferably LED sources (L).

11. A method of manufacturing a lighting device (10), including:

- providing a support member (16) with a fork-like shape with two prongs (162) carrying mutually facing electrically powered light radiation sources (L), and
- fitting an annular heat sink member (20) onto said prongs around said light radiation sources (L).

FIG. 1

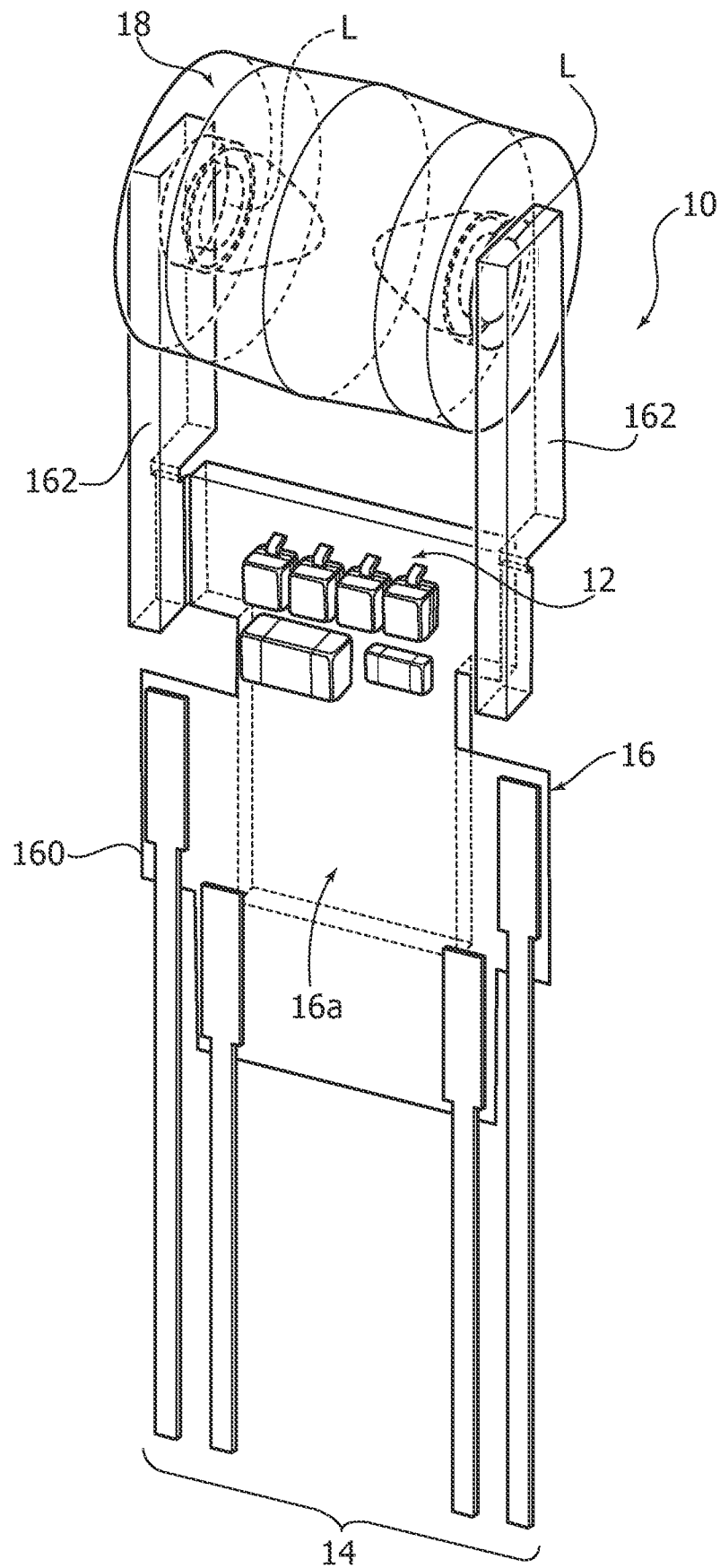


FIG. 2

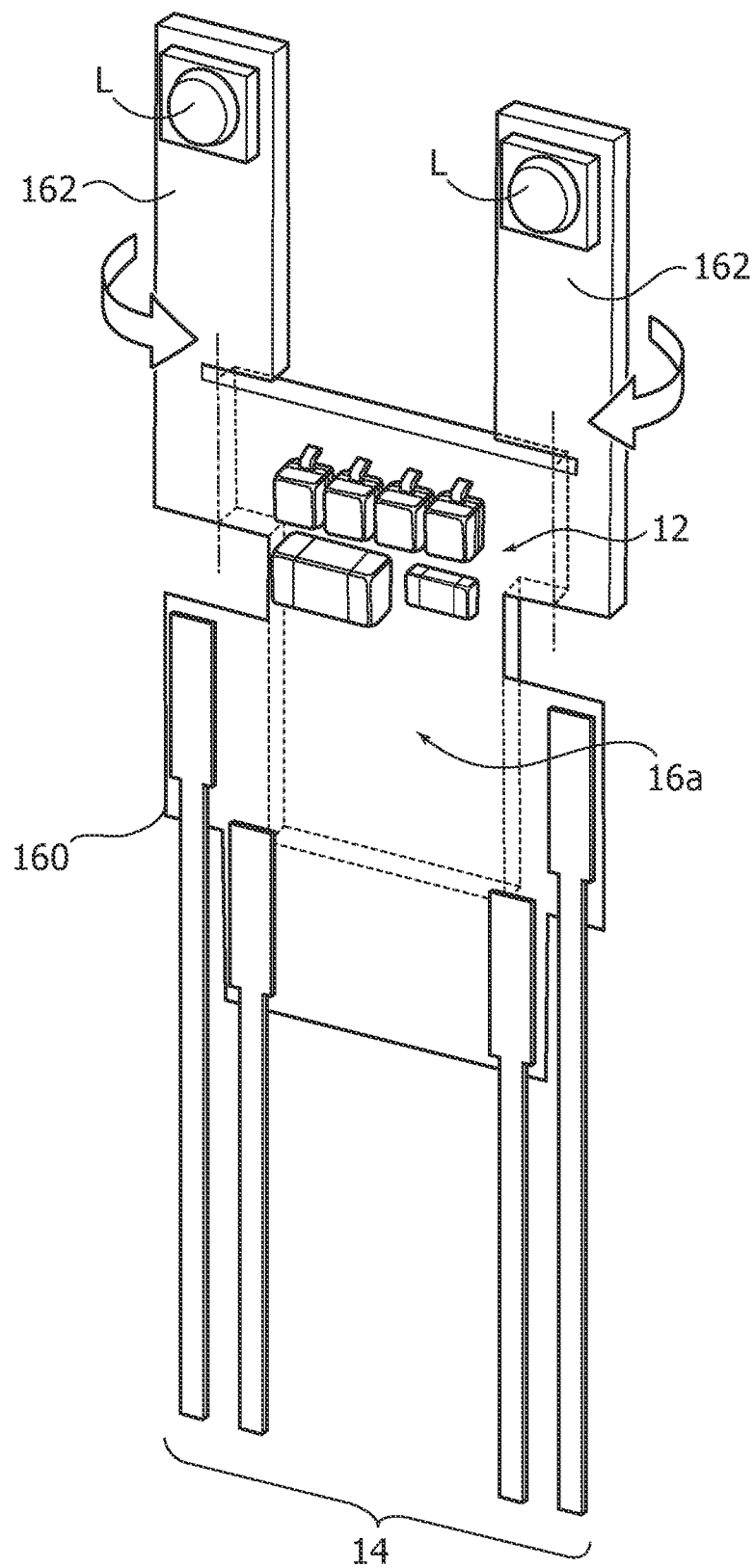


FIG. 3

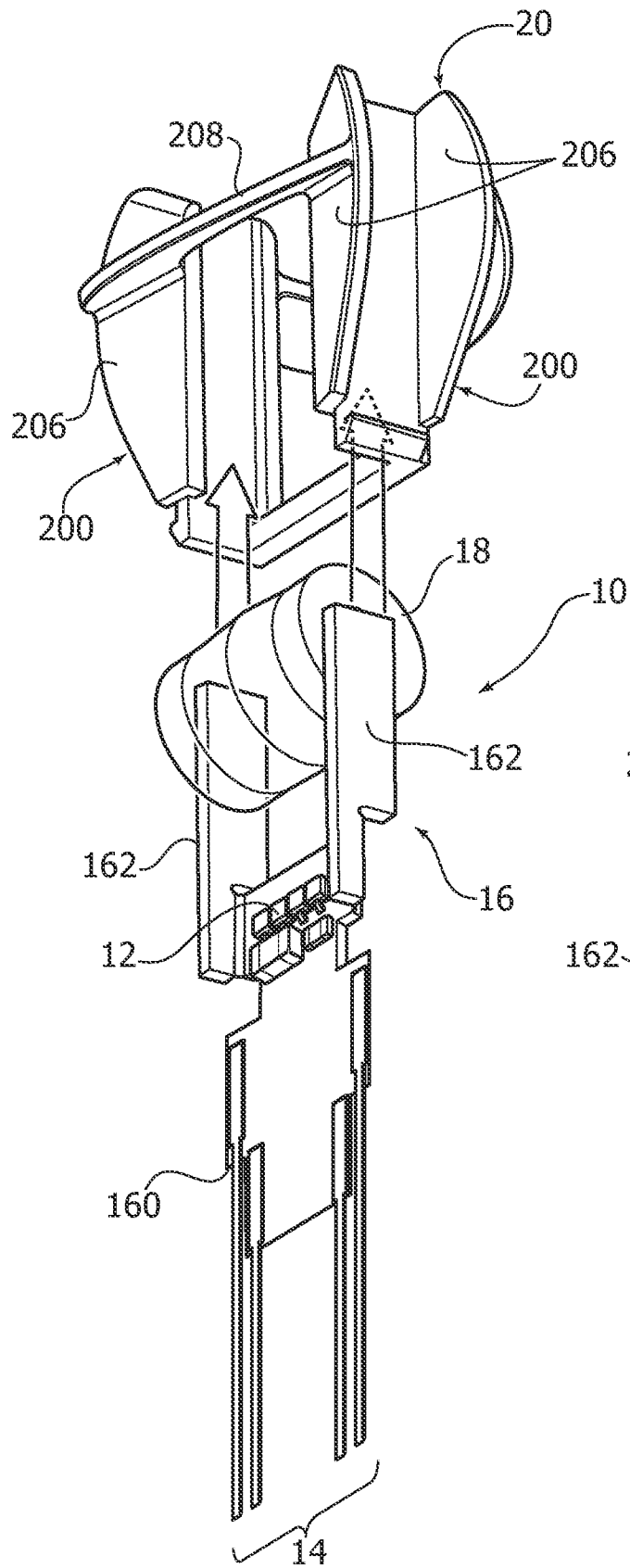


FIG. 4

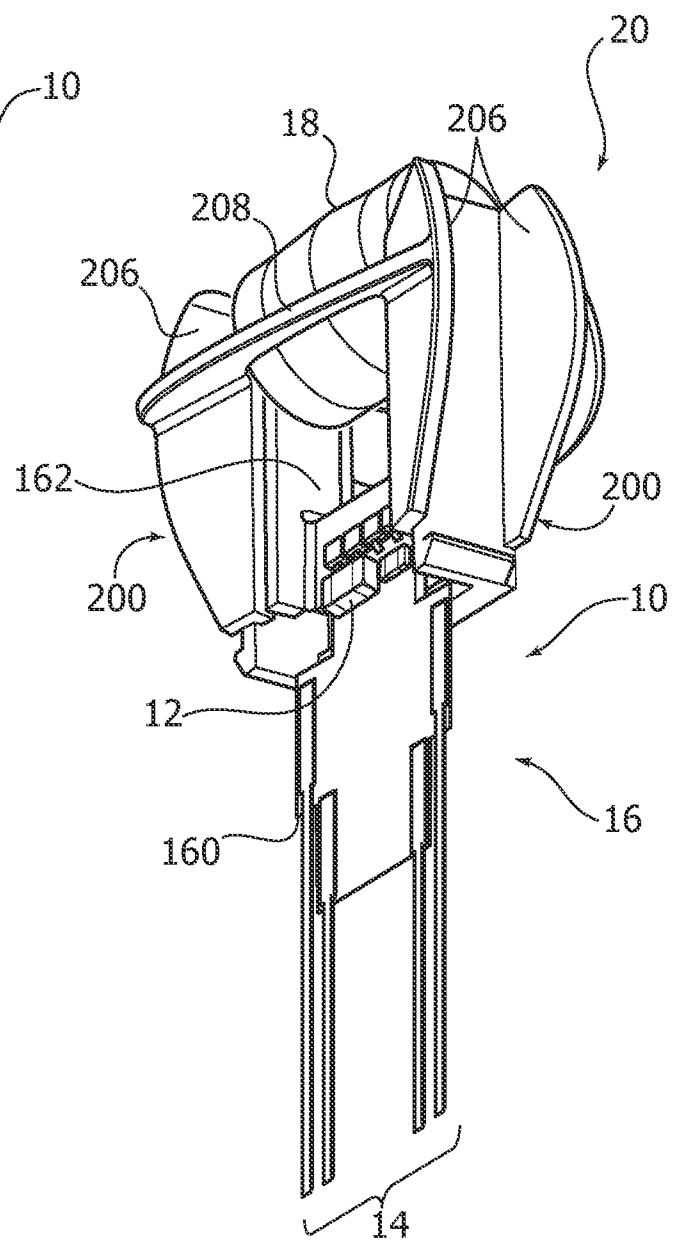
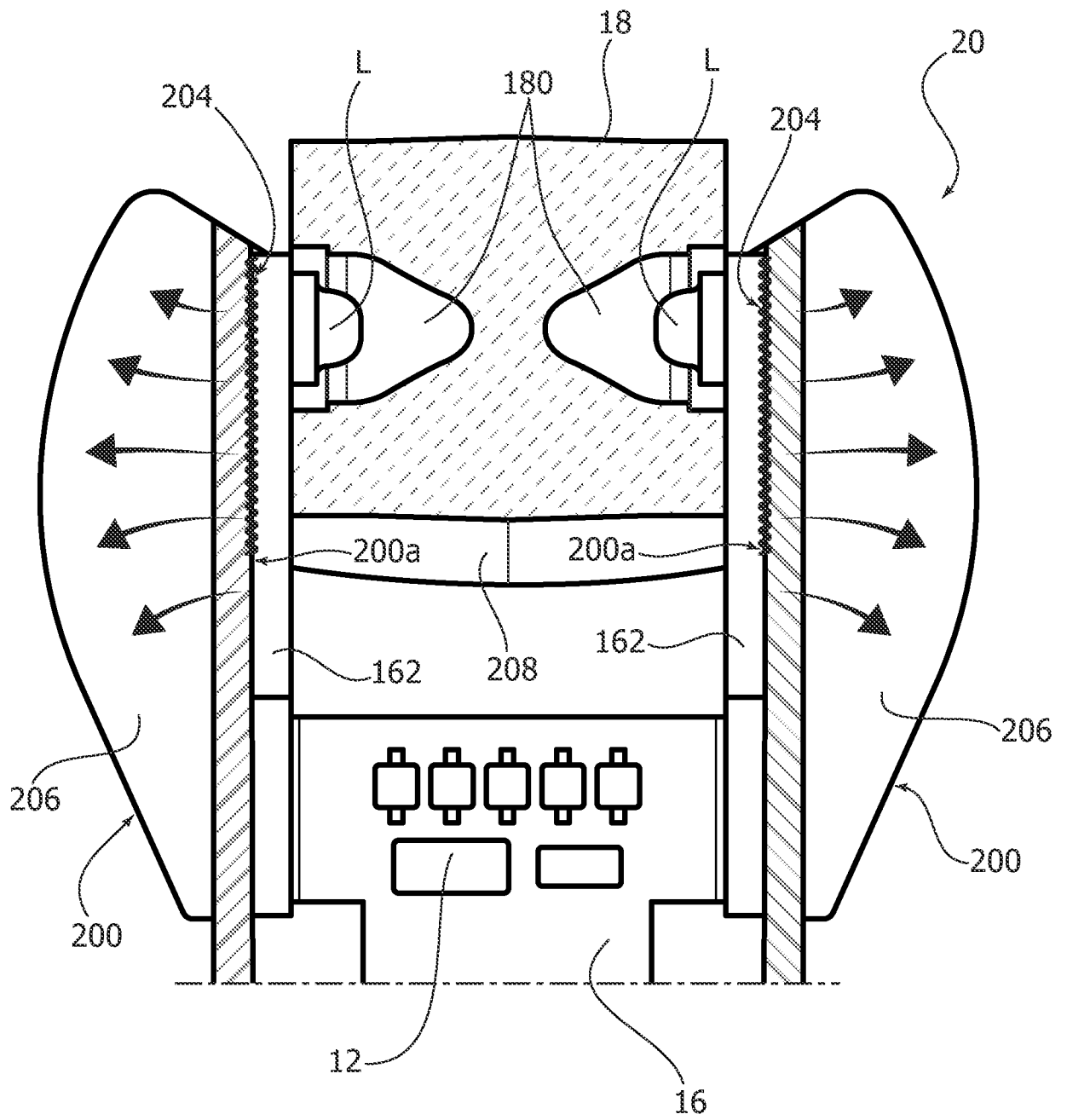


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2016/052662

A. CLASSIFICATION OF SUBJECT MATTER

INV. F21V29/70 F21K9/00 F21K9/90
 ADD. F21Y115/10

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 F21K F21Y F21V

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/149263 A1 (FOREVER BULB LLC [US]; CARROLL DAVID W [US]; CARROLL WENDELL L [US]) 10 December 2009 (2009-12-10)	1,3-11
Y	paragraph [0031] - paragraph [0051]; figures 1-7	2
X	US 2011/103055 A1 (CARROLL DAVID W [US]) 5 May 2011 (2011-05-05)	1,3-11
Y	the whole document	2
Y	US 2015/062909 A1 (PROGL CURT [US] ET AL) 5 March 2015 (2015-03-05)	2
A	WO 2015/040240 A1 (OSRAM GMBH [DE]) 26 March 2015 (2015-03-26)	1-11
	the whole document	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

23 June 2016

Date of mailing of the international search report

19/07/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

Thibaut, Arthur

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2016/052662

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009149263	A1	10-12-2009	CA 2727144 A1 10-12-2009
		CN 102224371 A 19-10-2011	
		CN 103256506 A 21-08-2013	
		EP 2297509 A1 23-03-2011	
		EP 2594841 A1 22-05-2013	
		JP 5356511 B2 04-12-2013	
		JP 5625095 B2 12-11-2014	
		JP 2011523180 A 04-08-2011	
		JP 2014003031 A 09-01-2014	
		US 2009302730 A1 10-12-2009	
		US 2012001545 A1 05-01-2012	
		US 2013301281 A1 14-11-2013	
		US 2015022116 A1 22-01-2015	
		WO 2009149263 A1 10-12-2009	
US 2011103055	A1	05-05-2011	CN 102713407 A 03-10-2012
		EP 2496877 A1 12-09-2012	
		US 2011103055 A1 05-05-2011	
		WO 2011056950 A1 12-05-2011	
US 2015062909	A1	05-03-2015	NONE
WO 2015040240	A1	26-03-2015	DE 102013219084 A1 26-03-2015
		WO 2015040240 A1 26-03-2015	