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

(11) EP 2 410 240 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
25.01.2012 Bulletin 2012/04

(21) Application number: **09841779.3**

(22) Date of filing: **17.11.2009**

(51) Int Cl.:
F21V 13/04 *(2006.01)* ***F21S 8/08*** *(2006.01)*

(86) International application number:
PCT/ES2009/070509

(87) International publication number:
WO 2010/106199 (23.09.2010 Gazette 2010/38)

(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 SM TR

(30) Priority: **17.03.2009 ES 200900736**

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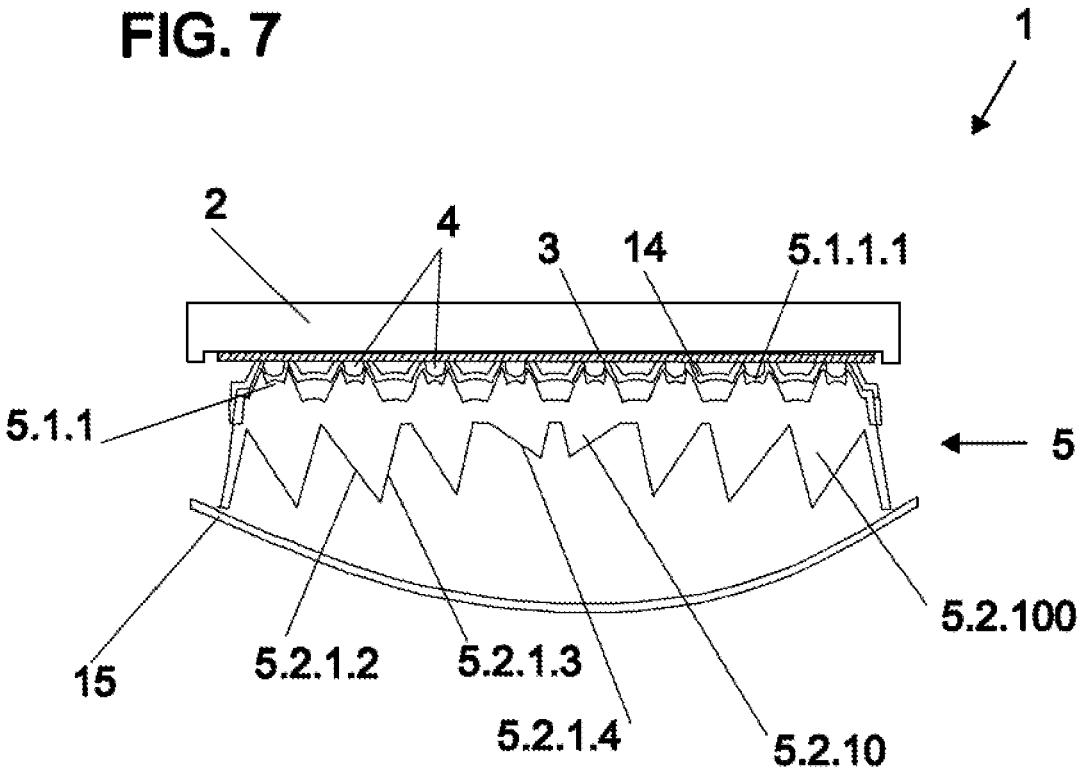
(54) OPTICAL DEVICE FOR AN LED LIGHT BULB

(57) This invention relates to an optical device for an LED luminaire lamp, intended to process the light beams emitted by the LEDs, formed by: a first face, from which emerge a set of luminous-flux collectors aligned with each of the LEDs; and a second face located on the part of the optical device opposite that comprising the first face, from which emerge means for projecting the light beams, formed in turn by prisms and conical lenses.

FIG. 7



EP 2 410 240 A1

Description

OBJECT OF THE INVENTION

[0001] The present invention relates to an optical device for an LED luminaire lamp, and specifically to luminaires having a set of LEDs forming rows and columns on a flat supporting plate.

[0002] The optical device of the invention is suitable for both outdoor use, as in streets, and for indoor use, as in households.

BACKGROUND OF THE INVENTION

[0003] Luminaires are devices designed to supply artificial light by means of a light source consisting in a lamp.

[0004] Luminaires intended for street lighting, and more generally outdoor lighting, normally consist of a lamp mounted on a luminaire attached to the upper end of a mast or support, placed at a sufficient height.

[0005] This type of illumination must comply with stringent regulations on lighting quality, and specifically those related to luminous flux, luminescence, surface area illuminated, uniformity of luminescence of said area and glare of the light source.

[0006] By way of example, a luminaire intended for illuminating a street must illuminate a substantially rectangular area on the floor of about 24 x 6 meters, with an illumination level greater than 10 lux, for example, with a relatively uniform luminescence in said area.

[0007] Luminaires are known with a light source formed by one or several incandescent lamps. These types of lamps consume a lot of power to provide only average illumination quality, at a high maintenance cost.

[0008] Also known are luminaires in which the lamp or light source are light-emitting diodes, or LEDs. LEDs are nowadays considered to be an advantageous alternative for reducing electric power consumption and increasing the lifetime of these illumination devices. In addition, LED-based luminaires allow precise illumination by controlling the amount of light emitted.

[0009] However, the use of LED luminaires for lighting or illumination has the following drawbacks:

[0010] An LED provides a large illumination angle, which means that the light is diffused greatly and that there are many losses in an application meant to illuminate an area distant from the light source obtained by LEDs. For this reason, LEDs are generally used with means for concentrating the light beams in order to unite the light beams in a maximum light intensity point that is oriented towards the area to be illuminated.

[0011] Another drawback of this type of lighting devices refers to the luminous power of LEDs, which is relatively weak. For this reason, it is necessary to combine several LEDs to obtain a luminous power equivalent to that of an incandescent lamp, for example. Normally, the LEDs are combined by grouping them in rows or luminous points with three LEDs.

[0012] In view of these limitations, LED luminaires are generally used in orientable illumination applications, such that the light beam can be oriented to illuminate a specific area, such as a reading spotlight in a vehicle, or a spotlight used in a theatre.

[0013] To optimise the light beams emitted by a LED, the lamps are combined with optical devices meant to obtain an optimum illumination by processing the light beams emitted by each LED.

[0014] LED luminaires (using LEDs as light sources) are known that are used for street lighting which comprise LEDs or bars of LEDs joined to a support that allows orienting the light beams of the LEDs in a direction to illuminate or light a specific area.

[0015] Specifically, a first illumination device or luminaire as explained above is known, described in patent WO-98/33007, which comprises several LEDs and means for processing the light beams emitted by said LEDs, in order to improve the distribution of the light beams on the area to illuminate. This document proposes an arrangement of the LEDs along different directions on an inclined support, and foresees means for processing the light beam using concentration and refraction means for each LED.

[0016] A second illumination device is known, described in patent WO-02/076788, comprising several LEDs, a curved support having a housing for each LED and means for processing the light beams emitted by the LEDs, formed by reflection and refraction means for each LED.

[0017] The arrangement of the LEDs along different directions proposed in these devices requires a poorly optimised assembly.

[0018] In fact, the above-described documents, the orientation of the light beams of the LEDs along the direction of the area to illuminate is achieved by arranging these LEDs on a support with inclined or curved surfaces, a configuration that is quite complex, so that it does not simplify its execution or cooling.

[0019] In addition, despite the configuration of the LED supports, the processing of the light beam emitted by each LED proposed in the above-described documents results in an uneven luminescence on the area to illuminate, this is, the luminous spot obtained is formed by several strongly illuminated areas.

[0020] A third known device, known and described in patent US-2004/0174706, comprises a flat support provided with a group of LEDs disposed in a grid and means for processing the light beams emitted by the LEDs. These means comprise reflection means by inclined slats separating the LED columns and refraction means superimposed on the reflection means.

[0021] The processing of the light beams emitted by the LEDs proposed by the illumination device described in patent US-2004/0174706 does not allow obtaining an illumination with an even luminescence, as it processes the orientation of the light beams in LED columns, obtaining a luminous spot composed of bands of variable

luminosity.

[0022] In view of the aforementioned drawbacks, the use of illumination means or luminaires with lamps based on LEDs for lighting or illumination is still inadequate for achieving a uniform lighting or illumination.

DESCRIPTION OF THE INVENTION

[0023] Therefore, the present invention relates to an optical device for an LED luminaire lamp for processing the light beams emitted by the LEDs, which has a set of LEDs disposed in rows and columns on a flat support plate which comprises:

- A first face located in correspondence with the flat support plate that holds the LEDs, from which emerge a set of luminous flux collectors in correspondence with each of the LEDs, such that these collectors form a truncated cone shape in which the truncation defines a cavity for housing at least part of the LED;

- A second face located in the face opposite that of the optical device, the first face, from which emerge means for projecting the light beams formed by a set of prisms, placed in correspondence with at least one part of the set of luminous flux collectors, so that the point defined by the prisms is pointing away from the second face from which said prisms emerge.

[0024] In addition, the invention relates to a lamp with an optical device for an LED luminary for treating the light beams emitted by the aforementioned LEDs.

[0025] With this configuration, the optical device for an LED luminary of the invention allows offering an even luminosity for the area to illuminate, even when the illumination source is considerably distant from the area to illuminate (for example, when it is used for an outdoor lighting luminary).

[0026] The configuration details corresponding to dependent claims 2 to 16 considered to be included by reference in this description.

DESCRIPTION OF THE DRAWINGS

[0027] The present specification is completed by a set of drawings, meant to illustrate the preferred example and in no way limiting the invention.

Figure 1 shows a perspective view of a luminary for outdoor lighting, for example in a street.

Figure 2 shows a schematic exploded view of a lamp.

Figure 3 shows a plan view of the support plate for the LEDs.

Figure 4 shows a perspective view of the optical device in which can be seen a first face defined by the device.

Figure 5 shows a perspective view of the optical device in which can be seen a second face defined by the device.

Figure 6 shows a cross-section view of a detail of the optical device showing the path followed by the light beam emitted by an LED when it passes through the optical device.

Figure 7 shows a cross-section view of a lamp with the optical device of the invention.

PREFERRED EMBODIMENT OF THE INVENTION

[0028] In view of the foregoing, the present invention relates to an optical device (5) for a luminary (10) with LEDs (4) for processing the light beams emitted by the LEDs (4) formed by a first face (5.1) from which emerge a set of luminous flux collectors (5.1.1) in correspondence with each LED (4) and a second face (5.2), located on the part of the optical device (5) opposite to the first face (5.1), from which emerge means for projecting the light beams, which in turn consist of some prisms (5.2.1) and some conical lenses (5.2.2) such that these flux collectors (5.1.1) and said projection means for the light beams are integrated in a single piece, forming the optical device (5).

[0029] Figure 1 shows, by way of example and in order to place the invention in context, a luminary (10) mounted on a support or mast (12) on the fac ade of a building or in a street, for example. This luminary (10) is composed of a top part (11) formed by a case and a bottom part (13) that can be open or covered by a transparent cover or casing, in order to let through the light emitted by a lamp located inside the casing formed by the top part (11) of the luminary (10).

[0030] Figure 2 shows a schematic representation of an example of the elements forming part of a lamp (1). Normally, a lamp is formed by a support (2), a support plate (3) in which the LEDs (4) are placed and an optical device (5) for processing the light beams emitted by the LEDs.

[0031] The support (2) can be mounted by suitable attachment means to the casing formed by the top part (11) of the luminary (10). On this support (2) is placed the support plate (3), formed by an electronics board consisting of a printed circuit on which the LEDs (4) are attached, arranged to form rows and columns. The supporting plate (3) ensures the power supply and management function for each LED.

[0032] The LEDs are preferably mounted in series in order to simplify the regulation of its power supply, so that the lamp (1) is powered by grid voltage for most object or place lighting applications. However, a parallel mounting can be considered.

[0033] Figure 3 shows an example of the implementation of the LEDs allowing to improve the illumination, particularly when the function is intended for an outdoor application, such as street lighting. However, as described above, this application is not limited to an outdoor lighting application and can be equally valid for an indoor lighting application.

[0034] The LEDs are arranged in straight lines (7) parallel to a first axis of the support plate (3) corresponding to the direction of the larger dimension of the area to light on the floor, and along symmetrical columns (8) along a second axis (9) of the support plate (3), the LEDs of which are perpendicular to the first axis (6) of the support plate (3). As shown in the figure, some of the columns (8) have a curvature radius that tends to move the LEDs away from the second axis (9) of the support plate (3), as they are farther from the first axis (6) of the support plate (3). As an advantageous factor, the curvature radius of the columns (8) decreases with the distance between the column (8) and the second axis (9) of the support plate (3).

[0035] Finally, to close the assembly on the bottom, an optical device (5) will be disposed as shown in figure 2, to process the light beams emitted by the LEDs in order to direct and optimise these beams to achieve an optimal illumination of the area to illuminate.

[0036] This optical device (5) can be formed by a single part with a first face (5.1), a second face (5.2) and a side wall (5.3), or by joining two parts, such that a first part forms the first face (5.1) of the optical device (5) and a second part forms its second face (5.2) and a side wall (5.3) to simplify the positioning of said optical device (5).

[0037] Figure 4 shows in detail the optical device (5) object of the invention seen from a first face (5.1) in correspondence with the LEDs (4).

[0038] From this first face (5.1) of the optical device (5.1) emerges a set of luminous flux collectors (5.1.1) in correspondence with each LED (4). Therefore, these collectors are disposed along rows and columns, and specifically along straight lines (18) parallel to a first axis (16) of the optical device corresponding to the direction of the larger dimension of the area to illuminate on the ground, and along columns (19) symmetrical to a second axis (17) of the optical device, substantially perpendicular to the first axis (16) of the optical device.

[0039] The function of these flux collectors (5.1.1) is to direct and concentrate the light emitted by the LEDs (4). To do so, each LED (4) is associated to a collector (5.1.1) with its axis aligned with the LED (4).

[0040] The flux collectors (5.1.1) have a truncated cone configuration, wherein the truncation forms a cavity (5.1.1.1) for housing at least one part of the LED (4). The surface of this cavity (5.1.1.1) is optically polished.

[0041] These collectors (5.1.1) can be, for example, of two different types, both with "X15B and "X24B symmetry of revolution, as shown in detail further below.

[0042] For a specific case, the optical device (5) is formed by 52 flux collectors (5.1.1), 18 of the "X15B type and 34 of the "X24B type. The centring of the axis of each collector (5.1.1.1) corresponds to the position of each LED (4).

[0043] In order to position each collector (5.1.1) as well as possible, it is possible to foresee means for positioning the optical device (5). These positioning means can consist of a side wall (5.3) that runs along the entire perimeter of the optical device (5), as shown in figure (4).

[0044] Figure 5 shows the optical device (5) of the invention from the face opposite the first face (5.1), this is, a view is shown from the second face (5.2) of the optical device (5).

[0045] From this second face (5.2) emerge means for projecting the light beams formed by a set of prisms (5.2.1) and additionally, by a set of conical lenses (5.2.2) placed in correspondence with the set of luminous flux collectors (5.1.1); this is, each projection means is in correspondence with a flux collector (5.1.1).

[0046] The prisms (5.2.1) are disposed such that the point (5.2.1.1) that they define is pointing in the direction opposite the second face (5.2) from which emerge said prisms (5.2.1), this is, the point (5.2.1.1) is pointing towards the outside of the lamp (1) where the light beams are projected out.

[0047] The function of these prisms (5.2.1) that form the projection means is to project the light beams resulting from each flux collector (5.1.1).

[0048] Depending on their position, these prisms have different heights and orientations. These two characteristics of the prisms (5.2.1) depend on the intended application of the luminary (10), in order to optimise the illumination provided by the LEDs (4) that form part of the lamp (1) of said luminary (10).

[0049] The prisms (5.2.1) that emerge from the second face (5.2) of the optical device (5) can be divided into two large groups, a first group of prisms (5.2.10) and a second group of prisms (5.2.100).

[0050] The second group of prisms (5.2.100) has at least two surfaces with an optical function, a reflection surface (5.2.1.2) and a refraction surface (5.2.1.3).

[0051] The function of the reflection surfaces is to change the direction of the light beam received from the flux collector (51.1). These surfaces have an optical treatment consisting of an optical polishing.

[0052] The function of the reflection surfaces (5.2.1.2) is to project the light beam received towards the outside. These surfaces have an optical treatment consisting of polishing.

[0053] On another hand, the first group of prisms (5.2.10) only has one surface with a single optical function, specifically a refraction surface (5.2.1.4) with an optical treatment consisting of frosting.

[0054] The conical lenses (5.2.2) have an optical reflection surface (5.2.2.1).

[0055] For a specific case, the projection means forming the second face of the optical device (5) are disposed symmetrically to a third axis (20) of the optical device (5). This third axis (20) is located in correspondence with the

second axis (9) of the support plate (3) holding the LEDs (4) and the second axis (17) of the optical device (5) located on the first face (5.1) thereof.

[0056] In this way, two central columns (c1 nd c2) are defined on either side of the third axis (20) of the optical device (5). These central columns (c1 and c2) have a certain curvature such that, as the separation from the prisms (5.2.1) located on said central columns (c1 and c2) increases with respect to a fourth axis (21) of the optical device which is perpendicular to the third axis (20) of the optical device (5), the separation increases between the prisms (5.2.1) located in the central rows (c1 and c2) and with respect to the third axis (20) of the optical device (5).

[0057] These two central columns (c1 and c2) are occupied by at least prisms (5.2.1) belonging to the first group of prisms (5.2.10) formed, for a specific configuration, by 5 prisms each. These prisms (5.2.1) of the first group of prisms (5.2.10) have a lower height than that of the prisms (5.2.1) that form part of the second group of prisms (5.2.100).

[0058] The second group of prisms (5.2.100) is placed after the central columns (c1 and c2) along lateral columns (c3) that also have a certain curvature, in correspondence with the columns (8) along which are disposed the LEDs (4) on the support plate (3).

[0059] For a specific case, three lateral columns (c3) of prisms (5.2.100) are placed after each of the central columns (c1 and c2), maintaining a symmetrical configuration of the projection means formed in the second face (5.2) of the optical device (5) with respect to the third axis (20) of the optical device (5).

[0060] These lateral columns (c3) are formed by two first columns closer to the third axis (20), formed by 7 prisms (5.2.100) each and one third column formed by 5 prisms (5.2.100).

[0061] Finally, and for a specific case, the central columns (c1 and c2) formed by prisms (5.2.1) corresponding to a first group of prisms (5.2.10), can be occupied in a first end (c1.1, c2.1) of these columns (c1 and c2) and by at least one prism of the second group (5.2.100) and in a second end (c1.2, c2.2) of said central columns (c1, c2) by at least one conical lens (5.2.2), so that the symmetry is maintained with respect to the third axis (20) of the optical device (5).

[0062] According to a specific example of the invention, the projection means of the light beams are preferably formed by 50 prisms (5.2.1) placed in correspondence with 50 of the flux collectors (5.1.1) and by 2 conical lenses (5.2.2) placed in correspondence with the remaining 2 flux collectors (5.1.1).

[0063] The optical device (5) is preferably made of a plastic material, specifically PMMA/PC, and is manufactured by an injection process.

[0064] Figure 6 shows a detailed view of the optical device (5), in order to represent the path followed by a light beam emitted by an LED (4).

[0065] As shown in the figure, the light beam emitted by the LED (4) is oriented by the flux collector (5.1.1), directing it toward the prism (5.2.1), and specifically toward its reflection surface (5.2.1.2), where it changes direction and is projected towards the refraction surface (5.2.1.3) of said prism (5.2.1) through which it is projected towards the outside.

[0066] Finally, figure 7 shows an example of the configuration of a lamp (1) with the optical device (5) of the invention with a cross-section of the optical device (5) along the fourth axis 821) of said optical device (5).

[0067] In this case, the lamp is formed by a support (2) in which is mounted the support plate (3) formed by the printed circuit with the LEDs (4), a mirror support (14) formed by a set of alveoli in correspondence with each LED (4) and finally the optical device (5) of the invention.

[0068] In addition, in order to protect the optical device (5) that is in contact with the outside, it is possible to place a protective cover (15) to cover the optical device (5) on the bottom, that is, covering the second face (5.2) of the optical device (5).

[0069] This protective cover (15) can be convenient as the height of some of the prisms (5.2.1) can act as a dust trap that is hard to clean.

[0070] However, this protective cover (15) can have drawbacks, as the cover (15) implies reflection losses, which reduces the performance of the luminary.

[0071] In order to minimise these losses, the cover (15) should have a suitable radius of curvature and be free of edges that may obstruct the light beam coming from the optical device (5).

[0072] This protective cover (5) can be made of PC, for example.

[0073] The essence of this invention is not altered by variations in the materials, shape, size and arrangement of its component elements, described in a non-limiting way that should allow its reproduction by one skilled in the art.

Claims

1. Optical device for luminary with LEDs for processing the light beams emitted by the LEDs having a set of LEDs (4) arranged in rows and columns on a flat support plate (3) that comprises:

   - A first face (5.1) located in correspondence with the flat support plate (3) that holds the LEDs (4), from which emerge a set of luminous flux collectors (5.1.1) in correspondence with each of the LEDs (4), such that these collectors (5.1.1) form a truncated cone shape in which the truncation defines a cavity (5.1.1.1) for housing at least part of the LED (4);
   - A second face (5.2) located in the face opposite that of the optical device (5), the first face (5.1), from which emerge means for projecting the light beams formed by a set of prisms (5.2.1) located

in correspondence with at least one part of the set of luminous flux collectors (5.1.1), so that the point (5.2.1.1) defined by the prisms (5.2.1) is pointing away from the second face (5.2) from which said prisms (5.2.1) emerge.

2. Optical device for luminary with LEDs according to claim 1, **characterised in that** the optical device is formed by a single part having the first face (5.1) from which emerge the collectors (5.1.1) and the second face (5.2) from which emerge the means for projecting the light beams.

3. Optical device for luminary with LEDs according to claim 1, **characterised in that** the optical device is formed by two parts such that a first part forms the first face (5.1) from which emerge the collectors (5.1.1) and a second part forms the second face (5.2) from which emerge the means for projecting the light beams.

4. Optical device for luminary with LEDs according to claim 1, **characterised in that** the means for projecting the light beams are also formed by conical lenses (5.2.2) in correspondence with a second part of the luminous flux collectors (5.1.1).

5. Optical device for luminary with LEDs according to claim 1, **characterised in that** the means for projecting the light beams are disposed in a symmetric configuration with respect to a third axis (20) of the optical device (5) located in correspondence with the second axis (9) of the support plate (3) of the LEDs (4).

6. Optical device for luminary with LEDs according to claim 1, **characterised in that** two groups of prisms (5.2.1) are established, a first group of prisms (5.2.10) and a second group of prisms (5.2.100).

7. Optical device for luminary with LEDs according to claim 6, **characterised in that** the first group of prisms (5.2.10) is established along two central columns (c1 and c2) on either side of the third axis (20) of the optical device (5) and **in that** this first group of prisms (5.2.10) has a single optical surface (5.2.1.4) for refraction.

8. Optical device for luminary with LEDs according to claim 6, **characterised in that** the second group of prisms (5.2.100) is established along lateral columns (c3) placed after each of the central columns (c1 and c2) and **in that** this second group of prisms (5.2.100) has two optical surfaces, a reflection surface (5.2.1.2) and a refraction surface (5.2.1.3).

9. Optical device for luminary with LEDs according to claims 4 and 7, **characterised in that** a conical lens is disposed on a second end (c1.2 and c2.2) of each of the central columns (c1 and c2).

10. Optical device for luminary with LEDs according to claim 7, **characterised in that** a prism is disposed belonging to the second group of prisms (5.2.100) on a first end (c1.1 and c2.1) of each of the central columns (c1 and c2), formed by two optical surfaces, a reflection surface (5.2.1.2) and a refraction surface (5.2.1.3)

11. Optical device for luminary with LEDs according to claim 1, **characterised in that** the prisms (5.2.1) have different heights.

12. Optical device for luminary with LEDs according to claims 1 and 4, **characterised in that** it comprises 52 flux collectors (5.1.1), 50 prisms (5.1.1) and 2 conical lenses (5.2.2), such that each prism (5.2.1) and each conical lens (5.2.2) is in correspondence with a flux collector (5.1.1).

13. Lamp with optical device for luminary with LED, **characterised in that** it comprises:

- An optical device 85 that in turn comprises:

  a) A first face (5.1) located in correspondence with the flat support plate (3) that holds the LEDs (4), from which emerge a set of luminous flux collectors (5.1.1) in correspondence with each of the LEDs (4), such that these collectors (5.1.1) form a truncated cone shape in which the truncation defines a cavity (5.1.1.1) for housing at least part of the LED (4);
  b) A second face (5.2) located in the face opposite that of the optical device (5), the first face (5.1), from which emerge means for projecting the light beams formed by a set of prisms (5.2.1), located in correspondence with at least one first part of the set of luminous flux collectors (5.1.1), so that the point (5.2.1.1) defined by the prisms (5.2.1) is pointing away from the second face (5.2) from which said prisms (5.2.1) emerge;

- A flat support plate (3);
- A group of LEDs (4) disposed on the support plate (3) arranged in rows and columns.

14. Lamp with optical device for luminary with LED according to claim 13, **characterised in that** it comprises a mirror support (14) disposed on the support plate (3).

15. Lamp with optical device for luminary with LED according to claim 13, **characterised in that** it com-

prises a support (2) on which the support plate (3) is mounted.

16. Lamp with optical device for luminary with LED according to claim 13, **characterised in that** it comprises a protective cover (15) for covering the optical device (5) on the bottom.

FIG. 1

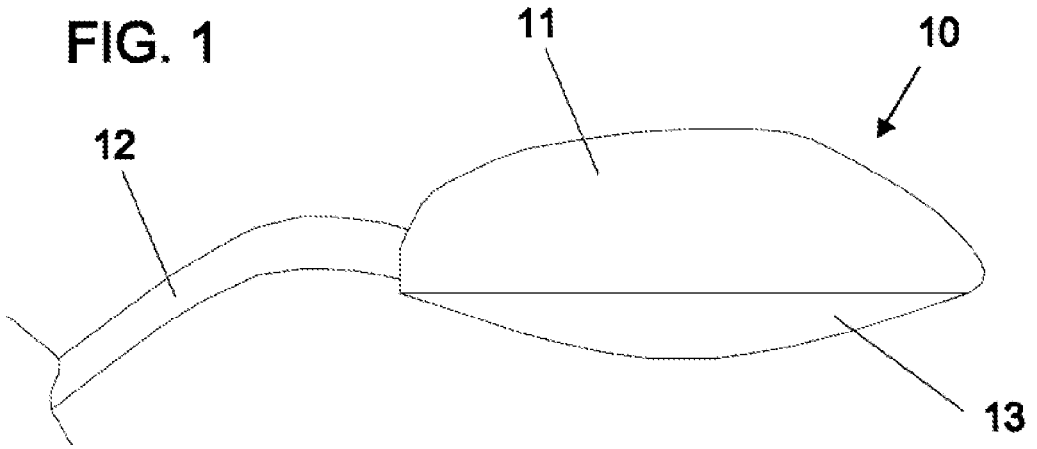


FIG. 2

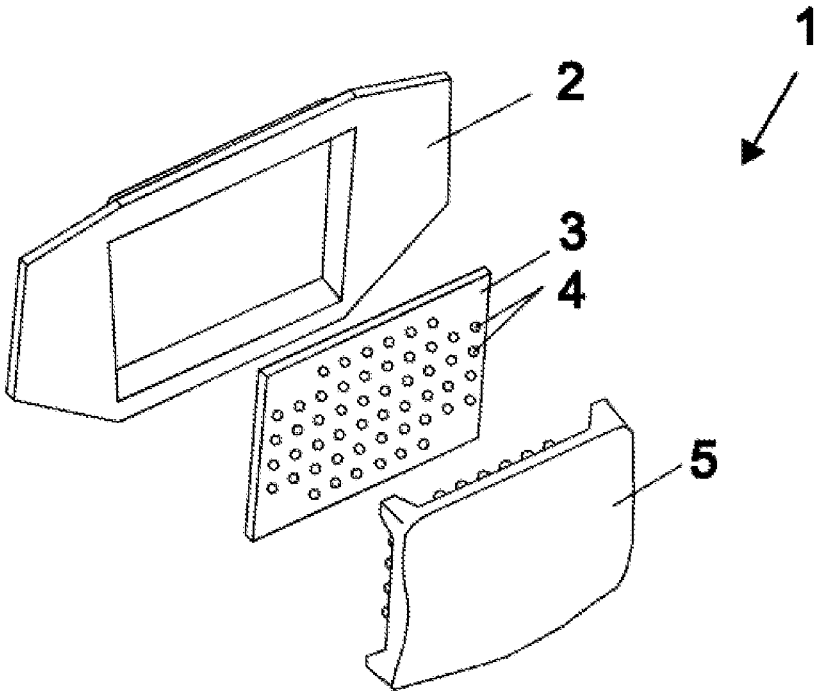


FIG. 3

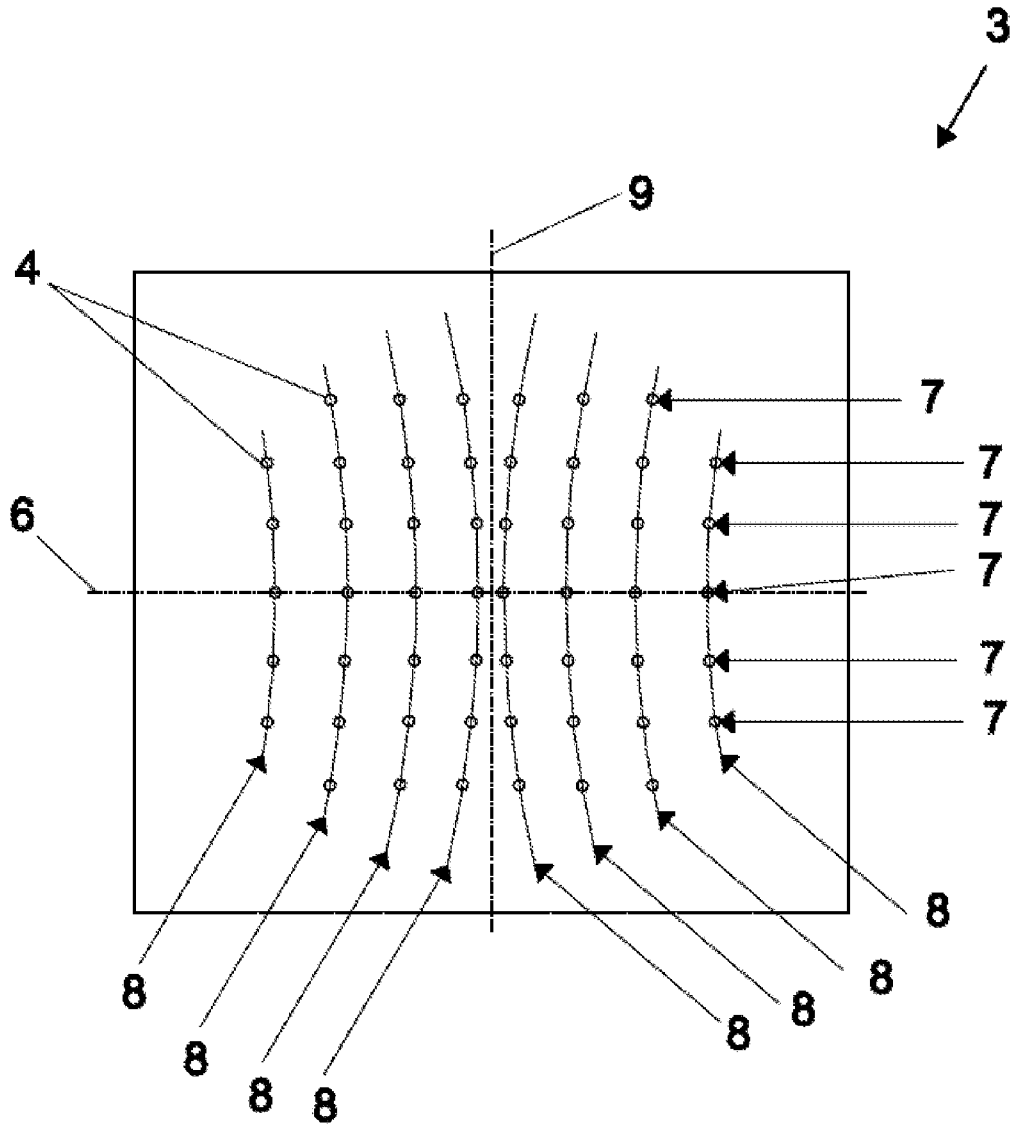


FIG. 4

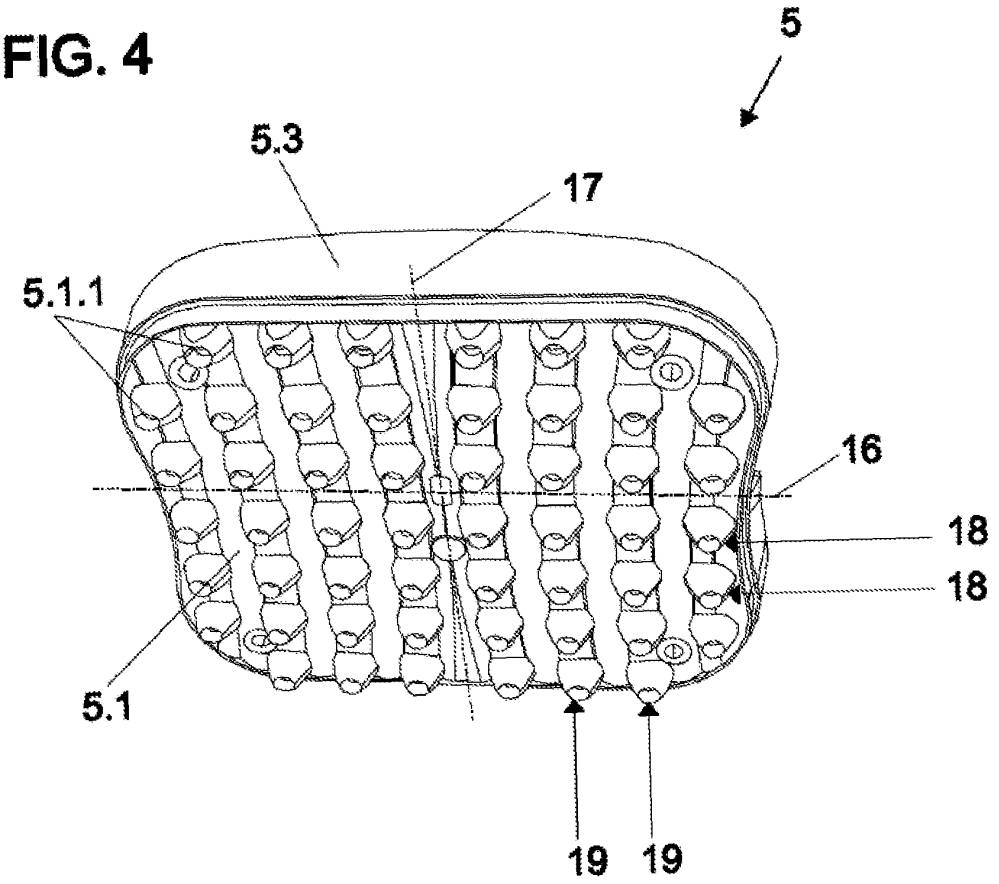

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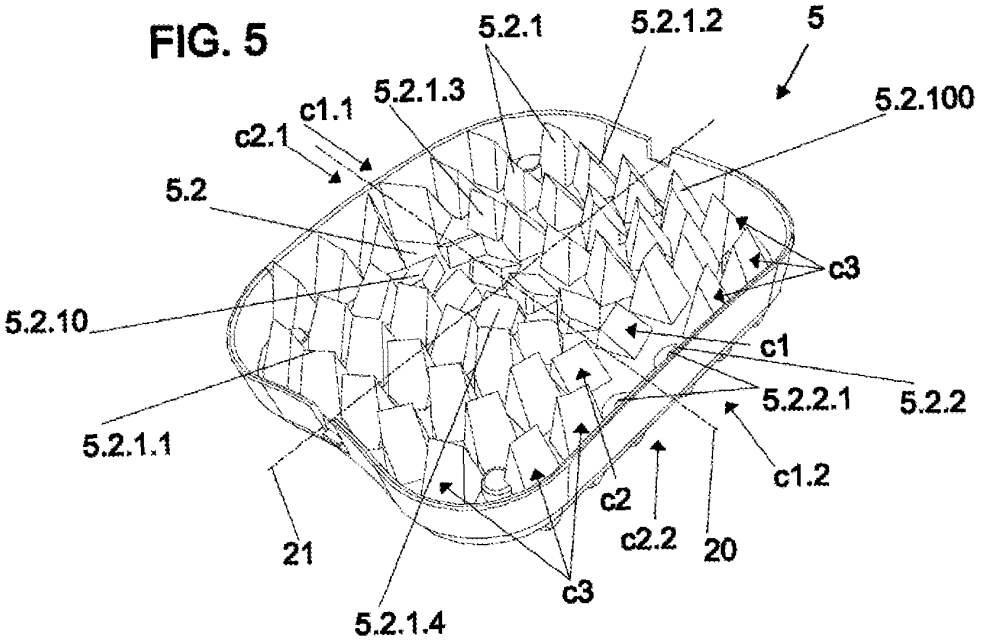
FIG. 5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5.2.1.1
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c2
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20
21
c3
5.2.1.4

FIG. 6

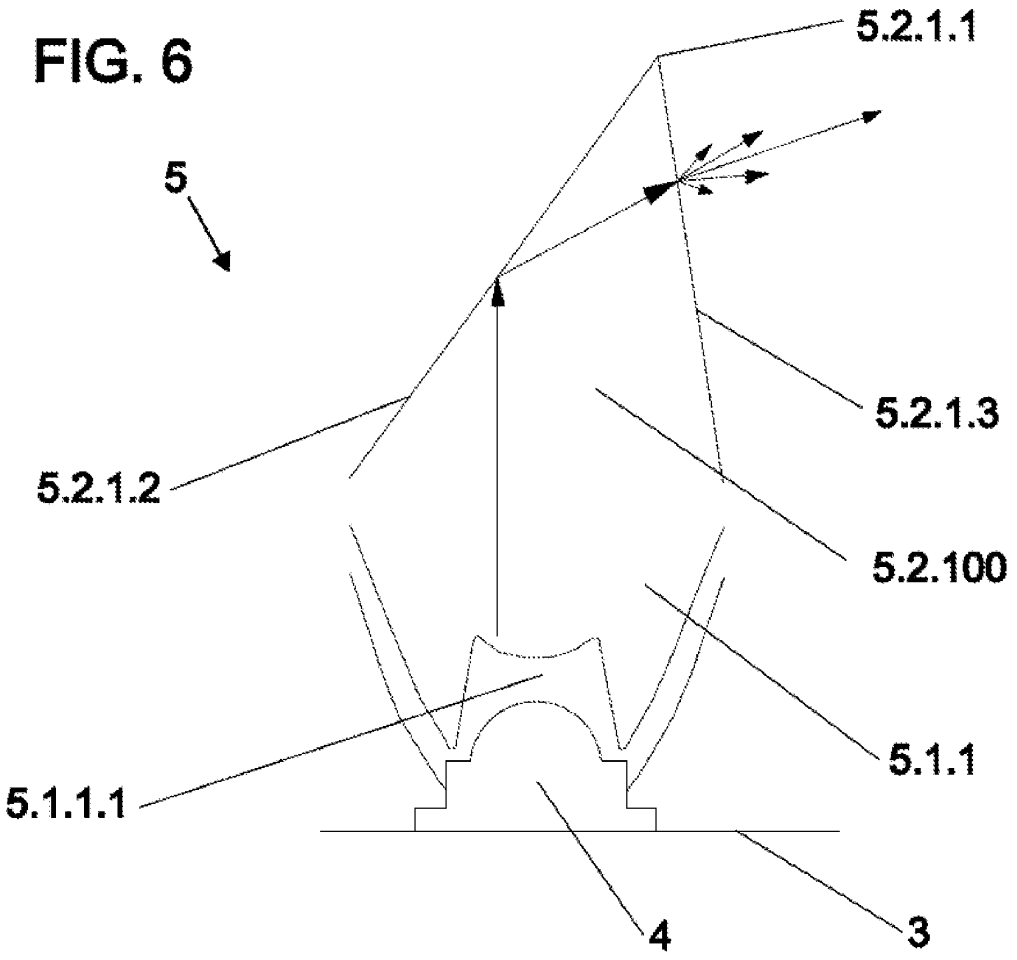
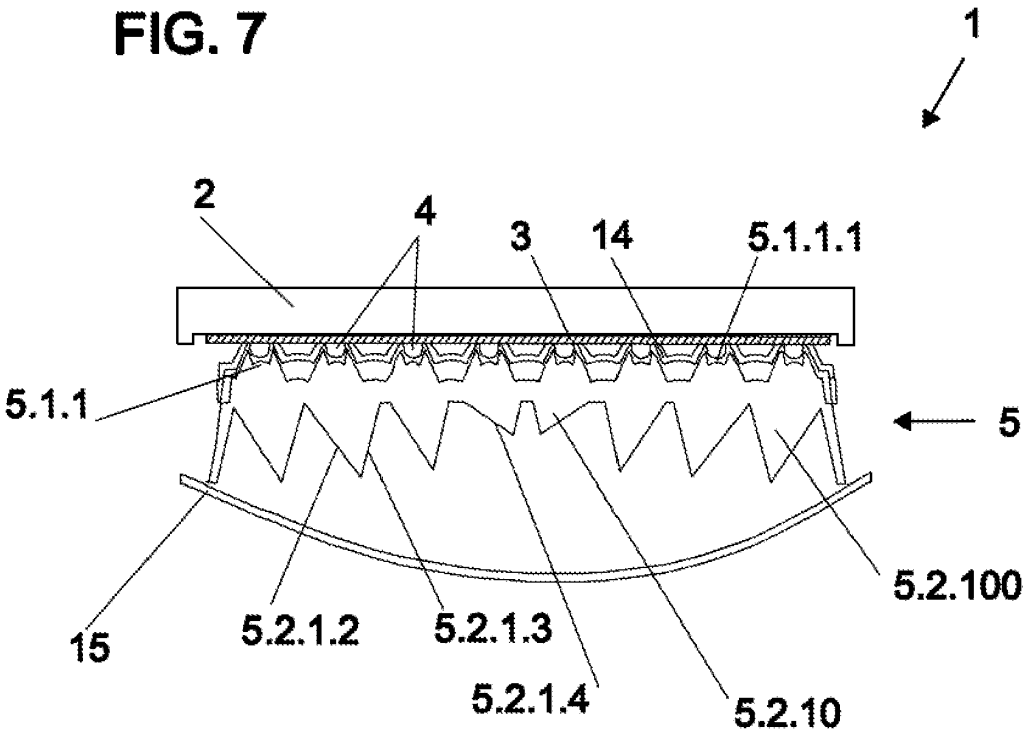

5.2.1.1
5
5.2.1.3
5.2.1.2
5.2.100
5.1.1
5.1.1.1
4
3

FIG. 7


1
2
4
3
14
5.1.1.1
5.1.1
5
5.2.100
15
5.2.1.2
5.2.1.3
5.2.1.4
5.2.10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ ES 2009/070509

A. CLASSIFICATION OF SUBJECT MATTER

see extra sheet
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)

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)

EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y Y A	WO 2008125772 A1 (LYRACOM ; PETIT MICHEL ; URRUTIA STEPHANE ; BERNEX) 23.10.2008, page 3, line 26 - page 4, line 24; page 6, line 16 - page 8, line 6; page 11, line 23 - page 15, line 6; claim 1, figure 1, figure 10, figure 11.	1-5 y 12-16 6 y 7 11 8-10
Y	DE 3729554 A1 (PETER A BALLA) 16.03.1989, figure 1, abstract.	6 y 7
Y	WO 2007111547 A1 (PRISMALENCE AB ; BERGKVIST LARS A) 04.10.2007, claims 1-4; figures 4-5.	11

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 March 2010 (15.03.2010)	**(18/03/2010)**
Name and mailing address of the ISA/ O.E.P.M. Paseo de la Castellana, 75 28071 Madrid, España. Facsimile No. 34 91 3495304	Authorized officer M. Argüeso Montero Telephone No. +34 91 349 32 73

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ ES 2009/070509

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
WO 2008125772 A	23.10.2008	FR 2913484 A	12.09.2008
		FR 2913483 A	12.09.2008
		EP 20080775672	04.03.2008
			04.03.2008
DE 3729554 AC	16.03.1989	CH 664817 A	31.03.1988
WO 2007111547 A	04.10.2007	SE 0600675 A	20.02.2007
		SE 0600675 L	20.02.2007
		SE 528795 C	20.02.2007
		EP 1999406 A	10.12.2008
		EP 20060824596	30.11.2006

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES 2009/070509

CLASSIFICATION OF SUBJECT MATTER

F21V 13/04 (2006.01)
F21S 8/08 (2006.01)

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 9833007 A **[0015]**
- WO 02076788 A **[0016]**
- US 20040174706 A **[0020] [0021]**