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

(11) **EP 2 260 232 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
07.05.2014 Bulletin 2014/19

(21) Application number: **09721050.4**

(22) Date of filing: **10.03.2009**

(51) Int Cl.:
F21K 99/00 *(2010.01)* ***F21V 29/00*** *(2006.01)*

(86) International application number:
PCT/IB2009/000474

(87) International publication number:
WO 2009/112927 (17.09.2009 Gazette 2009/38)

(54) **SUPPORT STRUCTURE FOR LED LIGHTING DEVICES**

TRÄGERSTRUKTUR FÜR LED-LEUCHTEN

STRUCTURE DE SUPPORT POUR DISPOSITIFS D'ÉCLAIRAGE À DEL

(84) Designated Contracting States:
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 SE SI SK TR

(30) Priority: **13.03.2008 IT MI20080428**

(43) Date of publication of application:
15.12.2010 Bulletin 2010/50

(73) Proprietor: **Catellani, Enzo**
24020 Villa di Serio (BG) (IT)

(72) Inventor: **Catellani, Enzo**
24020 Villa di Serio (BG) (IT)

(74) Representative: **Lunati & Mazzoni S.r.L.**
Via Carlo Pisacane, 36
20129 Milano (IT)

(56) References cited:
WO-A-2007/143991
JP-A- 2004 296 245
US-A1- 2003 224 687
US-A1- 2004 156 199
US-A1- 2005 104 059
US-A1- 2009 040 776
US-B1- 7 434 964

EP 2 260 232 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a LED lighting device of the type described in the preamble of Claim 1.

[0002] There are currently known LEDs (acronym for light emitting diode) recently used to light various spaces, such as: domestic spaces, offices, open spaces such as squares and gardens and the like.

[0003] LED lighting devices have various advantages with respect to more conventional lighting devices, such as incandescent lamps and fluorescent lamps.

[0004] In particular, LEDs have a very small volume, even less than one cm^3, very high efficiency, produce a light that can obtain a desired colour, switch on very quickly when energized by electrical current and so forth.

[0005] As well as said advantages, LED lighting devices also have some considerable drawbacks.

[0006] In fact, having powers of over one Watt, LED lighting devices can become very hot due to their small volume.

[0007] This heating can cause rapid deterioration of the chip associated with this LED and thus deterioration of the LED, which decreases in efficiency and other features.

[0008] In this situation the technical aim of the present invention is to devise a LED lighting device capable of substantially overcoming the aforesaid drawbacks.

[0009] Within said technical aim an important object of the invention is to achieve a support structure for LED lighting devices which allows optimum heat dissipation. Some support structure, not able to completely overcome the said drawbacks, is described in patent applications: WO-A-2007/143991, JP-A-2004-296245, US-A-2003/224687, US-A-2004/156199, US-A-2009/040776 and US-A-7434964.

[0010] Another important object of the invention is to produce a simple and inexpensive LED lighting device.

[0011] The technical aim and the objects specified are achieved by a LED lighting device as claimed in the appended claim 1.

[0012] Preferred embodiments are highlighted in the dependent claims.

[0013] Other characteristics and advantages of the invention are further elucidated in the following detailed description of a preferred embodiment of the invention, with reference to the accompanying drawings, wherein:

Fig. 1 shows a overall top view of the support structure according to the invention and an enlargement of a detail;

Fig. 2 shows a side view of a detail of the support structure;

Fig. 3 shows the normal section III-III, indicated in Fig. 1, of the support structure; and

Fig. 4 shows the normal section IV-IV, indicated in Fig. 1, of the support structure.

[0014] With reference to the Figures, the support structure according to the invention is indicated as a whole with the number 1.

[0015] It comprises a rod **2** and support means **3**, suitable to support at least one LED **4**.

[0016] Several LEDs **4** can also be provided for a single rod 2.

[0017] The rod 2 is circular and hollow and has an outer surface with a normal section preferably substantially circular. It is made a metal material with high thermal conductivity, such as in particular: copper, aluminium, silver, gold or their alloys and more preferably copper alloy nickel plated on the surface.

[0018] The rod 2 then comprises an internal hollow **2a** also circular and conveniently coaxial with the outer surface (Fig. 3).

[0019] The hollow rod 2 also preferably has an external diameter of between 2 mm and 6 mm, and preferably between 2 mm and 4 mm, and a diameter of the internal hollow 2a preferably of between 1 mm and 3 mm. Moreover, it conveniently has a length exceeding 5 cm and more preferably exceeding 10 cm and a maximum length variable to even more than 2 m.

[0020] The support means 3 is also at least partly integral and in one piece with the rod 2.

[0021] It comprises support surface **3a**, suitable to support, preferably through interposing of a further element better defined below, at least one LED 4 and preferably only one LED 4.

[0022] The support surface 3a is realized by a flattened portion of the rod 2.

[0023] For example, it can be at least partly produced by partial flattening of the rod 2. In this way any discontinuity of the material, which would realize a thermal resistance, is avoided.

[0024] In particular, a flattening along only one portion of the rod 2 is preferred. This flattening therefore defines a substantially flat support surface 3 which, in the normal section (Fig. 4), essentially realizes a chord of the circumference defined by the outer surface of the rod 2.

[0025] Moreover, as this is a plastic deformation, the entire portion of rod 2 corresponding to the support surface 3a will be deformed by said flattening, as shown in a simplified manner in Fig. 4.

[0026] Finally, said flattening will achieve a reduction of section, visible in Fig. 2, preferably of between 10% and 50%.

[0027] The support structure 3a preferably has a base with a width close to the diameter of the rod 2 and conveniently of between 2 mm and 6 mm, and a length preferably of between 1 cm and 5 cm and more preferably between 2 cm and 3 cm.

[0028] Moreover, an opening **3b** is provided in proximity of an end of the support surface 3a, to place the inner hollow **2a** of the rod 2 in communication with the outer surface. It is conveniently substantially circular with a diameter close to the diameter of the rod 2.

[0029] Moreover, the support means 3 is preferably not produced at an end 2b of the rod 2, but at a distance

of over 5 mm from this end 2b, as shown in Fig. 1.

[0030] This solution allows dissipation of heat along both sides in the direction of extension of the rod 2.

[0031] The end 2b of the rod 2, close to the support means 3, therefore conveniently has an annular circular and open shape and, conveniently, also the end 2c further from the support means 3 has an annular circular and open shape so as to allow the passage of air inside the hollow 2a.

[0032] The support means 3 also comprises a plate **8** made of a material with high thermal conductivity, as specified above and more in particular of aluminium alloy.

[0033] The plate 8 is fixed directly to the support surface 3a and preferably has base dimensions similar to those of this support surface 3a, or between 3 and 5 mm and between 2 and 3 cm, and a height preferably between 0.5 and 2 mm.

[0034] It is conveniently fixed to the support surface 3a by means of releasable mechanical connections, such as two screws **11** disposed in proximity of the ends of the plate 8.

[0035] This solution makes it possible to avoid the presence of glues, which could reduce heat transmission between the plate 8 and the rod 2.

[0036] Moreover, elements such as conductive pastes and the like can be present between plate 8 and support surface 3a or alternatively a conductive weld or double-sided adhesive tape could be provided.

[0037] The plate 8 is therefore conveniently the portion of the support means 3 suitable to support the LED 4.

[0038] The LED 4 is realized by a printed circuit **4a** and a bulb, or primary lens, **4b**.

[0039] The printed circuit 4a is conveniently substantially rectangular and has base dimensions of between 1 mm and 5 mm.

[0040] The bulb 4b is made of polymer or silicone material or glass and preferably has an external diameter of between 0.3 mm and 3 mm and more preferably between 1.5 mm and 2 mm. Moreover, it has a substantially semi-spherical shape.

[0041] The LED 4 has a power of between 0.1 W and 50 W and more preferably between 0.5 W and 30 W.

[0042] It is known per se and realized, for example, by the LED known with the trade name PHILIPS LUMILED LUXEON Rebel.

[0043] The LED 4 is also connected to an electrical power source through electrical connections **5** suitable to supply power to this LED 4.

[0044] It comprises at least one conductor wire **6**, and preferably two, covered with a sheath, or braid, **7** made of polymer material and preferably polyester, or alternatively, not covered.

[0045] The conductor wires 6 are disposed at least partly inside the rod 2 and, in proximity of the opening 3b, have no sheath 7.

[0046] These conductor wires 6 without the sheath 7 then pass through the opening 3b and connect, mechanically and electrically, to at least one clamping element **9**. Preferably, two clamping elements 9 are present, one for each wire 6, disposed on the plate 8 and realized by welds suitable to support and clamp these wires 6.

[0047] The clamping elements 9 also connect the wires 6 of at least one connection element **10**.

[0048] The connection elements 10, also preferably two in number, are connected directly to the LED 4 and preferably realized by two electrical connections in conductive material realized by two flat elements, as shown in Fig. 1.

[0049] The plate 8, including the connection elements 10 conveniently disposed on the surface, is finally preferably coated with white paint along the outer surface. The support structure 1 according to the invention achieves important advantages.

[0050] In fact, due to the particular shape, this structure 1 allows optimum heat dispersion through the rod 2, which allows the LED 4 always to be maintained at optimum temperatures so as to prevent deterioration or overheating thereof.

[0051] The heat is dispersed in particular by the hollow and annular shape of the rod 2 and by the material with high thermal conductivity.

[0052] In particular, the heat is diffused on both sides of the rod 2, due to the fact that the support means 3 are positioned at one end of the rod 2.

[0053] Moreover, the structure of the rod 2 allows air to circulate inside the hollow 2a, as the ends 2b and 2c are not closed, and the creation of convective move.

[0054] Moreover, the structure of the rod 2 allows air to circulate inside the hollow 2a, as the ends 2b and 2c are not closed, and the creation of convective movements which allow superior cooling of the LED 2.

[0055] Furthermore, the structure 1 is easily deformable in an axial direction and therefore allows the rod 2 to be shaped as required.

[0056] Yet another advantage is given by the fact that the structure 1 does not have exposed cables which can give the structure an unsightly appearance.

[0057] The invention is susceptible to modifications and variants falling within the scope of the claims.

Claims

1. LED lighting device comprising a LED (4) and a support structure (1)

- said LED (4) being realized by a printed circuit (4a) and a primary lens (4b)
- said support structure (1) comprising a rod (2)
- said road (2) having an hollow and annular shape, an end (2b) and support means (3) having a support surface (3a) integral, in one piece with the rod (2) and supporting said LED (4)
- said support surface is realized by a flattened portion of said rod (2) said rod is in a metal material of high thermal conductivity and has,

- an external diameter of between 2 mm and 6 mm,
- an internal diameter of between 1 mm and 3 mm,
- a length exceeding 10 cm,

and in that
said support surface (3a) is disposed at a distance of over 5 mm from said end (2b), said support means (3) further comprising a plate fixed directly to said support surface (3a) and supporting one of said LED (4), said plate (8) having base dimensions similar to those of the support surface and being in a metal material of high thermal conductivity, preferably selected among copper, aluminium, silver, gold or other alloys.

2. A device according to claim 1, wherein said metal material is made of a nickel plated copper alloy.

3. A device according to one or more of the preceding claims, wherein said rod (2) comprises open ends.

4. A device according to one or more of the preceding claims, wherein said plate (8) is fixed to said support surface (3a) by means of mechanical connections (11).

5. A device according to claim 4, wherein said plate (8) is made of aluminium alloy.

6. A device according to one or more of the preceding claims, wherein said LED (4) has a power of between 10 W and 30 W.

7. A device according to one or more of the preceding claims, comprising electrical connections (5) suitable to supply power to said LED (4) and at least partly disposed inside said rod (2).

8. A device according to claim 7, wherein said rod (2) comprises an opening (3b) suitable to place the inside of said rod (2) in communication with the outer surface and wherein said electrical connections (5) pass through said opening (3b).

9. A device according to one or more of the preceding claims, wherein said rod (2) has an external diameter of between 2 mm and 4 mm.

Patentansprüche

1. LED-Leuchte, die eine LED (4) und eine Trägerstruktur (1) aufweist

- wobei die genannte LED (4) eine bedruckte Schaltung (4a) und eine Primärlinse (4b) umfasst
- wobei die genannte Trägerstruktur (1) eine Stange (2) umfasst
- wobei die genannte Stange (2) eine hohle und ringförmige Form und ein Ende (2b) und Trägerelemente (3) aufweist, die eine über eine Trägerfläche (3a) verfügen, die mit der Stange (2) eine Einheit bilden und die genannte LED (4) tragen
- wobei die genannte Trägerfläche aus einem abgeflachten Abschnitt der genannten Stange (2) und die genannte Stange (2) aus stark Wärme leitendem Werkstoff besteht und Folgendes aufweist
- einen Außendurchmesser zwischen 2 mm und 6 mm,
- einen Innendurchmesser zwischen 1 mm und 3 mm,
- eine Länge von mehr als 10 cm,

wobei
die genannte Trägerfläche (3a) sich in einem Abstand von mehr als 5 mm von dem genannten Ende (2b) befindet und das genannte Trägerelement (3) außerdem eine Platte umfasst, die direkt an der genannten Trägerfläche (3a) befestigt ist und eine der genannten LEDs (4) trägt und die genannte Platte (8) Grundabmessungen aufweist, die denen der Trägerfläche (3a) entsprechen und aus einem stark Wärme leitenden Werkstoff bestehen, der vorzugsweise aus Kupfer-, Aluminium-, Silber-, Gold- oder anderen Legierungen gewählt wird.

2. Vorrichtung nach Anspruch 1, bei der der genannte metallische Werkstoff aus einer Nickel-beschichteten Kupferlegierung besteht.

3. Vorrichtung nach einem oder mehreren der vorangegangenen Ansprüche, bei der die genannte Stange (2) offene Enden umfasst.

4. Vorrichtung nach einem oder mehreren der vorangegangenen Ansprüche, bei der die genannte Platte (8) an der genannten Trägerfläche (3a) anhand mechanischer Verbindungen (11) befestigt ist.

5. Vorrichtung nach Anspruch 4, bei der die genannte Platte (8) aus einer Aluminiumlegierung besteht.

6. Vorrichtung nach einem oder mehreren der vorangegangenen Ansprüche, bei der die genannte LED (4) eine Leistung zwischen 10 W und 30 W aufweist.

7. Vorrichtung nach einem oder mehreren der vorstehenden Ansprüche, die elektrische Anschlüsse (5) umfasst und geeignet ist, die genannte LED (4) mit Strom zu versorgen und sich zumindest teilweise im Inneren der genannten Stange (2) befindet.

8. Vorrichtung nach Anspruch 7, bei der die genannte Stange (2) eine Öffnung (3b) umfasst, die geeignet ist, die Innenseite der genannten Stange (2) mit der Außenfläche zu verbinden und in der die genannten elektrischen Anschlüsse (5) durch die genannte Öffnung (3b) verlaufen.

9. Vorrichtung nach einem oder mehreren der vorangegangenen Ansprüche, bei der die genannte Stange (2) einen Außendurchmesser zwischen 2 mm und 4 mm aufweist.

Revendications

1. Dispositif d'éclairage à DEL comprenant une DEL (4) et une structure de support (1)

- ladite DEL (4) étant réalisée au moyen d'un circuit imprimé (4a) et d'une lentille primaire (4b)
- ladite structure de support (1) comprenant une tige (2)
- ladite tige (2) ayant une forme creuse et annulaire, une extrémité (2b) et des moyens de support (3) ayant une surface de support (3a) intégrale, formant une seule pièce avec la tige (2) et supportant ladite DEL (4)
- ladite surface de support étant réalisée par une partie aplatie de ladite tige (2), ladite tige (2) étant en matériau métallique à haute conductivité thermique et ayant
- un diamètre extérieur compris entre 2 mm et 6 mm,
- un diamètre intérieur compris entre 1 mm et 3 mm,
- une longueur supérieure à 10 cm,

et **caractérisée en ce que**
ladite surface de support (3a) est placée à une distance supérieure à 5 mm de ladite extrémité (2b), lesdits moyens de support (3) comprenant en outre une plaque fixée directement sur ladite surface de support (3a) et supportant ladite DEL (4), ladite plaque (8) ayant des dimensions de base similaires à celles de la surface de support (3a) et étant en matériau métallique à haute conductivité thermique, sélectionné de préférence parmi cuivre, aluminium, argent, or ou autres alliages.

2. Dispositif selon la revendication 1, dans lequel ledit matériau métallique est réalisé en alliage de cuivre plaqué au nickel.

3. Dispositif selon une ou plusieurs des revendications précédentes, dans lequel ladite tige (2) comprend des extrémités ouvertes.

4. Dispositif selon une ou plusieurs des revendications précédentes, dans lequel ladite plaque (8) est fixée à ladite surface de support (3a) au moyen de liens mécaniques (11).

5. Dispositif selon la revendication 4, dans lequel ladite plaque (8) est réalisée en alliage d'aluminium.

6. Dispositif selon une ou plusieurs des revendications précédentes, dans lequel ladite DEL (4) a une puissance comprise entre 10 W et 30 W.

7. Dispositif selon une ou plusieurs des revendications précédentes, comprenant des connexions électriques (5) aptes à alimenter ladite DEL (4) et au moins partiellement placées à l'intérieur de ladite tige (2).

8. Dispositif selon la revendication 7, dans lequel ladite tige (2) comprend une ouverture (3b) apte à mettre l'intérieur de ladite tige (2) en communication avec la surface extérieure et dans lequel lesdites connexions électriques (5) passent à travers ladite ouverture (3b).

9. Dispositif selon une ou plusieurs des revendications précédentes, dans lequel ladite tige (2) a un diamètre extérieur compris entre 2 mm et 4 mm.

Fig. 1

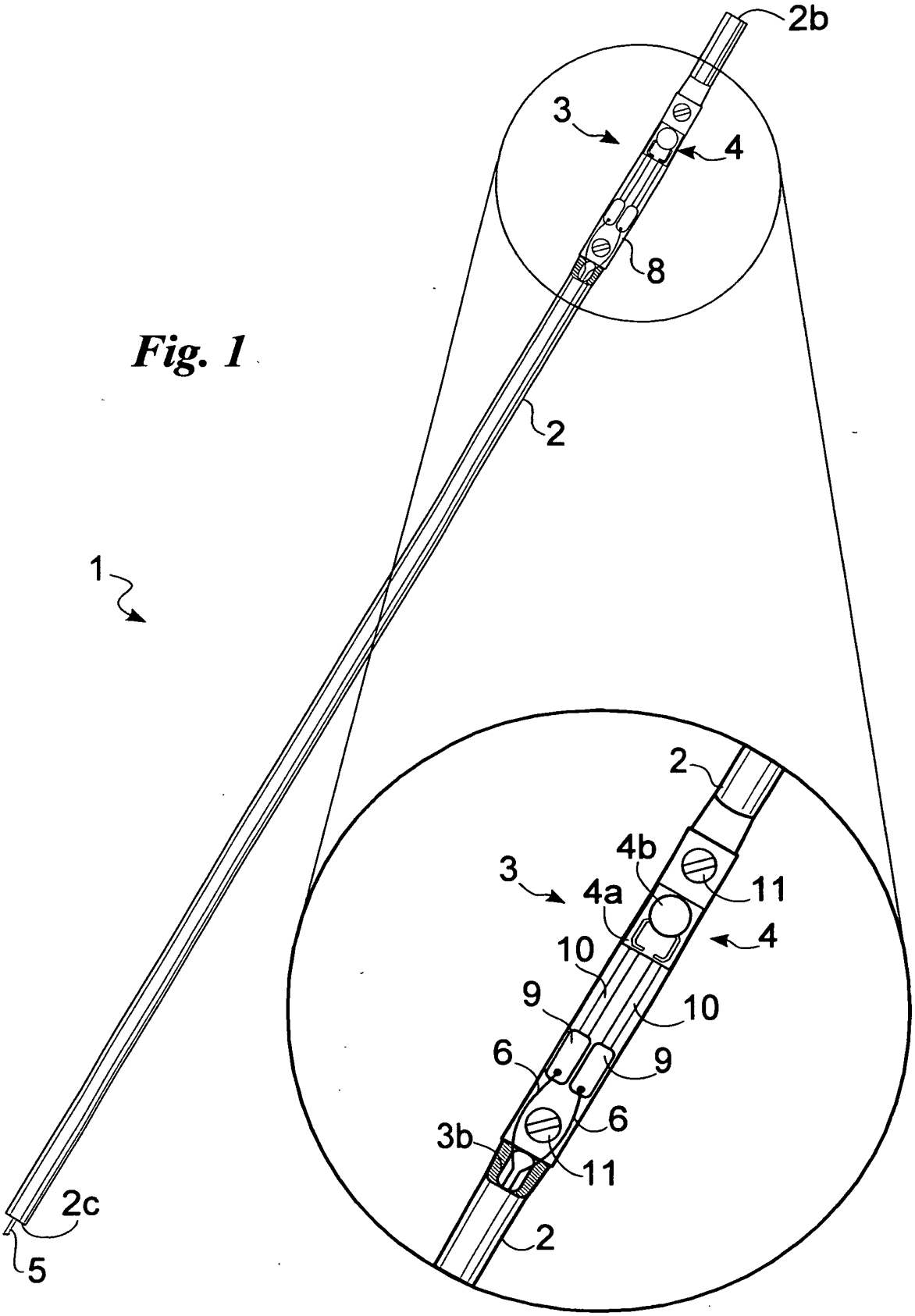
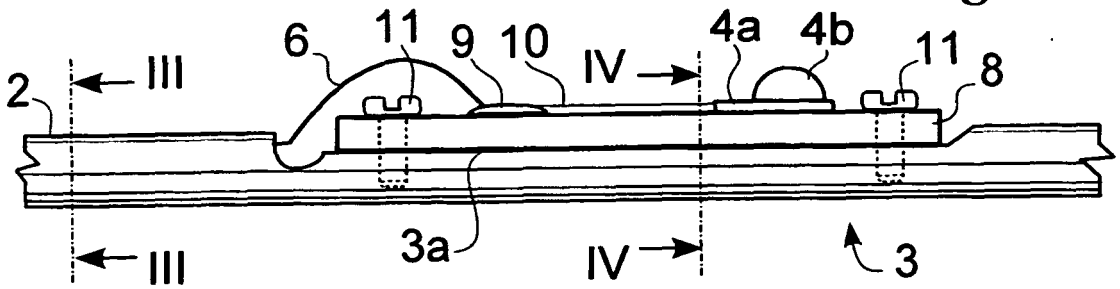


Fig. 2



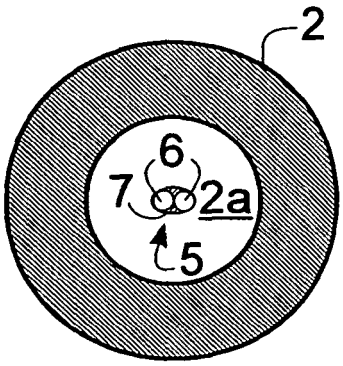


Fig. 3
sez. III-III

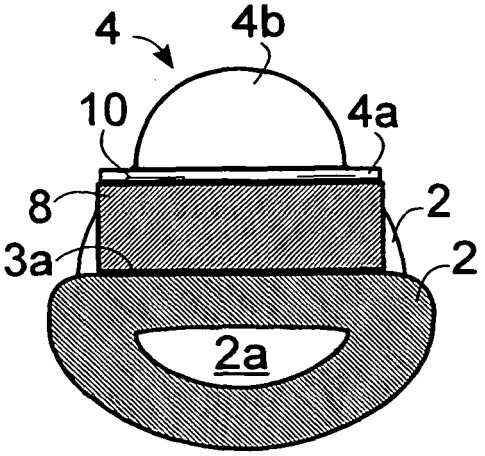


Fig. 4
sez. IV-IV

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

- WO 2007143991 A **[0009]**
- JP 2004 A **[0009]**
- JP 296245 A **[0009]**
- US 2003224687 A **[0009]**
- US 2004156199 A **[0009]**
- US 2009040776 A **[0009]**
- US 7434964 A **[0009]**