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(54) Title: ILLUMINATION DEVICE

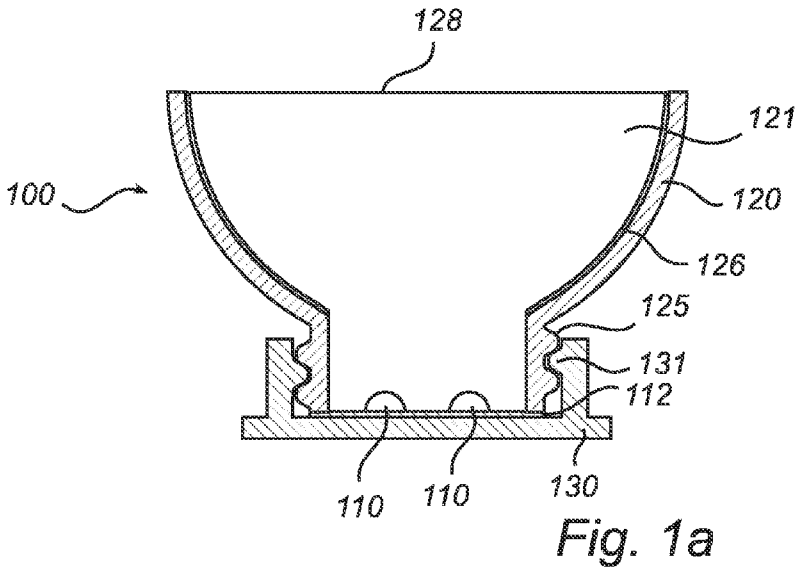


Fig. 1a

(57) Abstract: An illumination device (100) comprising: a light source (110) arranged to generate light, an envelope (120) at least partially enclosing said light source (110), and a carrier (130) arranged to support said light source (110), wherein said envelope (120) comprises glass and wherein said envelope (120) further comprises at least one thread (125) arranged for connection to a corresponding at least one thread (131) of said carrier (130).

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Illumination device

FIELD OF THE INVENTION

The present invention relates to an illumination device and, in particular, to an illumination device suitable for the use of light-emitting diodes (LED).

BACKGROUND OF THE INVENTION

The use of light-emitting diodes (LED) for illumination purposes continues to attract attention. Compared to incandescent bulbs, LEDs provide numerous advantages such as a longer operational life, a reduced power consumption, and an increased efficiency related to the ratio between light energy and heat energy. LED lamps may be used for a general lighting or even for a more specific lighting, as the colour and the output power of the LEDs may be tuned.

Generally, a lamp or illumination device comprises several parts which are assembled for a desired functioning of the lamp or illumination device, wherein these parts may provide one or more of electrical connection, mechanical support, heat management, etc. In the case of a lamp or illumination device comprising LEDs, these parts may e.g. comprise a mixing cavity for the purpose of homogenizing light and/or for converting the wavelength of the light to be emitted from the lamp or illumination device, a printed circuit board (PCB) for electrical connection of the LEDs, a heat sink for dissipating excessive heat from the LEDs, etc.

In EP 0 850 487, an electric lamp is disclosed, comprising a lamp envelope including a pressed glass reflector body. A light source is arranged within the lamp envelope, wherein the light source is electrically connected to a lamp base. The electric lamp further comprises a metallic skirt portion which is clamped to the pressed glass reflector body of the lamp envelope and which carries the lamp base.

In view of this, there may be an interest of an illumination device which provides alternative solutions with respect to the assembly of the illumination device.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an illumination device which achieves an easy assembly of the illumination device while still providing desired properties of the illumination device during operation.

This and other objects are achieved by providing a illumination device having the features in the independent claim. Preferred embodiments are defined in the dependent claims.

Hence, according to the present invention, there is provided an illumination device comprising a light source arranged to generate light. The illumination device comprises an envelope which at least partially encloses the light source. The illumination device further comprises a carrier which is arranged to support the light source. Furthermore, the envelope comprises glass and the envelope comprises at least one thread arranged for connection to a corresponding at least one thread of the carrier. Thus, the present invention is based on the idea of providing an illumination device wherein the envelope comprises glass which further is threaded for mechanical connection to a threaded carrier. Hence, the threaded glass and the threaded carrier of the illumination device provide an efficient and easy assembly of the illumination device, as the envelope easily and conveniently fits the carrier by the respective threads. Moreover, the unique mechanical and optical properties of glass even further improve the assembly and the operation of the illumination device.

By the term "envelope", it is here meant substantially any optical element for enclosing the light source.

By the term "carrier", it is here meant substantially any element for mechanical support (e.g. a substrate), thermal support and/or electrical support (e.g. an electrically conductive element for supplying electricity) of the light source.

The present invention is advantageous in that the threaded glass and the carrier of the illumination device provides an efficient, easy and fast assemblage of the illumination device. The threaded glass of the envelope is thereby easily mounted to the threaded carrier with one simple movement, and the illumination device assembly may readily be performed at automated assembly lines. The present invention further provides an easy replacement of the envelope, e.g. in the case of damage of the envelope and/or in a case it is desired to use an envelope with different optical and/or mechanical properties. The threaded glass of the envelope further provides a secure mechanical connection between the envelope and the carrier (which may act as a mechanical and/or electrical support for the light source) of the illumination device. Illumination arrangements in the prior art often comprise several parts, and the assembly of these parts is often circumstantial and troublesome as several steps are

needed for the mounting of these illumination arrangements. In contrast, the illumination device of the present invention provides an efficient and easy assemblage of the illumination device.

Furthermore, as the present invention provides the use of threaded glass of the envelope for a mechanical connection to the carrier, any additional use of glue and/or polymers, which often are used in prior art for fixation purposes, may be refrained from, and the present invention consequently provides an inexpensive and more easily achieved connection. Moreover, compared to prior art techniques, the mechanical connection of the present invention avoids any accidental smudging of glue and/or polymers on the envelope which may deteriorate the optical properties of the illumination device, e.g. by an obstructing and/or an undesired refraction of the light. The present invention mitigates/overcomes problems of this kind and provides an improved light distribution from the illumination device. Hence, compared to prior art arrangements, the present invention provides a more inexpensive, simpler and more easily assembled illumination device.

The present invention is further advantageous in that the glass material of the envelope provides an even further improved assembly of the illumination device compared to the use of other materials of the envelope, as glass provides a high mechanical stability and in that it may be produced in an easy, conventional and inexpensive manner.

The present invention is further advantageous in that the glass material of the envelope comprises advantageous optical properties compared to other materials, which further improves the operation of the illumination device. The use of glass provides a higher heat resistance compared to other materials which may be used in prior art arrangements, such as plastics. For example, as the thermal expansion of glass is lower than of e.g. plastics, the glass material of the present invention provides an improved operation of the illumination device at temperature variations, such as a heating of the glass at operation of the illumination device as well as a subsequent cooling when the illumination device is turned off. Furthermore, glass does not age under the influence of high temperatures or blue light. Consequently, the present invention improves the operational life of the illumination device and thereby also improves its reliability during operation.

The present invention is further advantageous in that the combination of the mechanical threaded connection of the envelope and the use of glass material in the envelope allows the illumination device to withstand high operating temperatures which other existing arrangements cannot withstand, e.g. due to the use of glues and/or polymers for fixation purposes, wherein these are susceptible to heat.

The present invention is further advantageous in that it allows an envelope which is reduced in size compared to other arrangements in the prior art, which in turn leads to a smaller illumination device. Consequently, more space may be provided for other functionalities of the illumination device, such as an integrated heat-sink structure for a heat management of the illumination device.

The present invention is further advantageous in that the glass material provides the ability to mould any further desired features to the glass, e.g. for light-modifying purposes of the illumination device.

The present invention is further advantageous in that the illumination device comprises a low number of components, thereby providing an easy assembly and/or relatively inexpensive realization of the illumination device. Moreover, the illumination device of the present invention is suitable both for retrofit and non-retrofit solutions. For example, the illumination device may be readily re-designed for specific purposes, e.g. regarding its optical properties (such as the light distribution) and/or its physical properties (such as size/dimensions of the illumination device).

According to an embodiment of the present invention, the envelope may be a mixing vessel. By the term "vessel" it is here meant substantially any element for enclosing a cavity around the light source of the illumination device and for mixing the light from the light source during operation of the illumination device. The present embodiment is advantageous in that the mixing vessel may provide a modification of the properties of the light from the light source, such as a homogenized light exiting from the illumination device and/or a conversion of the wavelength of the light from the light source, e.g. by a remote phosphor arrangement. The present embodiment is further advantageous in that the threaded mixing vessel is easily mounted to the threaded carrier of the illumination device, which leads to an easy assembly of the illumination device. Furthermore, the mixing vessel may readily be replaced, e.g. in case of a damaged mixing vessel and/or in the case it is desired to use a mixing vessel which may provide different light-modifying properties.

According to an embodiment of the present invention, the envelope may comprise pressed glass, blown glass, or a combination thereof. The present embodiment is advantageous in that the glass material(s) is (are) relatively inexpensive and easily producible.

According to an embodiment of the present invention, the carrier may comprise a printed circuit board (PCB). Hence, in the present embodiment, the printed circuit board, which is arranged for an electrical connection to the light source, may comprise at

least one thread such that the envelope is arranged for connection to a corresponding thread of the printed circuit board. The present embodiment is advantageous in that the envelope and the printed circuit board are thereby easily connectable. Furthermore, the direct connection between the envelope and the printed circuit board may render additional means for connection purposes between the envelope and the printed circuit board superfluous. The present embodiment is advantageous in that the carrier, comprising the printed circuit board, provides a stable connection between the envelope and the carrier of the illumination device.

According to an embodiment of the present invention, the carrier may comprise a heat-sinking structure arranged for dissipating heat from the carrier. The present embodiment is advantageous in that the threaded connection between the envelope and the carrier provides a secure and/or tight connection between the envelope and the heat-sinking structure of the carrier, such that heat may be efficiently transferred from the envelope to the heat-sinking structure of the carrier during operation of the illumination device. The present embodiment is further advantageous in that heat from the printed circuit board of the carrier may be efficiently transferred to the heat-sinking structure. Since the function of heat evacuation is fulfilled by the heat-sinking structure of the carrier of the illumination device, the present invention is further advantageous in that it does not require any additional (or specific) components for heat transfer. Furthermore, according to an embodiment of the present invention the carrier additionally comprises a printed circuit board, which is pressed against the heat sinking structure by the envelope because the threaded connection between the envelope and the carrier forces/presses the printed circuit board against the heat-sinking structure of the carrier. This may generate an efficient thermal contact between the printed circuit board and the heat-sinking structure of the carrier, and an effective heat dissipation of the illumination device may be achieved without the need of additional components/additives for thermal contact. Hence, the threaded connection between the envelope and the carrier comprising the heat-sinking structure leads to an improved dissipation of heat of the illumination device compared to other heat management arrangements in the prior art, which in turn leads to an improved service life of the illumination device.

According to an embodiment of the present invention, the at least one thread of the envelope may be arranged at a base portion of the envelope. By “base portion”, it is here meant a proximal/connecting portion of the envelope, e.g. the portion of the envelope opposite a top portion of the envelope. In other words, the base portion of the envelope is arranged for connection to the carrier by the respective threads. The present embodiment is advantageous in that the arrangement of the thread at the base portion of the envelope even

further contributes to an easy assembly of the illumination device, as a user, operator and or machine may grip the envelope at a top portion thereof for a connection of the envelope to the carrier. The present embodiment is further advantageous in that the base portion of the envelope serves the purpose of connecting the envelope to the carrier, whereas a center and/or upper portion of the envelope is provided for the optical purposes of the envelope, i.e. for allowing an unobstructed radiation of light from the light source.

According to an embodiment of the present invention, the envelope may further comprise an additional at least one thread arranged for connection to a light-modifying element. By the term "light-modifying element", it is here meant substantially any element which is able to modify the properties of the light from the light source, such as a lens, a diffuser or a remote phosphor component. The present embodiment is advantageous in that the additional thread of the envelope provides an efficient, easy and fast connection of the light-modifying element to the envelope of the illumination device. The present embodiment is further advantageous in that the envelope provides an easy replacement of the light-modifying element, e.g. in the case the element is damaged and/or in the case it is desired to use an element with different optical properties.

According to an embodiment of the present invention, the additional at least one thread may be arranged at a top portion of the envelope. The present embodiment is advantageous in that the arrangement of the additional thread at the top portion of the envelope even further contributes to an easy connection (replacement) of the light-modifying element to the illumination device, as the top portion is easily accessible by a machine and/or an operator.

According to an embodiment of the present invention, the illumination device may further comprise an inner envelope arranged at least partially within the envelope and enclosing the light source, wherein the inner envelope comprises at least one thread arranged for connection to the corresponding at least one thread of the carrier. By the term "inner envelope" it is here meant substantially any element for enclosing an inner cavity around the light source of the illumination device, e.g. a dome for light-modification purposes. Hence, the inner cavity of the inner envelope may be separated from the cavity of the envelope. The present embodiment is advantageous in that the threaded inner envelope allows an easy and efficient mounting of a illumination device, wherein the envelope already comprises an inner envelope (dome) for light-modification purposes. Hence, the present embodiment favors the use of inexpensive light sources (LEDs) with no dome. Furthermore, the present embodiment avoids any additional packaging and/or assembly steps of the illumination device compared

to arrangements wherein domes have to be provided separately. The present embodiment is further advantageous in that the inner envelope may be designed to provide a desired light distribution of the light radiated by the light source into the cavity of the envelope of the illumination device, before being further distributed by the envelope into the surrounding environment of the illumination device. Advantageously, the inner cavity which the inner envelope defines may comprise a liquid and/or silicone. If the liquid has a sufficiently large refractive index, the inner envelope may be relatively large to optimize the extraction of light from the light source.

According to an embodiment of the present invention, the connection between the at least one thread of the envelope and the corresponding at least one thread of the carrier is air-tight. Advantageously, the envelope may enclose an inert gas. The present embodiment is advantageous in that it prevents a leakage of substances and/or gases into the envelope which substances may degrade elements and/or material of the illumination device. For example, the present embodiment may be applied to prevent that sulphur enters the envelope of the illumination device, as sulphur may degrade Ag mirrors inside LED packages. Furthermore, a leakage of oxygen into the envelope may be prevented by the present embodiment, and the illumination device will hereby be more suitable for materials that may degrade by oxygen interaction, such as organic phosphors. Furthermore, if the illumination device comprises an additional thread arranged for connection to a light-modifying element, the connection between the additional thread of the envelope and the light-modifying element is preferably also air-tight.

According to an embodiment of the present invention, the envelope may be provided with a coating. The present embodiment is advantageous in that the reflective coating provided on the envelope glass is able to withstand high operating temperatures of the illumination device. Compared to arrangements in the prior art, wherein coatings may be provided on a plastic optical component, the present embodiment hereby provides an improved operation of the illumination device at high temperatures. Furthermore, the combination of an envelope comprising glass, a threaded connection between the envelope and the carrier and a coating of the envelope even further improves the possibility to withstand high operating temperatures compared to existing technologies in the prior art wherein heat-susceptible glues and/or polymers are used.

According to an embodiment of the present invention, the coating may be provided on the inside of the envelope. The present embodiment is advantageous in that the

coating is hereby protected by the envelope of the illumination device, which even further improves the assembly of the illumination device.

According to an embodiment of the present invention, the coating may be provided on the outside of the envelope. The transparency of the glass of the envelope allows for the (reflective) coating to be applied to the outside of the envelope of the illumination device. The present embodiment is advantageous in that the temperature of the coating may be kept lower compared to a coating applied on the inside of the envelope during operation of the illumination device, as the glass material of the envelope offers a high thermal resistance compared to other materials used in the prior art. Furthermore, the present embodiment allows a cooling of the coating on the outside of the envelope by any cooling means, such as convective air, wherein a lower temperature of the coating of the envelope of the illumination device provides the advantage of a longer operational life of the coating. Moreover, a coating applied to the outside of the envelope may be combined with an organic phosphor coating to even further lower the coating temperature at operation.

According to an embodiment of the present invention, the light source may comprise at least one light emitting diode (LED). The light source may for instance comprise an RGB LED (red-green-blue LED), or a plurality of diodes arranged to provide white light, such as an RGB combination, or a combination of blue and yellow, or a combination of blue, yellow and red, etc. Optionally, the illumination device may be arranged to provide coloured light. The light source may also comprise a plurality of light sources (such as a plurality of LEDs), that is (are) able to provide light at different predetermined wavelengths.

According to an embodiment of the present invention, there is provided a lighting device comprising at least one illumination device according to any one of the previously described embodiments. The lighting device further comprises an electrical connection to the carrier of the at least one illumination device. Furthermore, the lighting device comprises a luminaire for supporting the at least one illumination device. In the present embodiment, the lighting device, comprising the illumination device, may be a downlight LED device, a lamp or the like. The present embodiment is advantageous in that the concept of the threaded glass and the threaded carrier of the illumination device, providing an efficient and easy assembly of the illumination device as well as an improved operation of the illumination device compared to existing techniques, is further applicable for lighting devices.

Further objectives of, features of, and advantages with, the present invention will become apparent when studying the following detailed disclosure, the drawings and the

appended claims. Those skilled in the art will realize that different features of the present invention can be combined to create embodiments other than those described in the following.

BRIEF DESCRIPTION OF THE DRAWINGS

This and other aspects of the present invention will now be described in more detail, with reference to the appended drawings showing embodiment(s) of the invention.

Figs. 1a-b are cross-sectional views of an illumination device according to exemplifying embodiments of the present invention;

Fig. 2 is a cross-sectional view of an illumination device according to another exemplifying embodiment of the present invention,

Fig. 3 is a cross-sectional view of an illumination device according to yet another exemplifying embodiment of the present invention; and

Fig. 4 is a schematic view of a lighting device comprising at least one illumination device according to any embodiment of the present invention.

DETAILED DESCRIPTION

Fig. 1a shows an illumination device 100 according to an embodiment of the present invention. The illumination device 100 comprises a light source 110 arranged to generate light. In the present example, the light source 110 corresponds to two LEDs. Although Fig. 1a shows two LEDs to form the light source 110, a plurality of LEDs or LED packages may also be provided.

The illumination device 100 further comprises an envelope 120 which at least partially encloses the light source 110. The envelope 120 may be a mixing vessel for defining a mixing cavity 121, wherein the mixing cavity 121 may be used to homogenize the light exiting from the light source 110 before being emitted from the illumination device 100 into the surrounding environment. The envelope 120 in Fig. 1a is bulb-shaped from a base portion of the envelope 120 up to an equatorial plane 128 of the envelope 120, from which equatorial plane 128 the light from the light source 110 exits the illumination device 100. It will be appreciated that the shape of the envelope 120 is presented as an example, and that substantially any other shape of the envelope 120 of the illumination device 100 may be feasible.

The envelope 120 comprises a circumferential thread 125 at a base portion of the envelope 120, i.e. at a portion of the envelope 120 under the bulb-shape of a center/top

portion of the envelope 120. The thread 125 is arranged for connection to a corresponding circumferential thread 131 of a carrier 130 of the illumination device 100, which connection provides an efficient, easy and fast assemblage of the illumination device 100. The carrier 130 is arranged to support the light source 110, and may e.g. be a substrate for the light source 110 (LEDs). The carrier 130 comprises the thread 131 on a cylinder portion of the carrier 130, which cylinder portion is arranged to receive the thread 125 of the envelope 120. In Fig. 1a, the thread 125 of the envelope 120 is arranged on the outside of the envelope 120 for connection to the corresponding thread 131 arranged on the inside of the carrier 130. Alternatively, the thread 125 may be arranged on an inside of the envelope 120 for connection to a corresponding thread 131 arranged on the outside of the carrier 130.

The carrier 130 further comprises a base portion provided under the light source 110, such that the carrier 130 in Fig. 1a has a U-shape. The U-shape, comprising the cylinder portion and the base portion of the carrier 130, is arranged for receiving the threaded envelope 120.

The envelope 120 of the illumination device 100 comprises glass, and also the thread 125 of the envelope 120 comprises glass. The glass may for example be pressed glass, blown glass, or a combination thereof. The envelope 120 further comprises a coating 126 on the inside of the envelope 120, which coating 126 may be highly reflective. The coating 126 may further be a spray coating, which provides a highly reflective diffuse coating which may be required for an illumination device of a typical downlight device. Alternatively, the coating 126 may be provided on the outside of the envelope 120, as the transparency of the glass of the envelope 120 allows for the coating 126 to be applied to the exterior of the envelope 120.

The carrier 130 of the illumination device 100 in Fig. 1a further comprises a printed circuit board (PCB) 112 upon which the light source 110 is arranged. The PCB 112 is clamped between the base portion of the carrier 130 and the connection between the threaded envelope 120 and the threaded carrier 130. The carrier 130 and/or the PCB 112 may hereby be arranged in thermal contact with the light source 110, such that heat may be transferred away from the light source 110 and/or the PCB 112 to the base portion of the carrier 130. In other words, a transfer of heat may flow away from the light source 110 to the carrier 130. Furthermore, a transfer of heat may alternatively (or in addition to the flow between the light source 110 and the carrier 130) comprise a heat transfer between the PCB 112 and the carrier 130. In an alternative realization of the illumination device 100, the PCB 112 of the carrier 130 may also be provided with a thread for a connection to the envelope 120.

In Fig. 1b, the carrier 130 of the illumination device 100 comprises a heat-sinking structure 140 for dissipating heat from the carrier 130. In this embodiment, the carrier 130 and the heat-sinking structure 140 may comprise a single integrated part. The heat sinking structure 140 comprises fins for dissipating heat from the carrier 130 to a cooling means, such as passing (convective) air. Hence, in this embodiment of the present invention, the firm mechanical connection between the threaded envelope 120 and the threaded carrier 130 provides a thermal contact between the light source 110 and the carrier 130 and/or between the PCB 112 and the carrier 130. Hence, an effective heat management of the illumination device 100 is provided without the need of any additional components/additives for thermal contact between the parts of the illumination device 100.

Fig. 2 is a cross-sectional view of an illumination device 100 according to an embodiment of the present invention, wherein the envelope 120 further comprises an additional thread 150 arranged for connection to a light-modifying element 160. The light-modifying element 160 may be substantially any element which is able to modify the properties of the light from the light source 110, such as a lens, a diffuser or a remote phosphor component. In Fig. 2, the additional thread 150 of the envelope 120 is connected to a corresponding thread of the light-modifying element 160. Furthermore, the additional thread 150 is arranged at a top portion of the envelope 120.

Fig. 3 is a cross-sectional view of an illumination device 100 according to an embodiment of the present invention, wherein the illumination device 100 comprises an inner envelope 210. The inner bulb-shaped envelope 210 is arranged at least partially within the envelope 120 and encloses the light source 110. Further, the inner envelope 210 comprises a thread 220 arranged for connection to the corresponding thread 131 of the carrier 130. The inner envelope 210 may be substantially any element for enclosing an inner cavity 230 around the light source 110 of the illumination device 100, e.g. a dome for light-modification purposes. It will be appreciated that the size of the inner envelope 210 within the envelope 120 may be arbitrarily large, i.e. the inner envelope 210 may define a inner cavity 230 which constitutes a minor portion (or a major portion) of the cavity 121 of the envelope 120. The inner cavity 230 may comprise a liquid and/or silicone, and in a case the inner cavity 230 comprises a liquid with a sufficiently large refractive index, the inner envelope 210 (and thereby the inner cavity 230) may be relatively large to optimize the extraction of light from the light source 110.

In any embodiment of the present invention as shown in Figs. 1-3, the threaded connection between the thread 125 of the envelope 120 and the thread 131 of the

carrier 130 may be air-tight. Furthermore, also the connection between the additional thread 150 of the envelope 120 and the light-modifying element 160, as shown in Figs. 2-3, may be air-tight. Advantageously, the cavity 121 may thereby be filled with an inert gas. By the air-tight arrangement of the illumination device 100, a leakage of substances and/or gases into the envelope 120 is prevented, wherein these substances may degrade elements and/or material of the illumination device 100.

Fig. 4 is a view of a lighting device 300, wherein the lighting device 300 comprises a number of illumination devices 100 according to any one of the preceding embodiments of the present invention. The lighting device 300 comprises an electrical connection 302 to the carriers of the illumination devices 100. Further, the lighting device 300 comprises a luminaire 301 for supporting the illumination devices 100, wherein the luminaire 301 may be arranged e.g. in the ceiling or on a wall of a room. The lighting device 300 may be designed as any kind of lamp, e.g. standard lamp or a downlight device/luminaire arranged as a spot light.

The present invention may be applied for illumination arrangements used in substantially any kind of environment, e.g. homes, offices, stores, industry buildings, hospitals, etc. The present invention may also be used in outdoor settings.

The person skilled in the art realizes that the present invention by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims. For example, the illumination device 100 itself and/or the individual parts of the illumination device 100 may have different dimensions and/or sizes than those depicted/described. For example, the envelope 120 of the illumination device 100 may have substantially any other shape, e.g. round, elongated or flat. Moreover, the number of parts, e.g. the number of light sources 110 (LEDs), may be different from that of the depicted/described illumination device 100.

CLAIMS:

1. An illumination device (100) comprising:
a light source (110) arranged to generate light,
an envelope (120) at least partially enclosing said light source, and
a carrier (130) arranged to support said light source,
wherein said envelope comprises glass and wherein said envelope further comprises at least one thread (125) arranged for connection to a corresponding at least one thread (131) of said carrier.

2. The illumination device (100) according to claim 1, wherein said envelope is a mixing vessel.

3. The illumination device (100) according to claim 1 or 2, wherein said envelope comprises pressed glass, blown glass, or a combination thereof.

4. The illumination device (100) according to any one of the preceding claims, wherein said carrier comprises a printed circuit board (112).

5. The illumination device (100) according to any one of the preceding claims, wherein said carrier comprises a heat-sinking structure (140) for dissipating heat from said carrier.

6. The illumination device (100) according to any one of claims 1 to 3, wherein said carrier comprises a heat-sinking structure (140) and a printed circuit board (112) which is pressed against the heat sinking structure (140) by the envelope (120).

7. The illumination device (100) according to any one of the preceding claims, wherein said at least one thread of said envelope is arranged at a base portion of said envelope.

8. The illumination device (100) according to any one of the preceding claims, wherein said envelope comprises an additional at least one thread (150) arranged for connection to a light-modifying element (160).

9. The illumination device (100) according to claim 8, wherein said additional at least one thread is arranged at a top portion of said envelope.

10. The illumination device (100) according to any one of the preceding claims, further comprising an inner envelope (210) arranged at least partially within said envelope and enclosing said light source, wherein said inner envelope comprises at least one thread (220) arranged for connection to said corresponding at least one thread of said carrier.

11. The illumination device (100) according to any one of the preceding claims, wherein the connection between said at least one thread of said envelope and corresponding said at least one thread of said carrier is air-tight.

12. The illumination device (100) according to any one of the preceding claims, wherein said envelope is provided with a coating.

13. The illumination device (100) according to claim 12, wherein said coating is provided on the inside of said envelope.

14. The illumination device (100) according to any one of the preceding claims, wherein said light source comprises at least one light emitting diode.

15. A lighting device (300), comprising
at least one illumination device (100) according to any one of the preceding claims, wherein said lighting device further comprises an electrical connection (302) to said carrier of said at least one illumination device and a luminaire (301) for supporting said at least one illumination device.

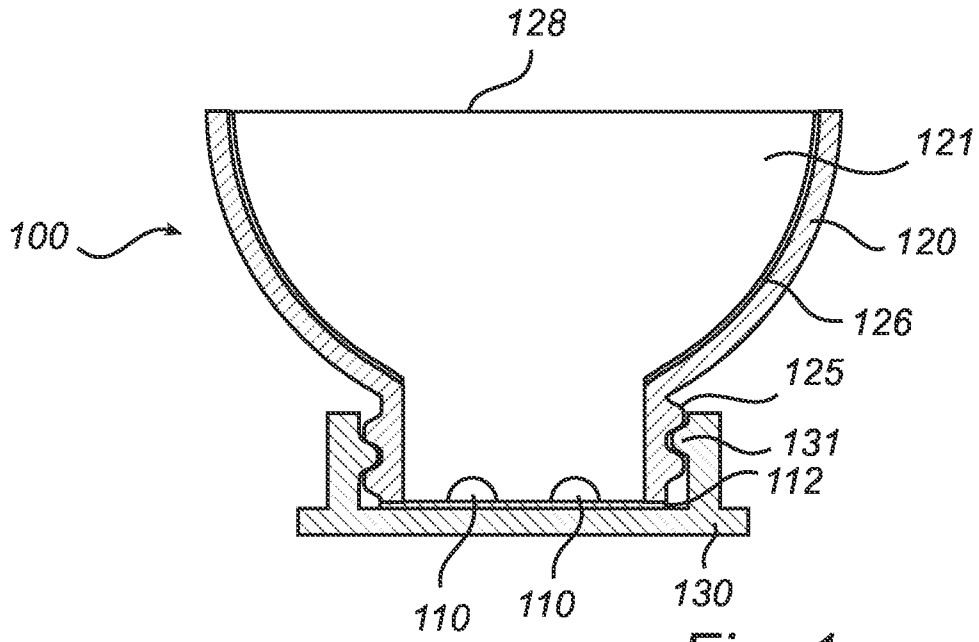

128
121
100
120
126
125
131
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130

Fig. 1a

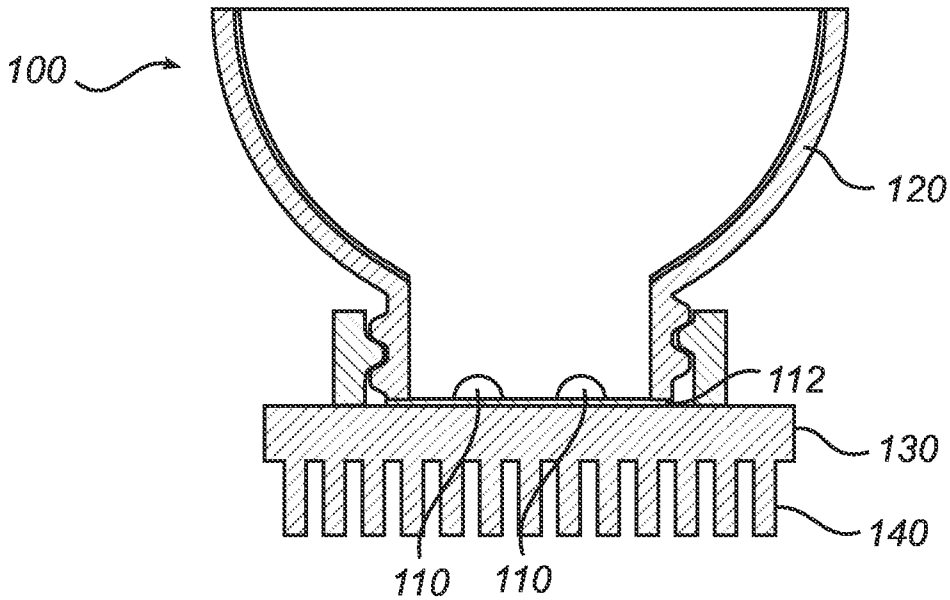

100
120
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Fig. 1b

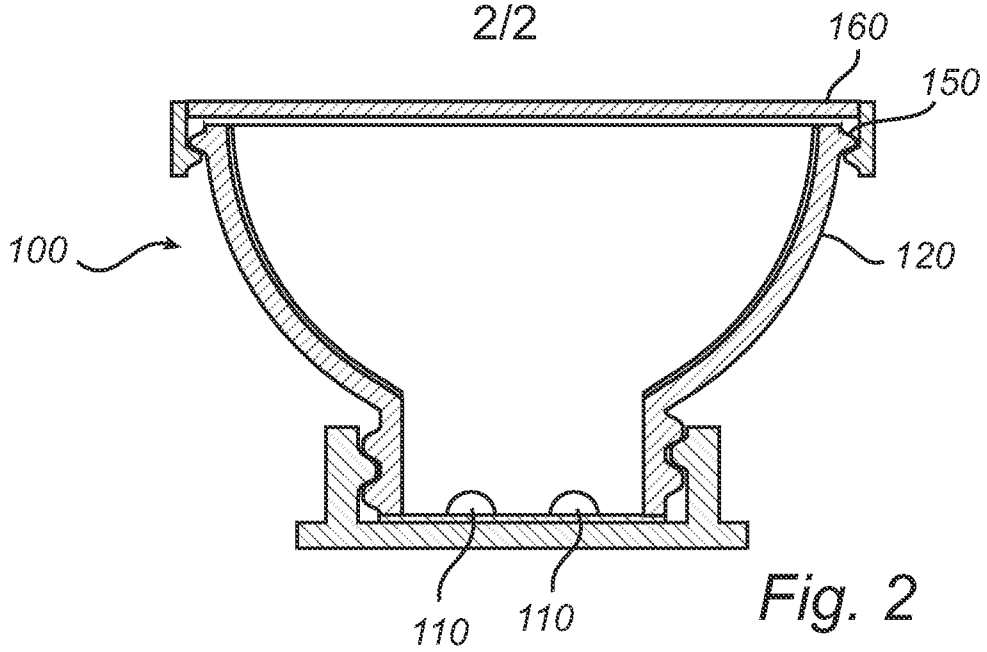


Fig. 2

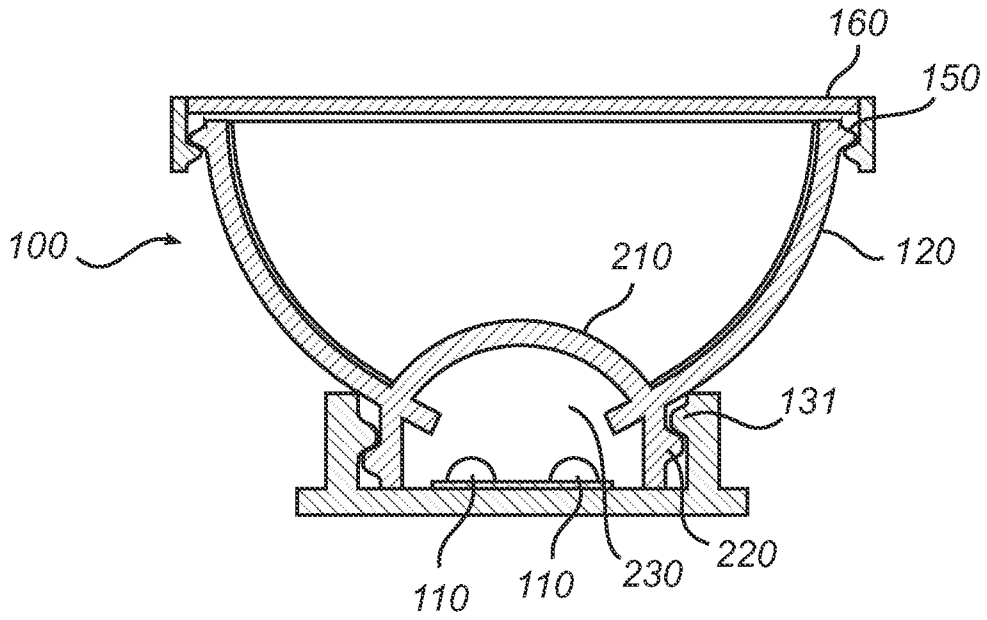


Fig. 3

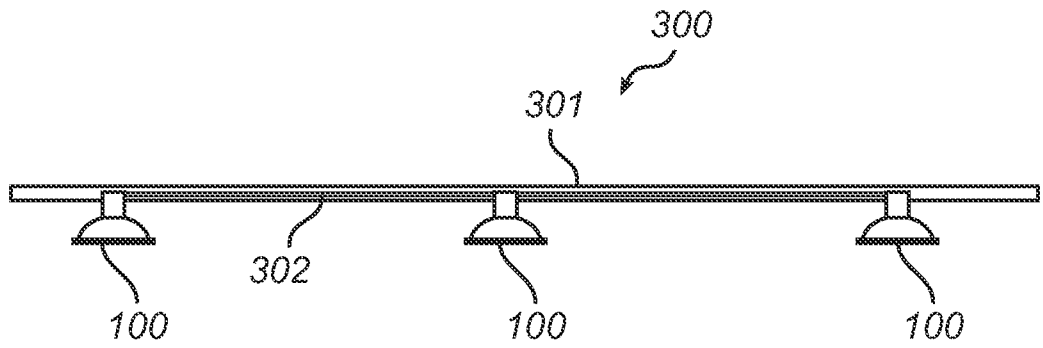


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/053978

A. CLASSIFICATION OF SUBJECT MATTER
INV. F21V17/12 F21V7/00
ADD. F21V29/00 F21V31/00 F21K99/00 F21V1/20 F21V3/04
F21V7/22 F21Y101/02 H05K3/00
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)
F21V F21K 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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2012/032574 A1 (LIN CHING FENG [TW] ET AL) 9 February 2012 (2012-02-09) paragraphs [0017] - [0019]; figures 1-3	1-7, 11-15 1,8-10, 12,13

Y	US 5 169 228 A (BREITZLER HANS-JUERGEN [DE]) 8 December 1992 (1992-12-08) column 2, lines 3-32 column 3, lines 3-10 column 3, line 62 - column 4, line 18; figure 4	1,8,9, 12,13

Y	WO 2010/078203 A1 (INTEMATIX CORP [US]; LI YI-QUN [US]; YANG HAITAO [US]) 8 July 2010 (2010-07-08) the whole document	10

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

[X] See patent family annex.

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"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	Date of mailing of the international search report
27 September 2013	07/10/2013

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	Menn, Patrick

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/053978

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/327745 A1 (DASSANAYAKE MAHENDRA [US] ET AL) 30 December 2010 (2010-12-30) paragraphs [0090] - [0091]; figure 7	10

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International application No
PCT/IB2013/053978

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