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

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

(72) Inventors: **BIZZOTTO, Alessandro**; Via Montegrappa, 96/A, I-31033 Castelfranco Veneto (Treviso) (IT). **ESPOSITO, Fabio**; Via Lisbona, 43, I-35010 Vigonza (Padova) (IT).

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

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(54) Title: A METHOD OF MANUFACTURING LIGHTING DEVICES AND CORRESPONDING LIGHTING DEVICE

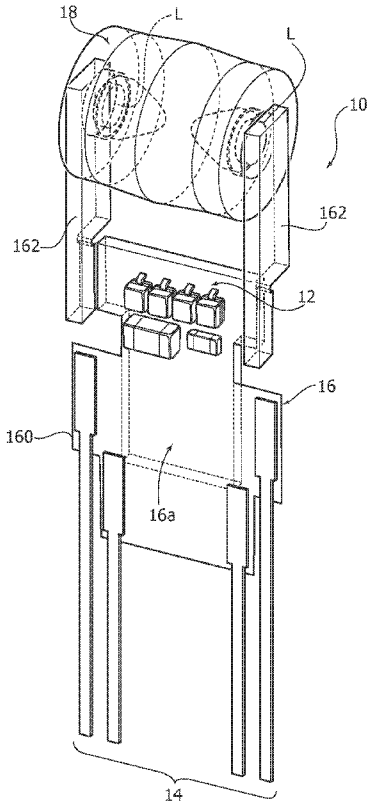


FIG. 1

(57) Abstract: Lighting devices (10), e.g. LED lighting devices, may be manufactured from a laminar fork-like support member (16) having mutually opposed first (16a) and second (16b) surfaces, and by arranging electrically powered light radiation sources, e.g. LED sources, on first surface (16a) of support member (16) at prongs (162). Said prongs (162) are then folded inwardly of support member (16) according to a channel-like configuration, whereby the light radiation sources (L) at said prongs (162) are mutually facing. A spacer element, such as a cylindrical lens (18), may be arranged between the mutually facing light radiation sources (L), so as to be held between said folded prongs (162).

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"A method of manufacturing lighting devices and corresponding lighting device"

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Technical Field

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

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 of existing traditional light radiation sources, such as filament lamps, thereby offering improved mechanical, electrical, thermal and optical performance while preserving, as regards appearance and use, features which are substantially similar to traditional electrically powered light radiation sources.

While pursuing these goals, solutions have been developed envisaging e.g. mounting several LEDs onto a support such as a printed circuit board, wherein the light emission from the LEDs is oriented externally with respect to a main axis (which may be considered as corresponding to the bulb main axis of a traditional light bulb), with the possible interconnection of multiple circuit boards via external components (soldered wires, connectors etc.)

Another solution envisages the arrangement of the LEDs on a planar printed circuit board, so that the light emission is substantially parallel with the bulb main axis, e.g. by employing a secondary optic or a

diffusive dome in order to backscatter a portion of the light emission from the LEDs.

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 method having the features specifically set forth in the claims that follow.

One or more embodiments may also concern a corresponding lighting device.

The claims are an integral part of the technical teaching provided herein with reference to the 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,
- the possibility of achieving a light distribution similar to a filament lamp, the distribution being adjustable to suit specific application requirements (e.g. in applications requiring the provision of a reflector, as is the case e.g. in the automotive sector).

Brief Description of the Figures

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 perspective view of a lighting device which may be implemented according to one or more embodiments, and
- Figures 2 to 5 show various components adapted to be included into a device as shown in Figure 1, as well as operations adapted to be performed on such components.

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

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 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 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 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 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 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 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 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 Figures, laminar support member 16 may have a general fork-like shape, with a body portion 160 from which two prongs 162 extend.

As can be seen in Figures 3 and 4, in one or more embodiments laminar fork-shaped support 16 may comprise a first material (e.g. an electrically conductive material such as a metal) having a first thickness at body portion 160 and at prongs 162, so as to impart stiffness thereto.

At the first surface denoted as 16a, between said thicker portions there may be provided a laminar (e.g. plastic) structure having a second thickness, lower than the first thickness, so as to originate hinge portions 163 connecting body portion 160 and prongs 162.

Such hinge portions may extend lengthwise of support 16, and allow both prongs 162 to be folded with respect to the body portion, as shown by the sequence of Figures 3 and 4.

Starting from a substantially planar configuration (as shown in Figures 2 and 3) it is therefore possible to impart a generally channel-like shape to support member 16 (at least in the proximal portion of prongs 162), as shown in Figures 1 and 4.

In one or more embodiments, surface 16a may comprise an electrically insulating material (e.g. a plastic material). In this way, in one or more

embodiments, such support structure 16 may host electrically conductive lines 14 and drive circuits 12, thus achieving the electrical insulation of such lines from the electrically conductive material of the thicker portions of support 16.

In one or more embodiments, circuits 12 and/or lines 14 arranged on first surface 16a of support 16 may be arranged within the channel-like shape which may be obtained when prongs 162 are folded with respect to body 160, as exemplified e.g. in the sequence of Figures 3 and 4.

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

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 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 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 completing the bending or folding movement of prongs 162, a spacer member, e.g. in order to keep prongs 162

ad 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.

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 method of manufacturing lighting devices (10), including:

- providing a laminar support member (16) having opposed first (16a) and second (16b) surfaces, said support member (16) having a fork-like shape with two prongs (162),

- arranging electrically powered light radiation sources (L) on the first surface (16a) of said support member (16) at said prongs (162), and

- folding said prongs (162) inwardly of the support member (16), whereby the light radiation sources (L) at said prongs (162) are mutually facing.

2. The method of claim 1, wherein a spacer member (18) is arranged between said mutually facing light radiation sources (L) to be held between said folded prongs (162).

3. The method of claim 2, including arranging said spacer member (18) between said light radiation sources (L) before said prongs (162) are folded inwardly of the support member (16).

4. The method of claim 2 or claim 3, including applying adhesive material between said spacer member (18) and said prongs (162).

5. The method of any of claims 2 to 4, including providing said spacer member (18) with opposed cavities (180) for insertion of said light radiation sources (L) at said prongs (162) of the support member (16).

6. The method of any of claims 2 to 5, including providing an optical member (18), preferably a lens, as said spacer member.

7. The method of any of the previous claims, wherein said laminar support member (16) includes:

- a body portion (160) and two prong portions (162) of a first thickness, and

- flexible portions (163) of a second thickness between said body portion (160) and said prong portions (162), wherein said second thickness is less than said first thickness.

8. The method of any of the previous claims, including:

- providing a layer of an electrically insulating material at said first surface (16a) of said support member (16), and

- arranging electrical circuits (12, 14) for driving said electrically powered light radiation sources (L) at said first surface (16a) of said support member (16).

9. The method of any of the previous claims, including selecting solid state sources, preferably LED sources (L), as said electrically powered light radiation sources.

10. A lighting device (10), including:

- a laminar support member (16) having opposed first (16a) and second (16b) surfaces, said support member (16) having a fork-like shape with two prongs (162),

- electrically powered light radiation sources (L) arranged on said first surface (16a) of said support member (16) at said prongs (162), wherein said prongs (162) are folded inwardly of the support member (16), whereby the light radiation sources (L) at said prongs (162) are mutually facing.

FIG. 1

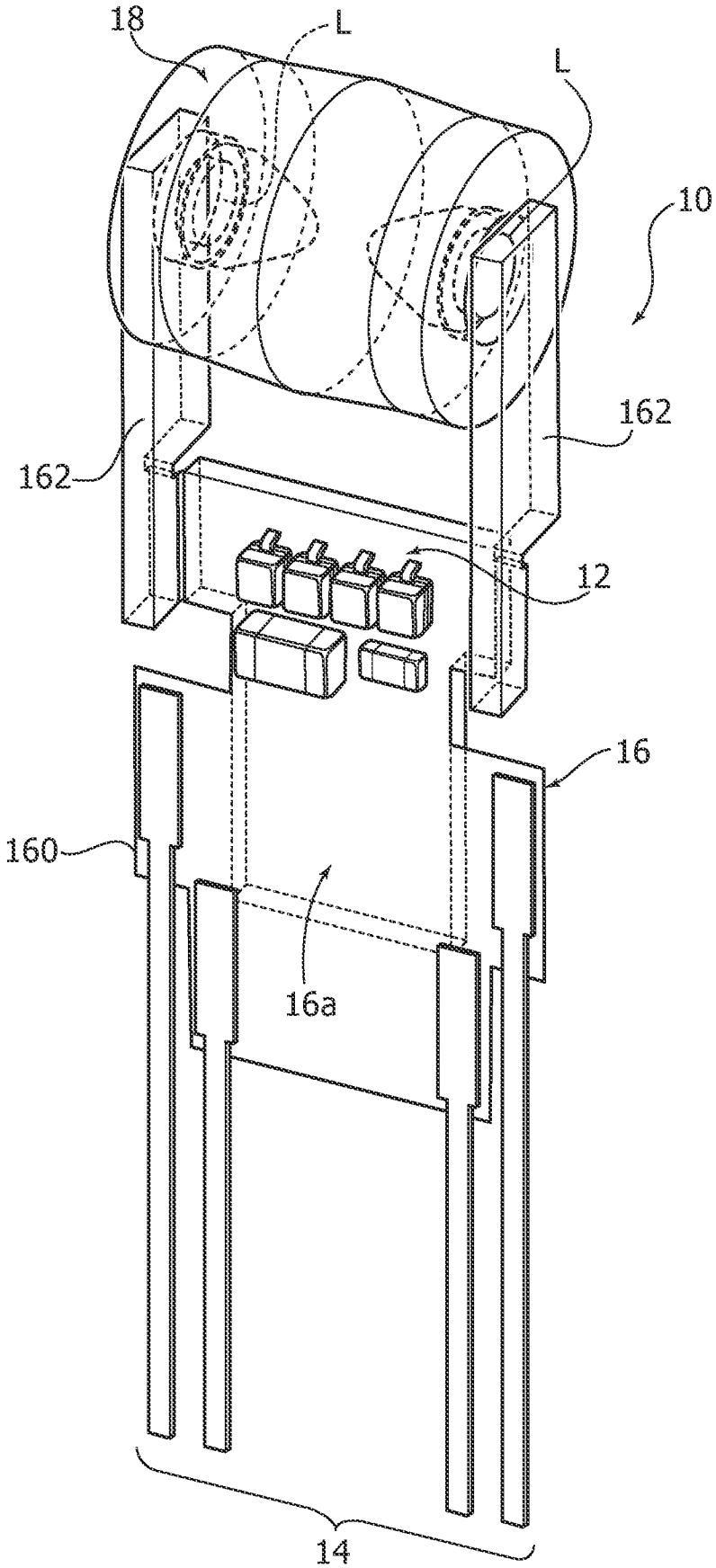


FIG. 2

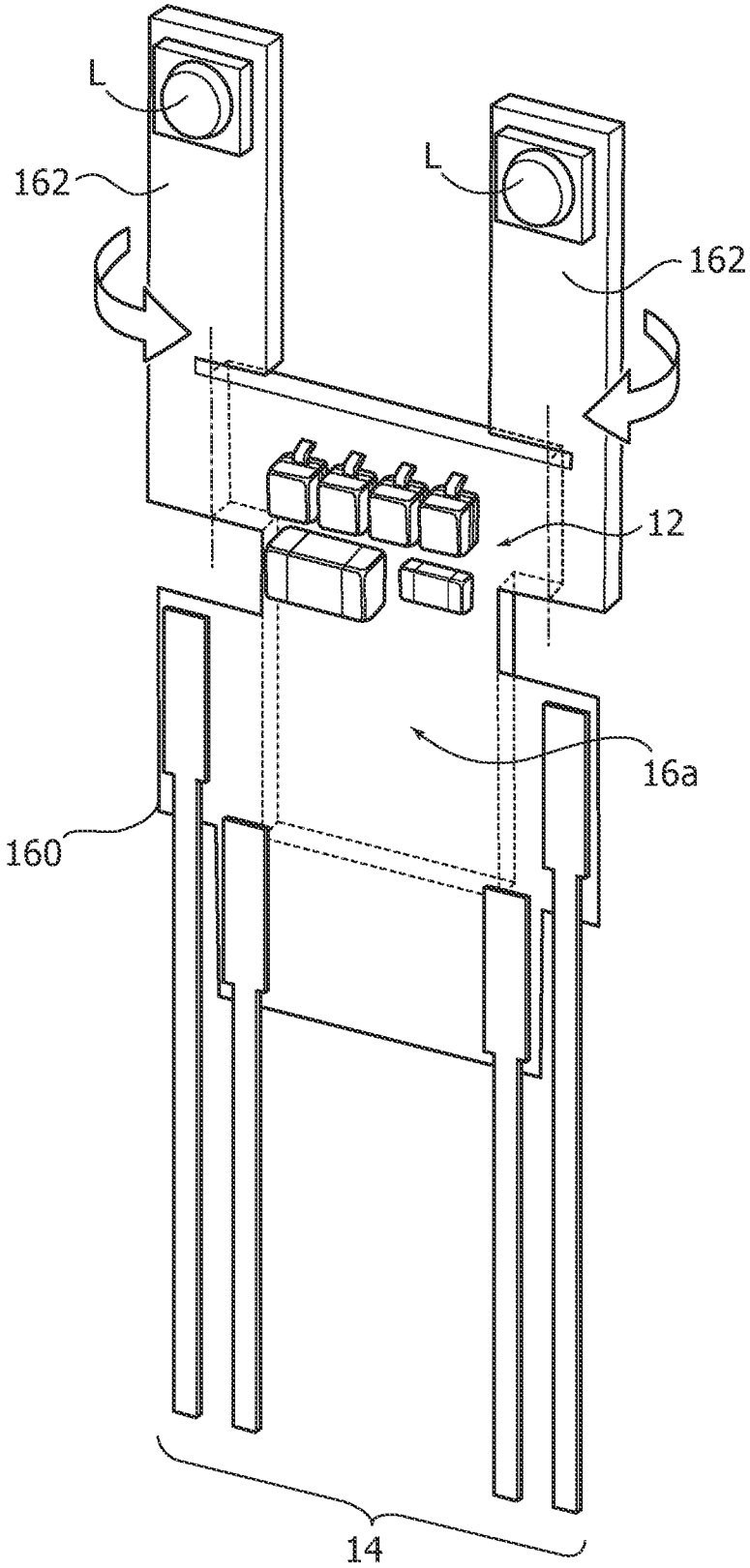


FIG. 3

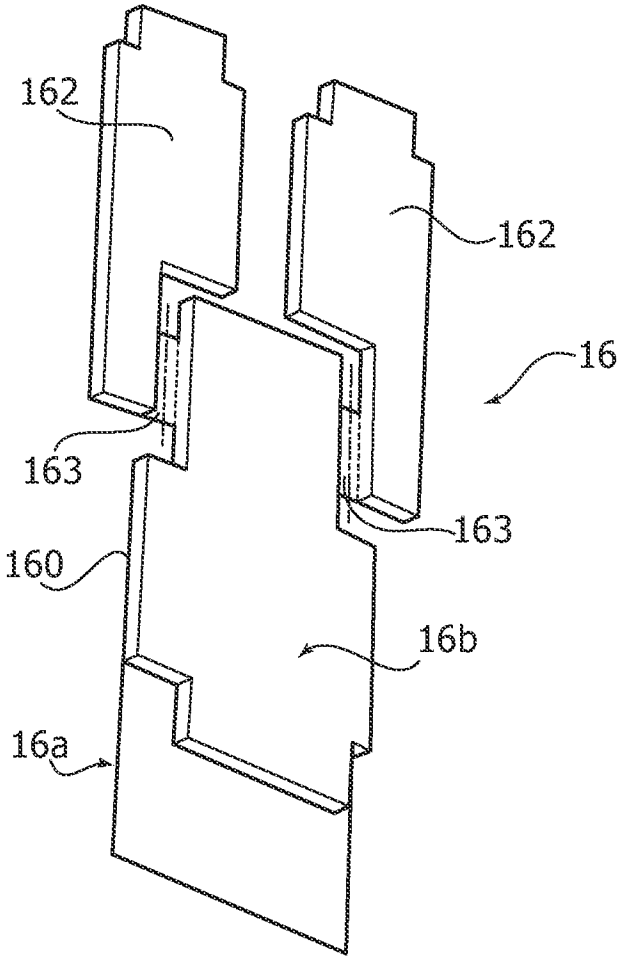


FIG. 4

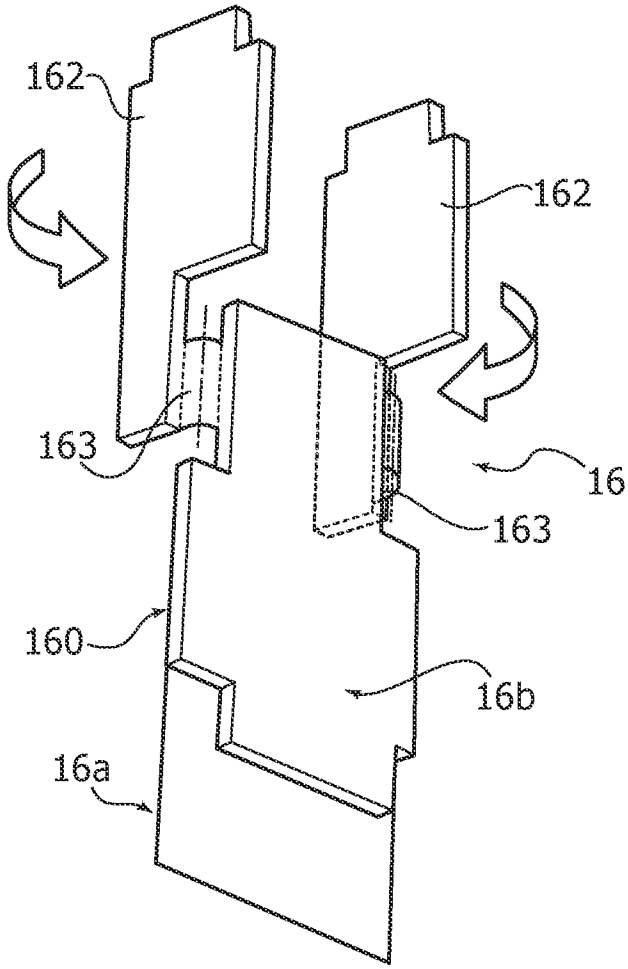
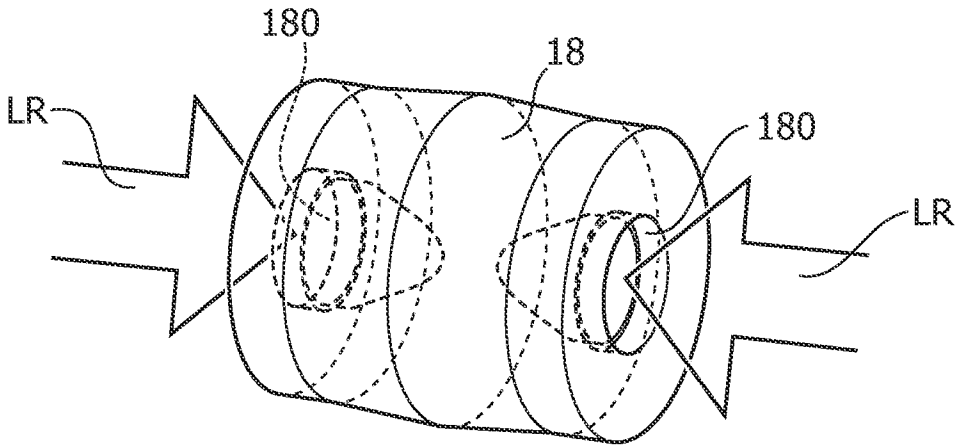


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/052653

A. CLASSIFICATION OF SUBJECT MATTER
INV. F21K9/00 H05K1/02 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 F21V F21Y H05K

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

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

[X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
23 June 2016	19/07/2016

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

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

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